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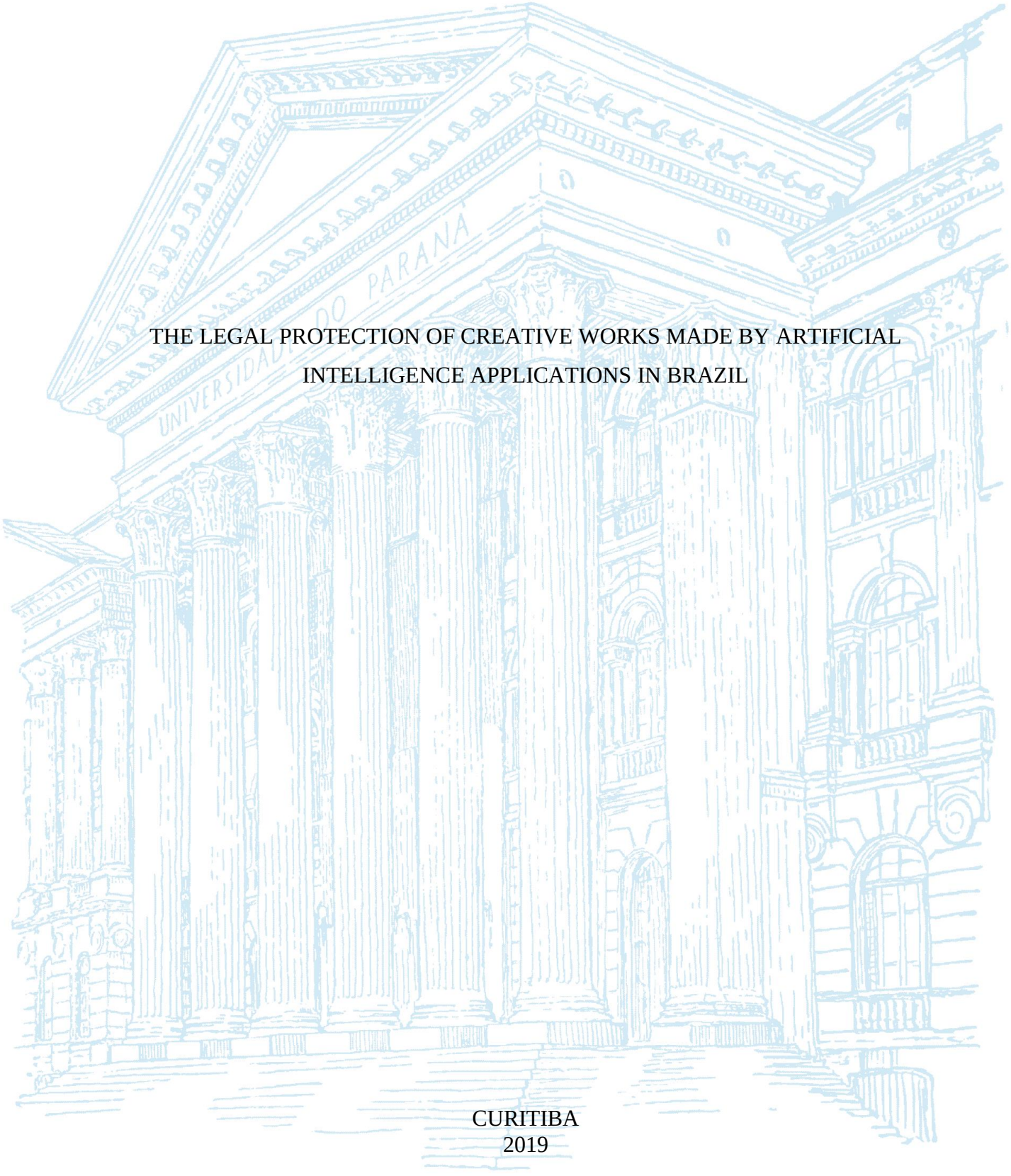

THE LEGAL PROTECTION OF CREATIVE WORKS MADE BY ARTIFICIAL INTELLIGENCE APPLICATIONS IN BRAZIL

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“Intelligence is whatever machines haven’t done yet”.
Larry Tesler

“AI is whatever hasn’t been done before”.
Douglas Hofstadter

ABSTRACT

Computer programs made with Artificial Intelligence (AI) technology have already evolved to the point of being able to produce complex works, even if compared to those produced by humans. However, the current Brazilian legal literature fails to deal with the manner in which works created by AI applications should be protected. These, when not a direct result of their basic programming, begin to reveal signs of creativity. The objective of this work, therefore, is to verify how the legal protection of these assets would be given in Brazilian soil. To this end, the definition of Artificial Intelligence is presented, as well as the definition of creative work, author and holder for copyright law. Next, an analysis of these concepts is made based on the paradigm of the Information Society of Castells. In the same way, the legislative process of the copyright legislation in force in the country is analyzed, seeking its motivation. Finally, based on the concept of the work of the German jurist Eugen Ulmer, it is verified whether the Brazilian legislation could protect works created by these computer programs. As a result, the technology and the law would be incompatible, since they are based on different paradigms. While the former seeks the greater dissemination of information, the latter seeks its control. In conclusion, two ways of protecting this type of work are proposed, considering the national legislation in force, given the absence of any prospect of legislative change in the short and medium terms. The first admits that the work produced by an AI application could be protected by national copyright legislation. The second, on the other hand, rules out this possibility.

Keywords: Copyright; Artificial Intelligence; Information Society; Computer Program; Legislative Process; Creative Work.

LIST OF GRAPHS AND TABLES

LIST OF ABBREVIATIONS AND ACRONYMS

ABC: Brazilian Cinematographic Association

ABCA: Brazilian Association of Composers and Authors

ABEM: Brazilian Association of Music Editors

ABPC: Brazilian Association of Film Producers

AGI: Artificial General Intelligence

AI: Artificial Intelligence

ASSESPRO: Association of Brazilian Software and Computer Services Companies

CCTCI: Committee on Science and Technology, Communication and Informatics (of the Brazilian Chamber of Deputies)

CDA: Copyright Coordination Department (of the Brazilian Ministry of Culture)

CDPA: Copyright, Designs and Patents Act

CERN: European Council for Nuclear Research

CNDA: National Copyright Council

CNI: National Confederation of Industry

ECAD: Central Office of Collection and Distribution

EU: European Union

GATT: General Agreements on Tariffs and Trade

GNMT: Google Neural Machine Translation

HTML: Hyper Text Markup Language

HTTP: Hyper Text Transfer Protocol

IDC: International Data Corporation

INPI: National Institute of Industrial Property

IoT: Internet of Things

IPO: Intellectual Property Rights Office

MinC: Ministry of Culture

MPA: Motion Picture Association

PL: Bill of Law

SADEMBRA: Brazilian Musical Execution Rights Administration Society

SBACEM: Brazilian Society of Authors, Composers and Music Editors

SBAT: Brazilian Society of Theatrical Authors

SICAM: Independent Society of Musical Composers and Authors

TRIPs: Trade-Related Aspects of Intellectual Property Rights (agreement)

UBC: Brazilian Union of Composers

UN: United Nations Organization

USA: United States of America

USPTO: United States Patent and Trademark Office

WCT: Wipo Copyright Treaty

WIPO: World Intellectual Property Organization

WPPT: Wipo Performances and Phonograms Treaty

WTO: World Trade Organisation

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INTRODUCTION[1]

Human civilization lives in a reality dominated by Artificial Intelligence. Its presence is ubiquitous in all areas of society and it tends to be more and more influential in people's daily lives. It is not about the AI of the robots from fiction, which appear in the form of humanoids which, in some instances, have the objective of dominating the world, as in the series of films Exterminator of the Future.

This is another kind of intelligence, one present in televisions, computers, cars and all those devices that start with the nickname smart: smartphones, smart TVs, smart houses, etc. It is an integral part of these technological goods of communication that are part of the Information Society of the 21st century.

Artificial Intelligence is not an entity, but a whole area of study that seeks to develop computer programs with the ability to perform human actions. And modern examples already include voice recognition in personal assistants, indication of movies and series in streaming programs, and even cars with the ability to travel the streets without a human driver.

And among these examples, there are also those applications of Artificial Intelligence capable of producing works of art. Technology has already evolved to such an extent that programs of this kind have the capacity to produce complex works, even when compared to that produced by humans and often without their intervention. From music to paintings, through book chapters and film scripts, this type of software already produces works that can be appreciated by humans just as one would admire a picture of Picasso or a composition of the Rolling Stones.

The question that is asked, therefore, is: how to protect these works when they begin to show signs of creativity? What to do when an Artificial Intelligence application goes beyond its original programming and starts producing content with clear signs of novelty and originality? How to legally classify these assets?

Current Brazilian legislation fails to address how these types of assets should be protected. In other words, there is no provision on how to protect works created by Artificial Intelligence applications, and not even those made by computer programs as a whole, in the Copyright laws in force in Brazil. With an increasing tendency to the use of

[1] This is a translated version of the original Master thesis, which can be found in its original language (Portuguese) in the following link: https://acervodigital.ufpr.br/handle/1884/60345.

such programs, this absence will bring difficulties for Brazilian justice, as more and more judicial imbroglio involving disputes over authorship on the subject should arise.

For this reason, the objective of this thesis is to verify how the legal protection of creative works made by Artificial Intelligence applications in Brazil should occur. To this end, it will be necessary to thoroughly explore the AI technology and copyright legislation currently in force in the country.

In the first chapter some fundamental concepts about creative works and Artificial Intelligence will be discussed. Here, the first international legislation applicable in Brazil on copyright, the Berne Convention, will be analyzed in the search for definitions that it brings of creative work, authorship and ownership. Then, the functioning of Artificial Intelligence technology will be presented, demystifying some concepts on the subject and presenting some applications that can already be found in the 21st century. Finally, the three fundamental components to ensure the proper functioning of this AI technology will be explained: the algorithm, the hardware and the data and information.

The second chapter will deal with Artificial Intelligence according to the theory of Castells[2] and the origin of the current Brazilian legislation on the subject. Manuel Castells is a prominent Spanish sociologist who, through his works, explains that information would be central to the Society of the 21st century. Using its theory as a theoretical framework, the technology of Artificial Intelligence will be analyzed based on it, given the fact that both have information as their central point. As a counterpoint, an analysis will be made of the way in which the protection of the software by means of the Copyright Law has developed. The aim will be to verify the way in which this development has taken place at the international level and, subsequently, the way in which it has taken place at the national level. The purpose is to find the motivation behind the legislative process of Laws 9.609/98 and 9.610/98.

The third chapter will deal with the tutelage of works made by Artificial Intelligence in Brazil. An analysis will be made of the main provisions of the Brazilian laws in force on copyright regarding the concept of creative work, authorship and ownership. Then, based on the concept of creative work of the German jurist Eugen Ulmer[3], the possibility of Brazilian legislation to protect works created by these computer programs will be verified.

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[2] About this topic, check: CASTELLS, Manuel. **The Network Society**. Vol I São Paulo, Paz e Terra, 1999.
[3] About this topic, check: ULMER, EUGEN - **Copyright and Publishing Law**. 3rd Ed. Berlin: Heidelberg, 1980.

Based on bibliographic and legislative analysis, the initial hypothesis is that the Brazilian copyright legislation and AI technology would be incongruent with each other, but that one could not simply fail to protect the assets created by these applications due to this fact. Because of this, at the end of the research, two proposals are made to regulate the theme based on Brazilian law. In the first one, Brazilian copyright law would be applied to the works created by Artificial Intelligence applications, but with limitations. In the second, the AI program itself would be protected, not the end result of the creation of an application of this type.

This is an incipient discussion of a topic with great potential for expansion. This work seeks to be able to contribute satisfactorily to a field that still faces many regulatory challenges and that has the potential to affect the functioning of the entire modern society of the 21st century.

1 FUNDAMENTAL CONCEPTS ABOUT CREATIVE WORKS AND ARTIFICIAL INTELLIGENCE

The novelty and relevance of the topic to be discussed demand a chapter to clarify the types of concepts and terms to be used in the rest of the work. The term Artificial Intelligence (whose acronym AI will also be used throughout this text to refer to it) has a series of definitions ranging from philosophy to computational engineering, passing through the vast field of science fiction, where it gained prominence in the popular imagination. This is in addition to a work proposal that seeks to explain how to protect works created by a machine, which involves the not so easy to understand branch of the Copyright Law, and due to that the correct delimitation of the topics to be addressed is essential in this research.

To this end, the first step is to address the concept of creative work based on the study of the fundamental legislation that regulates the subject: the Berne Convention. As the protection of creative works is done through the Copyright Law, the understanding of the definitions brought by the first international legislation on the subject is essential for the rest of the work. The understanding of the concepts of protected work, authorship and ownership will be explored at this point.

Next, it is proposed the definition of the concept of Artificial Intelligence, not of the philosophical or fictitious aspect, but of the practical one, as a factual entity existing in society and that has the capacity to generate legal consequences through its actions. This second topic will cover the definition of AI, a brief evolution of its uses and, finally, the types of applications that can be found in modern society in the 21st century.

Finally, the elements that allow the technology to function properly will be explained. As there is no express mention of the term Artificial Intelligence in the Brazilian legislation, the analysis of what allows its operation is essential to study what would be the correct legal protection for it in chapters 2 and 3. In this sense, the three items considered essential shall be covered: the algorithm, the hardware and the data and information.

1.1 Creativity and authorship in accordance with the fundamental copyright law

This work begins by seeking to understand the basic legislation for the protection of creative works of AI applications, which influences the legal treatment of this matter

in Brazil, that is the Berne Convention. It is going to be presented some of the reasons for its creation and the way in which it was adopted in Brazil. In a second moment, it shall be understood what creative work is for that Convention, what can be protected as such and what the requirements are for a given work to be considered as creative. Finally, it will be sought to understand who can enjoy this work and who can be considered as the author or, in another way, the holder of this creative work. Understanding the dynamics of the functioning of these items by the Berne Convention is fundamental, given that it is the first international legislation to deal with and regulate various points of copyright law and because it serves as a basis for Brazilian laws.

1.1.1 The basic copyright legislation for the theme: The Berne Convention

The Berne Convention, dated 1886, deals with the protection of works and the rights of their authors. It gives its creators, as musicians, poets and painters, the means to control how their creations are used, by whom and in what terms. The Convention is based on several basic principles and contains a number of provisions on the minimum level of protection to be guaranteed, as well as special provisions available to developing countries wishing to make use of such works (WIPO, 2018).

Prior to the Convention, "bilateral copyright treaties proliferated. But they represented a very slow process of achieving the international consecration of this right" (ASCENSÃO, 1997, p. 639). For this reason, efforts would have begun to be made to obtain multilateral protection instruments.

Still about the Convention, it is "the oldest international instrument in the field of copyright; the level of protection granted to intellectual works is high and the guarantees given to their authors are the most effective possible" (WIPO, 1980, p. 5). Ascensão adds that this "remains the standard instrument of international copyright law. Technically cared for, it's strongly protectionist. Its European scope has been eroded by the accession of many other countries.

Before the Berne Convention, copyright law remained uncoordinated at international level (IPO, 2006). So, for example, a work published in the UK by a British person would be protected by copyright in that territory, but it could be copied and sold by anyone outside of it.

This would lead associations of authors and book publishers, especially in France, to pressure European governments to implement an international regulation that would solve this problem. On this international solution, Fragoso comments (209, p. 84):

> Fruit of an effort originated from private entities of authors - the so-called societies of authors, especially the French society Societé des Auters et Compositeurs Dramatiques, which counted with Victor Hugo among its founders, and the Societé des Auteurs, Compositeurs et Editeurs de Musique, current SACEM - , the so-called Bern Union was initially established with ten countries, including France, Germany, Spain, Italy, Belgium, Switzerland and its colonies or countries under its direct influence such as Haiti (France), Liberia (Italy), Tunisia (France), and the United Kingdom.

The accession of the countries would take place gradually, so that in the 21st century the Berne Convention has already been signed by 164 countries[4], but the moment of signature of two in particular is emphasized here. The first one is from the United States of America, according to Ascensão (1997, p. 639):

> The United States of America has long prepared its accession to the Berne Convention, and the simultaneous revision of the Berne Convention and the Universal Convention, made in Paris in 1971, has already been carried out under its aegis. The adhesion was effective as of March 1, 1989.

The second is Brazil, where the last revision[5] of the Convention came into force in this country in 1975, through the Decree nº 75.699, of May 6, 1975. This chronology should not be interpreted as a coincidence, given that from the mid-1950s onwards, with the development of the US software industry, this country would lobby to implement a type of protection that would benefit its producers, as will be seen in more detail in chapter 2. Countries such as Brazil would have been influenced by the American lobby to sign this type of international legislation.

The Convention also contains some basic principles that must be followed by all its signatory countries and which therefore influence the way in which the domestic laws of these countries must be written in order to protect copyright. Given the French influence of its creation, his devices are based much more on the principle of *Droit D'Auteur*, which privileges the figure of the author and brings more rights in the moral field of the work. However, even countries whose copyright legislation is based on

[4] The full list of signatories to the Berne Convention can be found at: https://br.copyright-house.com/copyright/convencao-de-berna-paises.htm.

[5] This revision is one of those that the Berne Convention has undergone over the years. The first of these took place on May 4, 1886, known as the additional act of Paris. The most recent one also took place in Paris on July 24, 1971. In the meantime, and counting these two, there were a total of seven revisions promoted to the Berne Convention over the years (WIPO, 1980, p. 6). For the purposes of this work, the wording of the most recent version of the Convention will be considered.

Copyright[6] ended up, albeit reluctantly, adopting some elements of the *Droit D'Auteur* doctrine, especially the right of paternity.

José de Oliveira Ascensão states (1997, pp. 639-640) what these four fundamental principles of the Berne Convention would be:

I) Principle of national treatment - The first of these is provided for in Article 5 of the Berne Convention[7], which is ensured to each country that is or will become a signatory to this legal text. On this principle, Fragoso comments (2009, p. 89):

> National treatment of foreign authors and stateless persons, as well as foreigners domiciled in the country, respects the principle of formal reciprocity. By this principle, the local law (lex loci) applies, contrary to the principle of material reciprocity, in which an equivalence (...) is required between the law of the country of the foreign author (lex fori) and that of the country where protection is claimed. This is one of the aspects that gives the Copyright Law an international dimension...

Ascensão highlights (1997, p. 640), however, that:

> Some countries have, however, abolished the principle of personality, replacing it with the principle of universality of protection: every author, whether national or foreign, gains the protection of its rules. In such cases, the principle of the Convention adds nothing. But in most cases, and also in Brazil today, this was not the case, so only iure conventionis foreign authors can claim protection.

II) Guarantee of conventional minima - Ascensão reports that "the Convention goes further and establishes certain minimum rules of protection, which cannot be postponed by national legislation. The successive revisions have seen an increase in these conventional minima" (1997, p. 640).

On the subject Fragoso (2009, p. 85):

> Such guarantee is fundamental for the exploitation of the property rights of the author, who becomes the sole judge of the intended uses - with the limitations and exceptions provided, such rights are those of "manufacture", representation, public performance of music, public recitation of literary works, transmission or broadcasting of literary or artistic works, exhibition of works of art and construction of works of architecture (article 3, 3) in addition to those of translation and adaptation, under the various modes and technologically available means. There is also the so-called suite right or sequel right, or sequence right, by which the author has the right to pecuniary participation in the successive disposals of works of art and manuscripts, when there is added value.

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[6] The differences between the *Copyright* and *Droit D'auteur* doctrines is recognized, especially with regard to their philosophical premises and the focus given to the moral rights of works. However, for the purposes of this work, the usage of both terms in English will be done through the expression 'Copyright' or 'copyright'.

[7] The text of Article 5 of the Berne Convention reads as follows: 1) Authors shall enjoy, in respect of works for which they are protected under this Convention, in the countries of the Union, except that of origin of the work, the rights which their laws currently grant or may in the future grant to nationals, as well as the rights specially granted by this Convention.

III) The determination of the country of origin of the work - bearing in mind that the Convention only covers works produced in its member countries, comments Ascensão (1997, p. 640) that it is necessary to establish precisely which criterion is to be considered relevant for the connection of a work to a country. The same Article 5 (4)[8] is applied to this fixation, based on the distinction between published and unpublished works.

IV) Principle of conformity of domestic law - "It is presumed that when a country becomes part of the Convention, its domestic law permits the application of the provisions of the Convention" (ASCENSÃO, 1997, p. 640). On the subject, Fragoso (2009, p. 91) comments as an example the term of protection of works, which:

> ...must comply with the same term established in the law of the country where the protection is claimed - unless the latter provides otherwise, admitting a term longer than the law of the country of origin of the work itself provides. There is a great possibility of conflicts arising from this provision of the Convention, especially in relation to U.S. law - which provides that the scope of the provisions of the law will not be limited by the accession of the United States to the Berne Convention.

It is clear that the objective of the Berne Convention would be to protect the rights of authors and publishers of works, particularly at the international level. The pressure from associations, especially French ones, to guarantee the protection of their rights in other territories led to an international law that would establish the minimum protection requirements for this right worldwide. Although there are differences between *Droit D'Auteur* and Copyright, with the former being of continental European law origin and the latter applicable in common law countries, the Convention would be adopted in most countries of the world.

The purpose of the following two items in this section 1.1 is to address what the Berne Convention considers to be creative work and, subsequently, to whom this creation belongs. These are fundamental concepts for the discussion that will be developed in the following chapters of this work.

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[8] Article 5(4) of the Berne Convention provides as follows: (4) The country of origin shall be considered to be the country of origin: (a) for works published for the first time in one of the countries of the Union, the latter country; in the meantime, in the case of works published simultaneously in several countries of the Union which grant different terms of protection, that country among them whose law grants a shorter term of protection; (b) for works published simultaneously in a country outside the Union and in a country of the Union, the latter country; (c) for unpublished works or for works published for the first time in a country outside the Union without simultaneous publication in a country of the Union, to which the author belongs; in the meantime, (i) in the case of cinematographic works whose producer has his headquarters or habitual residence in a country of the Union, the country of origin shall be the latter; and (ii) in the case of architectural works built in a country of the Union or works of graphic and plastic arts encouraged in a building situated in a country of the Union, the country of origin shall be the latter country.

1.1.2 The concept of creative work according to the Berne Convention

In order to achieve an appropriate concept of what would be creative work, the basic legislation must first be used: the Berne Convention. The provisions on the types of works covered by the legislation can be found in Article 2 of this legal text. In order to start the analysis, the first paragraph of that Article is initially observed:

> (1) The themes "literary and artistic works" cover all productions in the literary, scientific and artistic fields, whatever their mode or form of expression, such as books, brochures and other writings; conferences, speeches, sermons and other works of the same nature; dramatic or dramatic-musical works; choreographic works and pantomime; musical compositions, with or without words; cinematographic works and works expressed by a process similar to cinematography; works of drawing, painting, architecture, sculpture, engraving and lithography; photographic works and those expressed by a process similar to photography; works of applied art; illustrations and geographical maps; projects, sketches and plastic works relating to geography, topography, architecture or science.

The object of this paragraph 1 is understood to be the definition of the terms "literary and artistic works". This is done by means of two criteria: "this terminology is aimed at all productions in the literary, scientific and artistic fields" and "it removes any limitation on the way or form of expression of works" (WIPO, 1980, p. 12).

On the first criterion, it is emphasized that the content of the work protected by legislation "is in no way a condition for protection. By referring to not only the literary and artistic, but also scientific field, the Convention therefore encompasses the scientific works that will be protected by virtue of their form" (WIPO, 1980, p. 12).

This means that the content of the expression of the idea is of little relevance to achieving protection through the Berne Convention (WIPO, 1980, p. 13):

> It is generally accepted that the value or merit of a work, an eminently subjective and individual notion, should not also be considered; in case of litigation, for example, the Judge will not have to assess the artistic or cultural value of a work. It is the same with the destiny of the work: it can be produced solely for educational purposes or for purely utilitarian or commercial purposes, without this constituting a determining condition for protection.

What the legal text requires for a work to be considered for protection is that it be expressed in a way that third parties can appreciate it. The WIPO Guide to the Berne Convention (1980, p. 13) states: "Indeed, the work may be communicated to the public in any form, oral or written. The form of expression is equally indifferent, whatever the process used for the realization of the work".

Regarding the second criterion, the list of items presented by the article cannot be considered as something that restricts what is considered as an expression of a work or not. According to the WIPO guide (1980, p. 13):

> ... the terminology of the Convention is to be regarded as forming a whole; the terms "literary and artistic works" may be understood as works capable of being protected and, to illustrate this terminology, Article 2(1) lists them. The use of the words 'as is' indicates that the list is purely enunciative and not restrictive: it is a question of providing national legislators with a series of examples...

This exemplary character of the Convention allows the legislators of each country to go further and consider as protected works other types of productions of the literary, scientific and artistic domain (WIPO, 1980, p. 18), such as the computer program, which will be mentioned in detail during this text.

To conclude the comments on Article 1(1) of the Berne Convention, the WIPO Manual states:

> In concluding these observations or clarifications with respect to Article 2(1), it should be noted that the Convention, in its definition of protected works, does not indicate any criteria for determining protection. It is, however, permissible to deduce from the general economy of the Convention that these must be intellectual creations (the word appears in Article 2 (5) [9]). It is in this spirit that many national laws (...) provide that, in order to be protected, works must be original, in the sense that they constitute a creation. Moreover, the Convention uses the term "original works" to distinguish them from derivative works. But originality should not be confused with novelty: two painters, by installing their easels in the same place and making each painting representing the same landscape, do creation work separately; the second canvas is not new because the same subject was already treated by another painter, but it is original since it reflects the personality of the artist. In the same way, two craftsmen sculpting a small sculpture representing an elephant on wood create an original work, although the two small sculptures are similar, and one cannot speak of novelty in relation to any of them. Of course, this condition of originality, as required by law, is often left to the courts.

It is this more general approach of the Convention that makes it necessary to seek complementation in the doctrine of the concept of what would become a work protected by Copyright. In addition to being expressed, one can allude to the Convention's analysis that the work must be an intellectual creation and, in addition, be original. The German author Eugen Ulmer (1980, pp. 130-131), whose position will be adopted to define what the authorial work would be, understood that the work would consist of an intellectual creative expression. Thus, to be defined as a work, it is essential that: 1) other persons

[9] Article 2(5) of the Berne Convention thus provides: The compilations of literary or artistic works, such as encyclopedias and anthologies, which, by the choice or arrangement of materials, constitute **intellectual creations**, are as such protected, without prejudice to the rights of authors on each of the works that form part of such compilations. [Sprayed].

may have access to the work either by material or immaterial means; 2) it is necessary that it brings some novelty in the cultural aspect, not being a mere reproduction of something existing and; 3) that it is a creation of spirit, that is, of an intellect. The author will comment on this definition (ULMER, 1980, pp. 127-128):

> The concepts of law have experienced a new dimension through the development and evolution of modern art. In particular, it concerns phenomena in the field of fine arts, music and poetry that no longer comply with traditional rules of aesthetics, in music with the laws of melody and harmony. The use of mathematical and geometrical rules and formulas as well as the involvement of technical means in the process of creating the work is characteristic. Examples are serial and electronic music, optical art, computer music, computer graphics, computer poetry, etc. (...)
> In the dispute of opinions about the concept of art, its vastness and its limits, we have to assume in principle that the jurist is not called upon to judge art trends. Rather, it will be based on the views represented in life, especially among artists, art connoisseurs and art lovers, and will also take into account the opinions of an artistic avant-garde. But the characteristic of personal spiritual creation remains indispensable. The assessment of typical phenomena must be reconsidered in the explanation of the concepts of musical works and works of fine arts.

In other words, what the author discusses is not the merit of art, whether it is considered beautiful in artistic circles or not, but whether it meets the minimum concepts expressed in law. In addition to having to be expressed in a medium perceived by others and being creative, not just a copy, the work must be a personal creation of spirit. Such a definition of Ulmer raises, however, two relevant questions, which are, firstly: what is creativity? And the other, to be addressed in item 1.1.3: what kind of author has the capacity to produce a creation of spirit?

Addressing the issue of creativity, Runco and Jaeger (2012, p. 92) comment that the standard definition of creativity requires both originality and effectiveness. Originality "is undoubtedly required. It is often labeled novelty, but whatever the label, if something is not unusual, novel, or unique, it is commonplace, mundane, or conventional. It is not original, and therefore not creative".

However, although vital, originality alone is not enough, for "original things must be effective to be creative. Like originality, effectiveness takes various forms. It may take the form of (and be labeled as) usefulness, fit, or appropriateness" (RUNCO & JAEGER, 2012, p. 92).

This effectiveness could also take the form of economic value. According to Runco and Jaeger (2012, p. 92) "this label is quite clear in the economic research on creativity; it describes how original and valuable products and ideas depend on the current market, and more specifically on the costs and benefits of contrarianism".

Another useful definition of creativity comes from Morris Stein (1953, pp. 311-312), which he attests:

> Let us start with a definition. The creative work is a novel work that is accepted as tenable or useful or satisfying by a group in some point in time (...). By ‘‘novel’’ I mean that the creative product did not exist previously in precisely the same form (...). The extent to which a work is novel depends on the extent to which it deviates from the traditional or the status quo. This may well depend on the nature of the problem that is attacked, the fund of knowledge or experience that exists in the field at the time, and the characteristics of the creative individual and those of the individuals with whom he [or she] is communicating.

In this way, creative work, first, is that which is externalized in some medium, which allows its perception on the part of others. Second, the work must be creative, which means that it must present originality, effectiveness and be accepted by the society in which it is created as such, as proposed by Morris Stein. Finally, this work must be a creation of the spirit, that is, it must be created by an intellect. What it is meant by this last point of the definition will be covered in the item below.

1.1.3 To whom does the creative work belong according to the Berne Convention?

In order to verify who Eugen Ulmer alludes to when he speaks of personal spiritual creation, it is necessary to return to the Berne Convention in the passages in which it addresses the question of the authorship of these creative works. The WIPO Guide to the Berne Convention (1980, p. 110) states that the provision on authorship would go back to the very origin of the Convention and aims to determine which person has the quality to enforce the protected rights of works.

Article 15(1) of the Convention provides that:

> For the authors of literary and artistic works protected by this Convention to be, until proven otherwise, considered as such and admitted consequently, before the courts of the countries of the Union, to take legal action against the factors, it is sufficient that their names be indicated in the works in the usual manner. This paragraph applies even if the names are pseudonyms, provided that the pseudonyms adopted do not leave any doubt as to the identity of the authors.

It is interesting to note that the Convention itself does not define who would be an author, but rather establishes a presumption that the author is the one who has his name indicated in the work in the usual way. "It is a general formula which leaves the judicial authorities with full discretion. The evidence to the contrary is the responsibility of the counterfeiters, that is to say, it is up to them, in the event of litigation, to prove that the person claimed to be the author is not" (WIPO, 1980, p. 110).

Another point highlighted by the WIPO guide is the following (1980, pp. 110-111):

> It should be noted that the Convention confines itself to establishing the fundamental principle that the author of a work is, unless there is evidence to the contrary, the one under whose name it is disseminated. It does not go any further and leaves it to national legislation to decide on the ownership of copyright. This question may be of some importance, for example, in the case of works created on behalf of an employer (natural person or legal person, private or public) in the context of an author's employment contract, or of works created under contract.

In other words, the Berne Convention leaves it up to national legislation to establish stricter criteria for determining authorship, but does not specifically mention other criteria besides appearing to be the author by means of the apposition of the name on the creative work. In chapters 2 and 3 it will be shown how the Brazilian legislation deals with this issue.

Article 15(1) would also apply to those works without an identifiable author, the anonymous works. According to the same WIPO guide (1980, p. 110):

> This paragraph states that the same presumption applies to pseudonym works if the pseudonym adopted by the author leaves no doubt as to his identity: this case is covered in identical terms in paragraph 3) of Article 7[10] regarding the duration of protection and the factual elements to take into consideration are also reserved here for the appreciation of the courts.

This issue of anonymous works and pseudonyms also has another paragraph that deal with the subject, which is article 15(3) of the Berne Convention, in which it is read:

> As for anonymous works, and pseudonyms other than those mentioned in paragraph 1) above, the publisher whose name is indicated in the work is, without the need for further proof, considered representative of the author; in this capacity he has the power to safeguard and enforce the rights of the author. The provision of this subparagraph shall cease to apply when the author has disclosed his identity and justified his capacity.

Such a provision is of great relevance to the present work. Considering that works made by Artificial Intelligence applications potentially have little or no human participation, the way in which it is disseminated may become determinant to establish to

[10] This is the wording of article 7, paragraph 3, of the Berne Convention: With respect to anonymous works, or pseudonyms, the duration granted by this Convention expires fifty years after the work has become lawfully accessible to the public. However, when the pseudonym adopted by the author leaves no doubt about his identity, the duration of protection is that provided in paragraph 1). If the author is of an anonymous work or pseudonym reveals his identity during the period indicated above, the term of protection applicable is that provided in paragraph 1). The countries of the Union are not obliged to protect anonymous works or pseudonyms for which there is reason to assume that their author died fifty years ago.

whom a certain creative work belongs. In this way, the one with the capacity to enjoy the work would not necessarily need to be a natural person.

However, on the question of authorship, Ulmer insists that traces of individuality would be essential in the process of creating the work so that an author could be attributed. In his words (1980, p. 133):

> IV. The protected works are distinguished from unprotected entities by the individuality inherent in them as personal spiritual creations.
> 1. literary and artistic creation includes both conception and formation. The focus of the intellectual achievement can be on the inspirations of the imagination, on the developments and logic of the thought process, on the representation or on the selection and arrangement of contributions and materials.
> 2 Individuality presupposes that personal traits are developed in the creation of a work. If there is no scope for such a development, as is the case, for example, with the numerical series of the logarithm tables or with chemical formulae, which by their nature are not variable, there is no copyrightable work of art.

The specific personality traits of the author would be necessary for a work to be protected. This means that the ability to assign this individuality is what would constitute the authorship process. However, it should be noted that not only the author is able to enjoy the rights attributable to creative works protected by law. At this point, it is necessary to deal with the distinction between ownership and authorship.

Ownership, according to Fragoso (2009, p. 195) is "the investiture in the author's rights. It is originally attributed to the author or intellectual creator of the work himself or can be commissioned and, also, in those cases of collective works where individual collaboration is not distinguished". Fragoso adds (2009, pp. 195-196) on this issue that:

> It may also be transmitted *inter vivos* or *mortis causa*. The transfer of effective ownership in practice is the transfer of the holder's ability to exercise copyright as if it were the author. Thus, the assignee as to the property rights; the organizer or the investor in the cases studied and the successors, with the reservations provided for, such as the prohibition on the exercise of the personal rights of modification and repentance that are not transmitted to him.

This means that a third party not related to the creation of a given work could exercise the rights over a work as if it were an author, without necessarily having participated in the creative process of that work. Even if this type of operation contradicts, in a certain way, the provisions on Ulmer's work and authorship (1980, pp. 130-131), because the Berne Convention leaves this concept open, not necessarily the creative spirit behind an intellectual work will be the one to exercise the rights over such creation.

Thus, at the end of point 1.1 it is already possible to draw some conclusions about the Berne Convention and the way in which it conceptualizes work and author. Firstly, as for the legislation itself, it would be the result of pressure from authors' associations that

sought to homogenize the protection of their works in all countries. This means that the Convention was already established with the intention of having a universal character. Given this attribute, it establishes the minimum requirements for copyright protection, which need to be followed in all its 164 signatory countries.

This comprehensiveness makes its text take a generalizing position, which leads to the second conclusion: work is all intellectual creation which has been externalized in a creative way. This concept, although useful, is not deepened by the Convention, which requires the search for complementary definitions in the doctrine in order to fill the gaps left by the treaty.

The doctrine used to define a work, in this case, comes from the German jurist Eugen Ulmer (1980, pp. 130-131), who attests that a work is a creative intellectual expression. Expression in the sense that she can be perceived by others; creative in the sense that it brings something new in comparison with existing works; and intellectual in the context that she needs to be a creation of spirit.

The concept of creativity was another one that merited more detail, because neither the Convention nor the German jurist provided definitions of it. Creativity, according to the definition found in Runco and Jaeger (2012, p. 92), would require both originality and usefulness of a given work. The first provides that the item created cannot be a mere copy of something already existing, but of these requirements, the most relevant is the second, utility, because it requires that the work be perceived as such in the context of the society in which it is created. In other words, it must be able to be appreciated and considered as a work of art that can be protected.

Finally, the third conclusion that can be drawn at the end of this point is the same generality of the Convention's definition of who is to be considered an author. This legislation only requires a person to put their identification on a certain work to be recognized as such. This openness frees national legislations to establish their own definitions of authorship, which, as will be seen in chapters 2 and 3, shall be explored by Brazilian legislators. In the same way, it implies that not necessarily the usufructuary of the copyrights on a work is its creator, allowing the ownership over it to be taken by third parties.

Having seen the essential legal definitions of what creative work and authorship would be, according to the main legislation that regulates the subject, the next two points shall be devoted to the conceptualization of what would become Artificial Intelligence.

The understanding of these concepts will prove essential when, in chapter 3 of the thesis, the most appropriate way to protect the works created by AI applications is debated.

1.2 What Artificial Intelligence is and how it works

The concept of Artificial Intelligence, just like that of work or creative work, holds fundamental importance in this thesis as well. In order to present this topic, the first objective is to demystify the usual notions of what Artificial Intelligence would be and present a definition, which will be used as a basis for the rest of the work. Next, a brief history of how the application of this type of technology has evolved and the type of consequence that modern iterations of technology can bring will be presented. Finally, the types of applications that can already be found in the 21st century are presented. The aim is to emphasize the importance of studying the legal consequences of the use of AI, given its ubiquity in contemporary society in the 21st century.

1.2.1 Demystifying the concept of Artificial Intelligence

The topic of Artificial Intelligence (AI) is one that in itself motivates the creation of an entire mythology around it. From the narrative about the Golem in the 16th century Jewish tradition to modern iterations like IBM's Watson participating in the American TV show Jeopardy[11], or personal assistants like SIRI, present in Apple's devices, the examples are numerous. After all, the question of whether man could create life from inanimate objects has always occupied human imagination.

In addition to the question about the creation of life, two aspects often present in myths about AI are, first, the fact that it would almost always have a human or humanoid form and, second, its intrinsic link with situations that occur in the future. Several science fiction stories present a robot character with human form living with humans in a utopian or dystopian future. Some examples are the films Her and Ex Machina, the game Detroit: Become Human and the catalog of books by Isaac Asimov, which contains classics like

[11] *Jeopardy is an* American television program that presents a question and answer competition. In one of the episodes, Watson, an Artificial Intelligence application created by IBM, was placed to compete with recent winners of the program and ended up winning the game.

I, Robot[12]. In addition, famous franchises such as Star Wars and Star Trek both take place in the future and rely, each in their own way, on intelligent robots that have human personality traits.

Two quotes that define well all the mysticism surrounding the area are in the epigraph of this work. The first one, by Larry Tesler[13], says that "Intelligence is whatever machines haven't done yet". The expression, coined by the author approximately in 1970 served as criticism to the fact that every action performed by a computer, in Tesler's opinion, would no longer be considered as an intelligent action because it would no longer be seen as an intelligent act, but rather as mechanical.

Douglas Hofstadter, American professor of cognitive sciences, brings his own interpretation of Tesler's expression when he says that "AI is whatever hasn't been done before". What this means is that there would be a tendency to disregard practical advances in the area, such as defeating the world chess champion[14], calling them mere computational practices, instead of intelligence. According to Pamela McCorduck, this would be a strange paradox (2004, p. 204):

> It's part of the history of the field of artificial intelligence that every time somebody figured out how to make a computer do something—play good checkers, solve simple but relatively informal problems—there was chorus of critics to say, 'that's not thinking'.

And the reality is that, as will be seen below, not only are these practical applications of AI already part of the everyday life of human civilization, but also they are far from being something destined only for science fiction stories, being able to perform activities with a quality equal if not superior to humans.

Before that, however, it is necessary to define exactly what would be Artificial Intelligence. According to McCarthy (1955), this is "the theory and development of computer systems capable of performing tasks that would normally require human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.

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[12] It was in this collection of short stories that Asimov introduced the Three Laws of Robotics, also called the laws of Asimov. They have been accepted and disseminated by other authors of the genre and the content of their text is as follows: 1 - A robot may not injure a human being or, through inaction, allow a human being to come to harm; 2 A robot must obey orders given it by human beings except where such orders would conflict with the First Law; 3 - A robot must protect its own existence as long as such protection does not conflict with the First or Second Law (ASIMOV, 1950).

[13] Tesler is an American computer scientist who worked at Xerox in the 1970s. He is best known for being the inventor of the copy and paste function of modern computers.

[14] Like the IBM *Deep Blue* program did by defeating Garry Kasparov in 1997.

Another definition, by Russell and Norvig (2016), heralds Artificial Intelligence as being “the study and conception of intelligent agents, where an intelligent agent is a system that perceives its environment and performs actions that maximize its chances of success”. In the same vein, Kurzweil (1990) treats AI as “The art of creating machines that perform functions that require intelligence when performed by people”.

Perhaps, however, the most famous definition of what Artificial Intelligence would be comes from Alan Turing, a British mathematician and cryptoanalyst very influential in the development of computer science in the first half of the 20th century. Born in 1912, he published an article in 1950 called Computer Machinery and Intelligence, on the topic of Artificial Intelligence, which is the first to introduce the concept of his "Turing Test" to the public. In this text, the author considers the question of whether the machines could think. Since the words "think" and "machine" could not be defined in a way that satisfied everyone, Turing suggests that the machine should be asked if it could win an "Imitation Game" (TURING, 1950).

In this game of imitation, an interrogator must ask questions of two players (a human and a machine), without knowing their identity, in order to determine if this machine could successfully make the interrogator think that it is human. If it were successful, it would be proof that a machine could be equipped with intelligence[15].

Artificial Intelligence thus embraces a multiplicity of definitions. However, the concept to be adopted for the purposes of this work provides that this is an area of study focused on solving problems (or creating machines that perform this function) that previously only the human mind would know how to respond. In this way, it cannot be said that there is "one" or "the" Artificial Intelligence. What exist are a series of different applications that use advanced technology in order to supply the capacity of human reasoning in one use or another.

An example of a practical application of Artificial Intelligence today is Google Translator. The Silicon Valley company's translation tool is a classic example of the ubiquity of Artificial Intelligence technology, which is currently facilitating the lives of

[15] The Turing Test, although extremely relevant for being the first to discuss machine intelligence capability, was widely criticized by the academic community in the decades following its publication. One of the most famous oppositions comes from John Searle, an American philosopher and writer, who proposes that it is not only because a program receives good instructions and manages to demonstrate intelligence that it would necessarily be intelligent. To illustrate his point he proposes the argument of the Chinese room, which postulates that a person, locked in a room, well instructed on how to answer questions asked in Chinese, could pass himself off as fluent in the language, even if he understood nothing about what was questioned (SEARLE, 1980).

its users. However, in order to understand how this translation system currently works, it is necessary to understand how it operated before.

In the early days of the program, in 2007, to translate a word or text from one language to another, the Google system used a single language as the basis for all types of translations. As the company is American, the language used as a base was English. So, for example, if someone wanted to translate a sentence from French into Dutch, it was first translated into English and only then from English into the target language.

This method, although functional, caused a series of inconsistencies between the original and the translated text, which made the program inefficient. In September 2016, however, those responsible for the platform announced that they were moving it to a new system called Google Neural Machine Translation (GNMT), which would learn from millions of examples, provided by users, and considerably improve the quality of translation (SCHUSTER et al., 2016).

What this means in practice is that Google's translation system has come to "learn" from the translations, so that the more it was used and with greater feedback from users, the better the quality of its translations. The introduction of this system also meant that the program no longer used English as the standard language, but introduced a zero-shot translation mode, which allowed direct translation from one language to another.

With this, what the company's researchers began to realize was that as the system did more and more translations, it started to learn about the semantics of languages, instead of simply memorizing the translated segments. With its neural network, the researchers argued (SCHUSTER et al., 2016), the program began to show signs of development of an interlanguage within its programming, something not intended by its programmers, but that significantly helped the translation process.

This example shows how even a translation application can have a complex Artificial Intelligence system in the way it is programmed. Likewise, it shows that AI is not only a popular concept applied to works of science fiction, but also, as emphasized, an entire branch of academic research that dates back to the middle of the 20th century and whose examples of application can be found in various areas of human activity.

However, this does not indicate that humanity is close to creating an Artificial Intelligence such as JARVIS[16], because although, back to the previous example, the

[16] JARVIS is an Artificial Intelligence application that serves as Tony Stark's personal assistant in Marvel's Iron Man movie series.

Google program is excellent in translations, it would be useless to make a shopping list, because it has not been programmed to do so.

And here it must emphasized an important distinction between the modalities of existing Artificial Intelligence applications. In the existing literature on the subject, four types are popularly found: narrow as opposed to general AI and weak as opposed to strong AI (also called AGI: Artificial General Intelligence).

Narrow refers to Artificial Intelligence capable of performing a single task. On the other hand, General is a machine capable of handling any intellectual task. All the Artificial Intelligence methods currently used (such as Google Translator) are characterized as narrow, with the General being within the scope of science fiction (ROOS, 2018).

Regarding the dichotomy between weak and strong, it is summarized to the philosophical distinction between acting intelligently and effectively being intelligent, as previously problematized with the Turing Test. A strong AI would amount to a "mind" that is genuinely intelligent and self-conscious. Weak AI, on the other hand, is what actually exists, namely systems that exhibit intelligent behavior despite being "mere" computers (ROOS, 2018).

In any case, even if mankind is not close to developing an AGI that has its own consciousness, its application in a restricted way is already widespread in society, even if not in a very obvious way. This type of narrow application does not, however, prevent existing programs from already exhibiting certain traits of independence and performing activities not foreseen by their creators, as will be discussed in chapter 3.

In short, Artificial Intelligence was defined as the area of study focused on developing computer applications that can emulate the ability of human reasoning to solve various problems. Likewise, it is well known that these applications are already widespread in society. It is now time to explain a little about how the evolution of the application of Artificial Intelligence technology took place until it reached the level it is currently at in the 21st century.

1.2.2 The evolution of the use of Artificial Intelligence applications

Artificial Intelligence as a field of organized scientific study has existed since the mid-1950s with research by, among others, Alan Turing and John Mccarthy. It was thanks to the work of these and other researchers, especially when gathered in conferences such

as that of Dartmouth[17] in 1956 (MCCORDUCK, 2004, p. 111), that this branch gained its first theoretical foundations, which allowed it to develop greatly in the following decades.

The first neural network created dates to 1950 and was conceived by two Harvard undergraduate students named Marvin Minsky and Dean Edmonds. The system, named SNARC, was created from 3000 vacuum tubes and an automatic piloting mechanism of a B-24 bomber to simulate a network of 40 neurons (RUSSELL & NORVIG, 2016, p. 16).

The initial success was great. As computers in the mid-twentieth century were considered too simple and unable to do anything other than simple arithmetic, it became surprising whenever a machine did some remotely intelligent task (RUSSELL & NORVIG, 2016, p. 18).

These years between 1950 and 1970 were marked by the development of machines with the ability to solve mathematical problems. Another example is Allen Newell and Herbert Simon's General Problem Solver, which was designed from the outset to mimic humane methods of problem solving. Similarly, in 1959, Herbert Gelernter, a former professor of computer science at Stony Brook University in the United States, built the Geometry Theorem Prover, capable of solving theorems that math students found difficult. Other applications at the time included: a 1968 program capable of solving integrated calculation types specific to university courses; another from 1968 that solved typical geometrical problems of IQ tests; and one from 1967 capable of solving algebra problems inserted in the context of a story (RUSSELL & NORVIG, 2016, p. 19).

However, despite the rapid initial advance of research in the area, in the 1970s, a saturation point was reached for this initial movement, which became popularly known as AI Winter. The term was coined in analogy to the idea of the 'nuclear winter' (CREVIER, 1993, p. 203). During this 'winter' of ten years, investment, especially by government agencies, and interest in the technology would reach very low levels. Part of the reason for the pessimism in the area is that that early movement in the 1950s and 1960s generated very high expectations on the part of the community. One of the most

[17] The 1956 Dartmouth Conference was organized by John McCarthy, Marvin Minsky and two scientists: Nathan Rochester of IBM and Claude Shannon. According to Mccarthy (1955) "the proposal for the conference included this assertion: 'any aspect of learning or any other characteristic of intelligence can be so accurately described that a machine can be made to simulate it'". It was at this Conference that McCarthy would persuade the other researchers to accept the name 'Artificial Intelligence' as the name of the research field (MCCORDUCK, 2004, p. 114).

representative speeches of this period comes from one of the researchers in the field, Herbert Simon, who attests in 1957 (RUSSELL & NORVIG, 2016, pp. 20-21) that:

> It is not my aim to surprise or shock you—but the simplest way I can summarize is to say that there are now in the world machines that think, that learn and that create. Moreover, their ability to do these things is going to increase rapidly until—in a visible future—the range of problems they can handle will be coextensive with the range to which the human mind has been applied.

Another of the causes of AI Winter was that the expectation generated by the technology was based on solutions of problems either very trivial or very simple, which was what the computers of the time were able to process. All the applications of Artificial Intelligence existing in the period were, in a certain sense, toys (CREVIER, 1993, p. 146). Researchers in the field began to encounter systems that failed miserably when tested with a wider or more complex range of problems (RUSSELL & NORVIG, 2016, p. 21).

One of the positive examples of this decade, however, was the development of the AARON application in 1973 by British artist Harold Cohen, who helped and often elaborated entire pictures without the help of the artist (GUADAMUZ, 2017. p. 02).

Since the 1980s, investments in Artificial Intelligence have increased again and more industry-focused applications have become commonplace. For example, an application created by Digital Equipment Corporation in 1982, which helped configure orders for new computer systems. Such a system, 4 years later, helped the company save an estimated $40 million a year (RUSSELL & NORVIG, 2016, p. 24).

On the development of technology from 1987 until the second decade of the 21st century, Russell and Norvig (2016, p. 25) stated that:

> Recent years have seen a revolution in both the content and the methodology of work in artificial intelligence. It is now more common to build on existing theories than to propose brand-new ones, to base claims on rigorous theorems or hard experimental evidence rather than on intuition, and to show relevance to real-world applications rather than toy examples.

And this relates, according to them, with the advances that the field of speech recognition began to have as soon as it started to adopt more rigorous methods, with the use of mathematical theories and a large amount of speech data to train programs of this type. Another field that would have benefited from this approach was that of neural networks. Through the use of improved methodology and theoretical structures, the topic reached an equivalent level with similar studies in the field of statistics, pattern recognition and machine learning (RUSSELL & NORVIG, 2016, p. 26). As a result, the

field of Data Mining, of fundamental importance to the understanding of Big Data, to be addressed below, has enabled further development of the industry.

An example is the Windows operating system, which uses applications with neural network architecture to correct problems found within the application itself (RUSSELL & NORVIG, 2016, p. 26).

Since the emergence and popularization of the Internet in the 1990s and its diffuse form of data and knowledge production, Big Data has enabled a greater variety of AI applications to emerge, given the wide availability of information to be used as input value in such programs. Russell & Norvig (2016, p. 28) cite as an example two researchers, Hays and Efros, who in 2007 developed an algorithm capable of filling spaces in photos. The program searched from a photo database to find one that matched the blank space. They realized that the more photos that were fed into the system, the better the performance of the AI application.

And the already mentioned computational advancements and the easy access to Big Data have made it possible to create several types of applications with different purposes, starting in the second decade of the 21st century. These applications range from stand-alone cars, such as Waymo's, which have walked more than 16 million kilometers without human drivers (MCDERMID, 2018), to speech recognition applications, such as those present in the tele-service of large retail companies and the filtering of spam emails, which in the case of Google's GMAIL, is done by a Machine Learning algorithm with an effectiveness of 99.9% (METZ, 2015).

In addition, the use of these applications may incur distinct legal effects. As they were created to carry out an activity that originally could only be done by a human, the consequences of a potential legal relationship that is carried out through an application of this type should also be analyzed. Although it seems another achievement of science fiction, Artificial Intelligence applications have been causing legal consequences that are sometimes serious, without any human being involved in the act. In 2018 in Arizona, as an example, an Uber autonomous car hit and killed a pedestrian crossing the street (LEVIN & WONG, 2018). For this reason, one cannot ignore the actions of this type of application, because they may have serious consequences in various areas, as has been demonstrated.

This thesis will focus will on the type of application of Artificial Intelligence capable of producing works that can be perceived as art, such as music, books, pictures, etc. Specifically, what would be the legal status attributed to the output of an algorithm

trained to produce this type of work. It will be analyzed, especially in chapter 3, how the Brazilian copyright laws would deal with these cases. However, after this brief history of the technology, it is now time to discuss the types of AI applications that can already be found in circulation in the modern society of the third millennium.

1.2.3 Types of Artificial Intelligence applications in the 21st century

Within the proposal to demystify the concept of AI, one of the objectives of this thesis is to show that Artificial Intelligence technologies already have a great impact on the way in which modern society operates. In this sense, it is intended to show in this item which are the main research trends for the area, according to the One Hundred Year Study on Artificial Intelligence report, produced by researchers at Stanford University in 2016.

The areas described below are not necessarily more important or valuable than existing ones, but rather those that are identified by the report as receiving the most attention from the scientific community at the moment.

The first of these areas is called Large-scale Machine Learning. A major focus of this branch of research would be to make existing algorithms capable of working with extremely large databases (STONE et al. 2016, p. 14). We will see in the work the great dependence of Artificial Intelligence applications in the use of data, especially in the modern era, in which everything is digitalized and informational. Thus, applications that can handle an increasing amount of information would be essential for the development of this branch of research.

Soon after that is Deep Learning. This especially benefits the field of computer vision, with applications for object recognition, video labeling and activity recognition (STONE et al. 2016, p. 14). It has also made great progress in the area of audio recognition and others such as natural language processing.

The third item, Reinforcement Learning, focuses on AI application decision making and is a technology that will help such programs improve the actions they take in the real world (STONE et al. 2016, p. 15). One of the applications of this method was in AlphaGo, Google's DeepMind AI program, which defeated the South Korean board game champion of Go[18].

[18] More details about this episode can be found in the documentary AlphaGo (https://www.imdb.com/title/tt6700846/), which portrays the journey of the developers of this program from its conception in London to its victory on Korean soil against the champion of the board game Go.

Another area of fundamental importance, Robotics, will be developed through advances in machine perception, including computer vision, strength and tactile perception, much of which will be driven by Machine Learning (STONE et al. 2016, p. 15).

Specifically on Computational Vision, this is the most prominent area of the above-mentioned machine perception. Those responsible for Stanford's research report that for the first time, thanks to advances in the field, computers are able to perform image classification tasks better than people. Much of the current research would be focused on automatic image and video capture (STONE et al. 2016, p. 15).

Natural Language Processing, also framed within the perception of machines, is another area that demonstrates great advances. Often accompanied by automatic speech recognition, it is fast becoming a commodity for languages with large data sets (STONE et al. 2016, p. 15). Google has announced that about 20% of phone searches are done by voice (STERLING, 2016) and demonstrations have already proven the ability to translate in real time[19].

The seventh area to be highlighted is that of Collaborative Systems. In this, models and algorithms are researched in order to help develop autonomous systems that can work collaboratively with other systems and with humans. This research depends on the development of formal systems of collaboration and studies the capabilities needed for systems to become effective partners (STONE et al. 2016, p. 16). Stanford researchers point out that there would be a growing interest in applications that can utilize the complementary forces of humans and machines - for humans to help AI systems overcome their limitations and for them to help improve human skills and activities.

Another interesting field to be highlighted is Crowdsourcing and human computing. Because human skills are superior to those of automated systems to accomplish many tasks, this line of research investigates methods to improve computer systems using human intelligence to solve problems that computers alone do not solve well. The best example of crowdsourcing is Wikipedia, a virtual encyclopedia maintained and updated by its users and which has a broader and deeper scope than traditional sources. Current research in this line explores the optimal division of tasks between humans and machines based on their different capacities and operating costs (STONE et al. 2016, p. 16).

[19] An example of real-time translation from English into Chinese can be found at this link: https://youtu.be/Nu-nlQqFCKg.

The report points out that it would also be drawing attention to the computational dimension of Artificial Intelligence, including its incentive structures, especially in the economic and social field, through Game Theory and algorithmic Social Choice (STONE et al. 2016, p. 16). In other words, AI applications that can deal with different incentive structures, imperfect data and variables not foreseen like agents that do not fit the structures of a given game are sought. One of the main examples of the use of technology in this area is in poker, with applications such as DeepStack[20] and even AlphaGo itself, as mentioned earlier.

The penultimate area to be highlighted is Internet of Things (IoT). Stanford's report highlights that an increasing area of research is being devoted to the idea that a wide range of devices could be interconnected to collect and share sensory information. Such appliances could range from refrigerators and microwave ovens to cars. An Artificial Intelligence application could process and use this large amount of resulting data for useful and intelligent purposes (STONE et al. 2016, p. 16). It could also be used to connect a wide range of devices using different programming languages.

Finally, the field of Neuromorphic Computing seeks to create computers based on biological neural networks. Traditional computers implement the Von Neumann computing model[21], which separates the input/output, instruction-processing and memory modules. This new computational structure would seek to improve hardware efficiency and the robustness of computer systems (STONE et al. 2016, p. 17).

Although their uses and objectives are different, all the above-mentioned modalities have a common denominator that is their dependence on data analysis to extract some result, which is one of the corollaries of Machine Learning technology, as will be seen in the following items. About this subject, Teemu Roos (2018) states that:

> To summarize, machine learning is a very powerful tool for building AI applications. In addition to the nearest neighbor method, linear regression, and logistic regression, there are literally hundreds, if not thousands, different machine learning techniques, but they all boil down to the same thing: trying to extract patterns and dependencies from data and using them either to gain understanding of a phenomenon or to predict future outcomes.

[20] *DeepStack is an* Artificial Intelligence application designed to deal with scenarios where the data made available for analysis is fickle and where agents, the poker players, make decisions that are not necessarily logical or rational. More details about it can be found through the link: https://www.deepstack.ai/.

[21] John Von Neumann (1903 to 1957) was a Hungarian mathematician who designed the way computers today capture and process data, from the separation of a processing unit (CPU) and a storage unit (known as 'memory'), which comprise, respectively, instructions and data.

All the types of Artificial Intelligence applications mentioned above depend on data and, as will be seen below, the type and quality of these data can have a great influence on the result that will be obtained from a given input value. Roos (2018) emphasizes that:

> In order to build a model that generalises well to data outside of the training data, the training data needs to contain enough information that is relevant to the problem at hand. For example, if you create an image classifier that tells you what the image given to the algorithm is about, and you have trained it only on pictures of dogs and cats, it will assign everything it sees as either a dog or a cat. This would make sense if the algorithm is used in an environment where it will only see cats and dogs, but not if it is expected to see boats, cars, and flowers as well.

At the end of this item 1.2 it should be possible to notice that the Artificial Intelligence study area already has a series of different applications in various areas of modern society. Such applications are intended to make the lives of humans easier by intending to solve problems that previously only they could solve. The evolution of the use of this type of application has meant that it has ceased to be just a toy or curious experiment and has, on the other hand, had serious legal consequences and the multiplicity of possible applications reveal the urgency of studying its effects in depth.

The following items will seek to explain which the fundamental components of an Artificial Intelligence are and which allow them to perform tasks as if they were human. From the analysis of the above, it is already possible to conclude that the programming of an AI application does not work in isolation, but in conjunction with other elements whose evolution would also be essential for the development of the technology to occur in a satisfactory manner.

1.3 The key components of an Artificial Intelligence application

Artificial Intelligence was defined as the area of study focused on developing applications that can emulate the ability of human reasoning to solve various problems. In the same way, it has been demonstrated that these applications are already widely spread in society in various forms and may have serious legal consequences. It is now time to take a closer look at the elements that make up this technology, in order to avoid folkloric explanations of its architecture that go beyond its real capabilities. From the analysis of the exposed so far it is possible to identify three main elements that enable the proper functioning of an application of Artificial Intelligence, which are its algorithm, the

hardware in which it is executed, and the data and information used in it. These elements will be explained in more detail below.

1.3.1 The Algorithm

Being Artificial Intelligence applications computer systems, as previously defined by McCarthy (1955), the first element that needs to be studied, and which constitutes the basis of any program of the type, is the algorithm.

The algorithm "is a set of mathematical instructions, a sequence of tasks to achieve an expected result in a limited time" (KAUFMAN, 2018). It means that its existence is not necessarily linked to a computer or other electronic device, so that a cake recipe, for example, can be considered an algorithm for the physical world, because it is a series of instructions to achieve a certain end. The term is the Latinization of the name of a 9th century Persian mathematician called Al-Khwãrizmi, whose works taught mathematical techniques to be solved manually, with him being responsible for presenting the first solution for the linear and quadratic equations (GANDZ, 1926).

Ed Finn (2017, p. 17) defines algorithm as being "any set of mathematical instructions for manipulating data or reasoning through a problem". In the computing field, the algorithm would be defined as "any well-defined computational procedure that takes some value or set of values as input and produces some value or set of values as output" (CORMEN et al., 2002, p. 3).

Such an instruction set that transforms a certain input value into an output results from lines of code that when applied on a given machine perform specific actions. Such lines of code constitute, fundamentally, a computer program.

This type of software can be programmed in different ways to perform different functions. As seen earlier, Artificial Intelligence programs were created to emulate human reasoning in different activities, such as playing chess or doing translations. Just as there is a wide variety of applications that apply Artificial Intelligence, there is also a wide range of ways to program them. It is now necessary to highlight some of the main methods by which AI applications are created, beginning with the method called Machine Learning.

It can be said that Machine Learning is exactly what it seems to be: an attempt to teach a program a trick that even primitive animals are able to do, in this case learn from experience (ECONOMIST, 2015). Kaufman (2018) states that:

> ... Machine Learning explores the study and construction of algorithms that can learn and make predictions about data - these algorithms follow strictly static instructions when making predictions or data-based decisions, by building a model from sample inputs. Machine learning is employed in a variety of computing tasks, where the design and programming of explicit algorithms with good performance is difficult or impractical.

The term is attributed to Arthur Samuel, because his work was one of the first successful initiatives in Machine Learning research (RUSSELL & NORVIG, 2016, p. 868). His research began in 1952 when Samuel wrote a series of software programs for the game of Checkers that eventually learned to play at a strong amateur level (RUSSELL & NORVIG, 2016, p. 32). During his research, Samuel refuted the idea that computers could only do what they were told: his program quickly learned to play checkers at a better level than its creator (RUSSELL & NORVIG, 2016, p. 33). A concise definition of Machine Learning would be as follows (ROOS, 2018): "systems that improve their performance in a given task with more and more experience or data".

The idea that computers could learn and improve independent from human intervention, originated in Samuel's research, persists and serves as a basic concept in the study of Artificial Intelligence. It is worth noting that its roots are in statistics and the way they extract data, and there are three main ways in which an application of this type could learn to read information: through supervised learning; unsupervised learning; and reinforced learning (ROOS, 2018).

In supervised learning, there is an input to the program, for example a photo with a traffic signal, and the task is to label the item correctly, with the program having to say whether the signal would be a speed or STOP sign. In the simplest cases, the answers would be in yes/no forms, in a binary classification form (ROOS, 2018).

Through unsupervised learning there would be no correct labels or results. The task of the program would be to discover the structure of the data, for example, by grouping similar items or reducing the data to a small number of important dimensions. Data visualization could also be considered as unsupervised learning (ROOS, 2018). When it comes to the use of Big Data as an input value in a given AI application it is unsupervised learning as a rule, because this type of database is not commonly filtered.

Finally, reinforced learning is commonly used in situations where the Artificial Intelligence agent, such as an autonomous car, must perform tasks in an environment where feedback on good or bad decisions is available with some delay. This type of

technique is also used in games where the result can only be decided in the end (ROOS, 2018).

From the Machine Learning method, which uses data to teach an AI application a certain activity, a more complex programming modality called Deep Learning was developed. It uses artificial neural networks, simplified simulations of how biological neurons behave, to extract rules and patterns from certain data sets (ECONOMIST, 2015).

This technology consists of a series of units (similar to neurons). Each of these units combines a series of input values to produce an output value, which in turn is also passed on to other neurons following a current (OSTP, 2016, p. 09). This way, an application that uses Deep Learning will, in a first step, analyze a sequence of data to reach a certain pattern; then it will pass that pattern through a second layer of analysis to get to a more refined pattern and so on. The Office of Science and Technology of the Government of the United States of America (OSTP, 2016, p. 10) states that:

> Deep learning networks typically use many layers—sometimes more than 100—and often use a large number of units at each layer, to enable the recognition of extremely complex, precise patterns in data.

Roos (2018) states that this depth of layers allows the network to learn more complex structures without requiring unrealistically excessive amounts of data. In addition, the author points out that another great reason to build artificial neural networks would be to use the biological systems present in humans as inspiration to program better AI systems. According to him (ROOS, 2018):

> The case for neural networks in general as an approach to AI is based on a similar argument as that for logic-based approaches. In the latter case, it was thought that in order to achieve human-level intelligence, we need to simulate higher-level thought processes, and in particular, manipulation of symbols representing certain concrete or abstract concepts using logical rules.

It is this technology based on neural networks that seeks to emulate human thought that is one of the greatest advances in the way Artificial Intelligence applications are programmed.

Illustrating with another example, as closure for this topic, DeepMind, the Artificial Intelligence branch of Google[22], stands out. Among its many AI application projects, one of them is called WaveNet. According to Andres Guadamuz (2017, p. 04), it was initially created to generate voice excerpts, through a machine learning algorithm,

[22] The main page of this Google branch, which contains a series of articles and explanations of the achievements of the project so far, is the following: https://deepmind.com/.

in order to try to overcome the mechanical sound that computers make when they speak. What drew attention, the author continues, is that by doing the voice wave analysis, the app also learned how to create music. When they gave the application pieces of classical music to analyze, WaveNet produced piano compositions that successfully emulated the human ability to make music[23].

And this is just one of the ways that complex Artificial Intelligence applications are used today. Google Translator, DeepBlue (the AI that defeated Kasparov in chess) and image detection applications are some of the examples already listed that use programs with higher or lower degrees of Machine or Deep Learning in their programming. These are the modalities of algorithms, mathematical instructions which can be programmed to produce AI applications, that are the most used in the 21st century in this type of programming.

1.3.2 The Hardware

Being an algorithm, there are a number of technological barriers in several areas that needed and still need to be overcome in order to help the advancement of AI research. This is because an AI algorithm, despite its great potential, is not capable of running without a suitable machinery for that. This is where the computing speed of the machines on which AI applications run gains relevance.

Hans Moravec (1976), associate professor at the Institute of Robotics at Carnegie Mellon University, suggests an analogy that Artificial Intelligence needs computing power the same way that an aircraft needs horsepower for lift-off. Below a certain threshold it is impossible, but as power increases it becomes easy. This is an area, fortunately, that has been constantly improving.

Gordon E. Moore, co-founder of Intel, elaborated in 1965 a theory (eventually known as Moore's Law) which states that the number of transistors[24] in a dense integrated circuit would double every twelve months (MOORE, 1965, pp. 01-04). This means, in practice, that the processing capacity of computers would grow at a geometric progression year after year.

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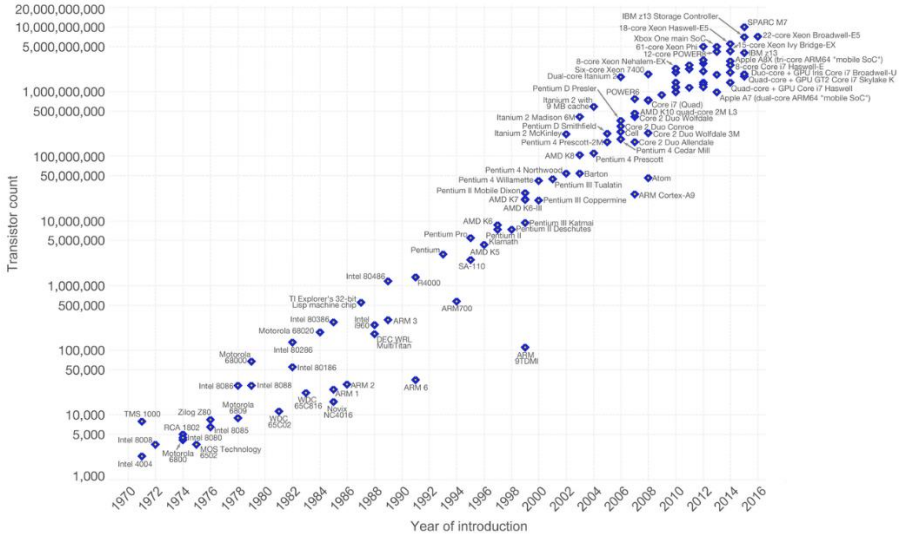
[23] The website containing these audio files and the results of the *WaveNet* search is: https://deepmind.com/blog/wavenet-generative-model-raw-audio/.

[24] Transistor is an electronic component used as amplifier and electrical signal switch and is the main component of computers.

Although eventually revised by Moore himself, changing the prediction of doubling the capacity from one to two years (1975, pp. 01-03) and even though this is already outdated, there is no way to deny that the computing speed of machines that run Artificial Intelligence applications is already much higher after the turn of the 20th century to the 21st than it was in the 1960s and 1970s. This can be proved by the analysis of the graph below, which shows the advancement in the number of transistors in integrated circuits from year to year:



GRAPH 1 - The Number of Transistors in Integrated Circuit Chips (1971-2016) (WIKIPEDIA, 2018).

Such an exponential increase in the number of transistors and, consequently, in the speed of computers also helps in the fact that many more complex equations can only be solved in exponential time. In other words, the more complex the input value, the longer the computing time required to produce a satisfactory output value. Finding an optimal result would require infinite computing time, unless the problems were trivial. That is why solutions of the kind generated by AI in the 1960s and 1970s would never be scalable to useful systems.

Another technological barrier capable of being solved by faster hardware refers to what is called Moravec Paradox. This is the finding, opposite to what might be assumed, that complex mental problems require a low computational capacity to be replicated and that motor activities of a low degree of complexity (such as holding a glass) would inversely require enormous resources. On the subject, Carnegie Mellon's teacher (MORAVEC, 1988, p. 15) writes:

> it is comparatively easy to make computers exhibit adult level performance on intelligence tests or playing checkers, and difficult or impossible to give them the skills of a one-year-old when it comes to perception and mobility.

This difficulty is justified by the fact that these apparently simpler activities require a large amount of data to be carried out that is not perceived by the human consciousness. This is related to the third fundamental component of AI applications, which is the fact that they require a very large amount of data to produce satisfactory results.

In applications that perform this type of motor activity the program needs to have some idea of what it is observing or this requires that it has knowledge of the same information about the world that a child would have. Researchers soon discovered that this was really a vast amount of information. Moreover, no one in the 1970s could build such a large database and no one knew how a program could assimilate so much information (MORAVEC, 1988, p. 13).

It can be seen that Artificial Intelligence applications depend largely on the evolution of the computers that are used to run this type of program. That is why in the 21st century there is a great focus, as seen in the previous chapter, on applications that see and hear, as pointed out in the Stanford report. It has come to a point where the hardware has sufficient robustness, capacity and speed to handle complex calculations and the amount of data needed to produce a satisfactory result from an equally complex input value.

And the prospect is of improved computer capacity. It was commented in item 1.2.3 about Neuromorphic Computing, which would come to replace computers created with Von Neumann architecture, which is present in modern computers since its conception in 1950. Companies like Microsoft have been developing so-called Quantum Computers, which promise to considerably improve the analytical capabilities in comparison to current machines. For example: "in 1997, IBM's Deep Blue analyzed 200 million moves per second to beat chess champion Garry Kasparov. A quantum machine, on the other hand, would be able to analyze 1 trillion movements every second" (GARRETT, 2018).

The difference would be in the way a quantum computer works. Processing on a traditional computer occurs in a binary manner, with information being transmitted from bits that can only have a binary value of 0 or 1, which limits the processing power. In quantum computing, on the other hand, a quantum bit can hold both values at the same

time, which is called the superposition state, and this allows the processing speed to be vastly higher when compared to traditional computers (MICROSOFT, 2018).

In addition to advances in computer technology, as occurs in any knowledge process, it is necessary that the application has the necessary information to produce a given result. The greater the amount of information and the better the quality of the data, the better the result obtained by an Artificial Intelligence application. See the example given earlier of the program that only had been fed pictures of dogs and cats suddenly see themselves in an environment in which they need to identify boats. Pamela McCorduck (2004, p. 299) reported that AI researchers had begun to suspect that intelligence could very well be based on the ability to use large amounts of different knowledge types in different ways.

This great amount of different knowledge types is the subject to be addressed in the next item of this work and that completes the tripod of items necessary for the proper functioning of an Artificial Intelligence application. Two of them have already been seen: the complex algorithms and the high-capacity computers.

1.3.3 Data and Information

Russell and Norvig write (2016, p. 27) that during the 60-year period of computer science history, from 1950 to approximately 2010, therefore, the emphasis had been on the algorithm as the main object of study. They state, however, that recent studies in the area of Artificial Intelligence show that for many problems it would make greater sense to be more concerned with the data collected and to be less judicious about which algorithm to apply. This would be due to the high availability of databases on the Internet.

Being Data any given symbol (images, sounds, etc.) that needs to be interpreted in order to be transformed into information, and being the function of an AI application precisely to transform a certain input value into an output value, it is now necessary to introduce an extremely important concept, already mentioned above, that completes the tripod of elements necessary for the proper functioning of an AI application: Big Data.

Big Data can be defined as the "representation of information assets characterized by such a large volume, speed and variety that they require a specific technology and analytical methods for their transformation into value" (DE MAURO et. al., 2016). In addition to that, Big Data "typically includes data sets larger than the ability of common

computer programs to capture, cure, manage, and process within a tolerable period of time" (SNIJDERS, 2012).

The origin of the term dates to an article by Michael Cox and David Ellsworth in 1997[25], which was the first to deal with the challenges of Big Data for the capacity of computers of the time. The term was later popularized in 1998 by John Mashey, chief scientist of Silicon Graphics from 1992 to 2000, in an article called Big Data... and the Next Wave of Infrastress, which also deals with the sudden increase in the amount of data available compared to the storage capacity of computers at the time.

The time of the appearance of the term (late 1990s) cannot be taken as a coincidence. After all, it was during the 1990's that there was the popularization of the Internet, especially after the integration of HTML[26] and HTTP[27] codes by Tim Berners-Lee[28] in one of his creations made in partnership with CERN[29], the World Wide Web, and its subsequent dissemination through web browsers already in the first year of that decade (CERN, 2003). Three years later, the number of existing websites had already reached 600, including pages such as the White House and the UN and in 1998 the Google search engine would have had its origin (ZIMMERMANN & EMSPAK, 2017).

The development of the Internet has allowed every user, and in modern iterations even household appliances and home objects through the Internet of Things, to produce data and information such as photos, text, videos, etc. which can be grouped into large data sets to be analyzed by certain software. This is because the world wide web is not media in the traditional sense, in which only one party produces the content and the other passively receives it. Instead, it is an interactive means of communication (CASTELLS, 2010, p. xxvi).

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[25] The article is titled Application-Controlled Demand Paging for Out-Of-Core Visualization. The expression Big Data can be found at the text's introduction: "visualization provides an interesting challenge for computer systems: data sets are generally quite large, taxing the capacities of main memory, local disk, and even remote disk. We call this the problem of big data. When data sets do not fit in main memory (in core), or when they do not fit even on local disk, the most common solution is to acquire more resources" (COX & ELLSWORTH, 1997, p. 235).

[26] *Hyper Text Markup Language* (HTML) is the language by which documents on the network are structured.

[27] The *Hyper Text Transfer Protocol* (HTTP) is the rules for communication between browsers and servers.

[28] Sir Tim Berners-Lee is an English engineer, computer scientist, and professor at Oxford University and the Massachusetts Institute of Technology (MIT). He is best known for being one of the leading inventors of the *World Wide Web*.

[29] The *Conseil Européen pour la Recherce Nucléaire* (CERN) is the European department of nuclear research that provides infrastructure for high energy physics studies.

Russell and Norvig (2016, p. 27) cite an influential work by David Yarowsky[30] from 1995 on the importance of this greater availability of data for Artificial Intelligence applications. The question to be answered by Yarowski, the authors continue, was whether the use of the word 'plant' in a sentence would refer to the flora or the factory. Previous approaches to the problem used examples labeled by people combined with machine learning algorithms. Yarowsky demonstrated that the task could be accomplished with an accuracy of more than 96% without any example selected and filtered by humans. On the contrary, say Russell and Norvig, given a large amount of unedited text and only the dictionary definitions of both meanings of the word ('works, industrial plant' and 'flora, plant life'), it was possible to label the examples given and from this point on only adapt it to learn new patterns that would help to identify new examples.

Two other computer scientists, Banko and Brill, have a text of their own from 2001 quoted by Russell and Norvig (2016, p. 28) when they state that techniques like the one previously demonstrated have an even better performance as the available amount of texts goes from one million to one billion words and that this increase in the performance of using more data exceeds any difference in the choice of algorithm. Banko and Brill, still in the words of Russell and Norvig, attest that a mediocre algorithm with 100 million words of unlabelled training data achieves a better result than the most popular algorithm with only 1 million words.

On this topic, Russell & Norvig conclude (2016, p. 28) that works such as this one suggest that the 'knowledge bottleneck' in Artificial Intelligence (the problem of how to express all the knowledge that the system needs) could be solved in many computer programs of this type by means of training methods (such as those previously mentioned of supervised, unsupervised and reinforced) rather than by means of human knowledge coded directly in the platform. The condition for this would be that these algorithms would need enough data to perform their functions in a satisfactory manner.

This conclusion from Russell and Norvig's brings two important points that deserve to be highlighted. One of them is the ability of Artificial Intelligence applications to produce better results even with less human interaction. If even with uncured data the applications produce satisfactory results, how would the final product that was a work of

[30] Professor in the Department of Computer Science at John Hopkins University in the United States.

art produced almost entirely without human intervention be treated? Would it be possible to say that this application reveals signs of creativity?

The other point is the need to be careful about the quality and origin of the data that is used in Artificial Intelligence applications. Two key issues need to be addressed in relation to Big Data in order to ensure that the results obtained from a computer program of this type are reliable or consistent with reality and do not infringe on any rights of third parties, whether personal or proprietary.

The first of these questions refers to the extent to which the data collected present some type of bias or not. To illustrate with an example: Amazon, an American company that acts mainly as a platform for buying and selling products over the Internet, began to use, since 2014, an Artificial Intelligence application to evaluate the resumés of all people interested in working in the company, due to the large number of candidates. This program had been fed with data from curricula submitted to the company dating back to 2004. These data were used as a basis and reference to give a 1 to 5-star rating to new candidates. According to a report from The Guardian the problem was that given the fact that most of the resumés for this technology company had been historically sent by men, the algorithm tended to give higher marks for male candidates and lower marks for female candidates, which resulted in this application to evaluate applications to be eventually discontinued in 2017 (REUTERS, 2018).

This is a problem called AI Bias, which occurs when an Artificial Intelligence application reaches a biased result that was not expected by its programmers, but that would be in accordance with the database used by this program as reference. On the subject, researchers from the Berkman Klein Center of Harvard University (RASO et. al., 2018, p. 7) comment:

> AI can easily perpetuate existing patterns of bias and discrimination, since the most common way to deploy these systems is to "train" them to replicate the outcomes achieved by human decision-makers. What is worse, the "veneer of objectivity" around high-tech systems in general can obscure the fact that they produce results that are no better, and sometimes much worse, than those hewn from the "crooked timber of humanity.

This is due to the fact that the biased patterns emulated by the machines are present in elements that often go unnoticed by the sieve of the programmers, but that are imbued in the very way in which the language is constructed. In the case of Amazon, its curriculum analysis system learned that male candidates were preferable because its

database was trained with curricula mostly coming from men. According to The Guardian's report (REUTERS, 2018), the algorithm:

> …penalized résumés that included the word “women’s”, as in ‘women’s chess club captain’. And it downgraded graduates of two all-women’s colleges, according to people familiar with the matter. (…) Instead, the technology favored candidates who described themselves using verbs more commonly found on male engineers’ resumes, such as ‘executed’ and ‘captured’’.

On the subject, Halevy, Norvig and Pereira (2009, p. 12) state that the human language is already evolved in such a way that using an AI application to analyze a large amount of unfiltered data in an unsupervised manner can bring results with more details than those that go through a human analysis. However, as seen above, it can lead to the same biases and prejudices present in the interaction between people.

The second issue to be addressed regarding Big Data is its origin. Since the Internet is a space of multiple communication patterns, information of all kinds circulates in this environment. These range from text to photos, videos and computer programs, which are created and can circulate freely on the network. When a portion of this data is gathered to be the input value of Big Data from certain Artificial Intelligence software, it is often not known the origin of this data. It was discussed above about the possibility of this causing problems depending on the end of the application. However, even before using the program, another problem to be verified is whether the text or photo to be analyzed by the application already has a holder and if this holder authorizes the transformative use of their property.

Although the focus of this work is to deal with the legal protection of works produced by an AI application, that is, at the end of the analysis and data transformation cycle by a certain program, it is necessary to point out that the problem of Intellectual Property on Artificial Intelligence applications arises long before a final product is produced. This is because certain transformative uses that an application of Artificial Intelligence makes of protected works fed to its algorithm, starting from its own reproduction, depend on the authorization of the holder of the work of art, film, etc. that will be modified.

Jessica Fjeld and Mason Kortz, researchers at Harvard University's Berkman Klein Center (2018) argue that it is necessary to separate how to protect each step of the process of creating a work by Artificial Intelligence. They attest that the protection, and the potential infringements to the intellectual property of a holder whose work is used by an AI application, varies throughout this process.

So, as far as Big Data is concerned, the use of data by an application of Artificial Intelligence is a matter that must be taken very seriously, in order to ensure that its application does not infringe the intellectual property rights of third parties, either by obtaining licenses or by using free works, and that it does not present biased results, through the conscious use of data by means of ethical principles. The databases make up the third item of the tripod for the proper functioning of AI and its proper development is as essential for the evolution of technology as the algorithms and hardware.

The conceptualization of creative works and Artificial Intelligence, as well as the exposure of the applicable legislation to the case, are essential for the rest of the work. This is because they allow the drawing of relevant conclusions: the type of discipline that regulates the issue, copyright law; the definition of creative work as a creative expression of the intellect; the demonstration of AI as an area of study that seeks to create computer applications that perform human tasks; the ubiquity of the presence of this technology in modern society and its legal effects; and finally the elements that make up this technology, algorithm, hardware and data, and that enable its proper functioning.

2 ARTIFICIAL INTELLIGENCE IN ACCORDANCE WITH THE THEORY OF CASTELLS AND THE ORIGINS OF CURRENT BRAZILIAN LEGISLATION ON THE SUBJECT

Considering the intrinsic function of laws in regulating society and establishing behaviors and the symbiotic existence between the two of them, with one influencing the other, it would not be wrong to think that both exist or are created on the basis of the same social paradigms. This would be essential in order to ensure compatibility between the norm and what it intended to regulate, as well as in order to comply with the intentions of the original legislator with the utmost precision.

With the technology of Artificial Intelligence promising to revolutionize all aspects of life in society, it is necessary to verify its compatibility with the laws created to regulate it. As this thesis is focused on the discussion of the protection of creative works, it will seek to study the congruence between a society where the existence of AI, internet and the wide dissemination of information is a reality with the laws of Copyright currently in force in Brazil.

To this end, the technology of Artificial Intelligence will first be approached in the light of Manuel Castells' theory of the Information Society. This theory was chosen due to the centrality that data and information occupy in both areas. Parallels will be sought between the theory of the Spanish sociologist and the technology of AI aiming to conclude whether this would have been made with the Information Society as a paradigm or not.

The origins of the international legislation suited to regulate the subject will then be discussed. Considering that AI applications are computer programs, the origin of the mention of the word ‘software’ in international devices and the justification given to its regulation will be sought.

Finally, the same process will be carried out in relation to the Brazilian legislation. An analysis will be made of the laws in force on the subject, addressing their legislative process, the agents who influenced their creation and the mention of computer programs and provisions that speak about their authorship in their text.

It will be sought to verify under the influence of which paradigm these laws were created and if it would be possible to affirm that they are compatible with the one that would serve as an influence for the creation of Artificial Intelligence technology. Based

on the answer to this question, it will be possible to explore, in chapter 3, the way in which the creative works of an AI would be regulated based on Brazilian law.

2.1 Artificial Intelligence in the Context of the Information Society

Manuel Castells, a Spanish sociologist, proposes in his theory of the Information Society that the development of new technologies in itself does not alter the bases or foundations of a given society, but rather enhances existing issues and processes. In this sense, considering the potential of Artificial Intelligence technology, it is important to verify which would have been the aspects of society that influenced the development of this technology. The analysis will start from information and data, central to both Castells' theory and AI, seeking to explain the fundamental precepts of the Spanish sociologist's theory, the role of information in it and its relationship with the technology discussed above.

2.1.1 The Information Society according to the theory of Castells

From the analysis of the previous items, it can be concluded that some of the main advances made in the field of Artificial Intelligence are due to the advancement of the Internet. Online networks allowed a greater creation and sharing of data which, generally, are available on the web to be freely used by AI applications, that use them for analysis and creation of, for example, works of art.

Manuel Castells (2010, p. xviii) comments that while networks would be an ancient form of organization in human experience, digital technologies, features of the Information Society, have enhanced organizational and social networks in ways that allowed their infinite expansion and reconfiguration, overcoming the traditional limitation of organizations to manage complexity beyond a certain size. Given the fact that networks are not limited to the borders of countries, the Information Society was constituted as a global system, unveiling a new form of globalization characteristic of the end of the twentieth century and the beginning of the twenty-first century.

In this 'Information Society', explains Wachowicz, information, communication and computing technologies, focusing on the Internet, would serve as the basis for a new industry of computer programs, information services, media, and knowledge processing, essential to all other industries and services (2004, p. 26).

This centrality of information is an important aspect to be highlighted. Information never ceased to be important in any society before what Castells calls the Information Society. The great feature of this one, therefore, would be the possibility to produce and share data (texts, images, photos, etc.) in a much faster and more efficient way. This is largely due to the evolution of information technologies, which have not necessarily created new habits in the peoples of the world, but have enhanced existing practices. In the words of Pierre Lévy (2014, p. 51):

> Indirectly, the development of interactive digital networks favors virtualization movements other than that of information itself. Thus, communication continues, with the digital, a virtualization movement initiated long ago by the oldest techniques, such as writing, sound and image recording, radio, television and telephone. Cyberspace encourages a style of relationship that is almost independent of geographical places (telecommunications, telepresence) and the coincidence of times (asynchronous communication). It is not an absolute novelty, since the telephone has already accustomed us to an interactive communication. With the mail (or writing in general), we come to have a very old tradition of reciprocal communication, asynchronous and distant. However, only the technical peculiarities of cyberspace allow the members of a human group (who can be as many as they like) to coordinate, cooperate, feed and consult a common memory, and this almost in real time, despite the geographical distribution and the time difference.

In other words, those movements for "reciprocal, asynchronous and remote" communication have been enhanced by the digital technologies typical of the Information Society, which, moreover, ignore any geographical and geopolitical barriers.

Technology, says Castells (2010, p. 5) does not determine society and, likewise, society also does not make plans for technological advancement. The dilemma that 'technology does not determine society, it incorporates it, and that society does not determine technological innovation either, but uses it' is considered a false problem. The author affirms that technology is society and that it could not be understood or represented without its technological tools.

And the vector of this data exchange is the World Wide Web, which is the communication vehicle used to post and exchange documents. In the words of Castells (2010, p. xxvi):

> These documents can be texts, audios, videos, software programs; literally anything that can be digitized. As a considerable body of evidence has demonstrated, the Internet, and its diverse range of applications, is the communication fabric of our lives, for work, for personal connection, for information, for entertainment, for public services, for politics, and for religion. The Internet is increasingly used to access mass media (television, radio, newspapers), as well as any form of digitized cultural or informational product.

In addition to the centrality of the exchange of information and its occurrence in the field of the Internet, another aspect to be highlighted about the Information Society is its difference in relation to the society resulting from the Industrial Revolution. While in the first (CASTELLS, 2010, p. 17) the source of productivity is based on the technology of knowledge generation, information processing and communication of symbols, in the Industrial Society this would be the search for money and wealth through the production of commodities (CASTELLS, 2010, p. 505). The author, however, makes a reservation (2010, p. 17):

> To be sure, knowledge and information are critical elements in all modes of development, since the process of production is always based on some level of knowledge and in the processing of information. However, what is specific to the informational mode of development is the action of knowledge upon knowledge itself as the main source of productivity.

On this subject, Jeremy Rifkin (2014, pp. 13-14) highlights:

> The role of property is changing radically. The consequences for society are enormous and far-reaching. (...) In this new era, markets are giving way to networks and access is increasingly replacing ownership. (...) Suppliers in the new economy keep the property and lease it, rent it or charge an admission, subscription or registration fee for its short-term use. The exchange of ownership between buyer and seller, the most important feature of the modern market system, becomes immediate access between servers and clients operating in a network-like relationship.

A second difference between the two types of society would be their driving force. According to Castells (2010, p. 30):

> Information technology is to this revolution what new sources of energy were to the successive industrial revolutions, from the steam engine to electricity, to fossil fuels, and even to nuclear power, since the generation and distribution of energy was the key element underlying the industrial society.

This difference in the driving force would represent a shift from a techno-economic paradigm to an information technology paradigm. As Christopher Freeman (1988, p. 10) points out:

> In each new paradigm a particular input or set of inputs may be described as the "key factor" in that paradigm characterized by falling relative costs and universal availability. The contemporary change of paradigm may be seen as a shift from a technology based primarily on cheap inputs of energy to one predominantly based on cheap inputs of information derived from advances in microelectronic and telecommunications technology.

Finally, each development mode would also have, according to Castells (2010, p. 17), a structurally determined performative principle around which the technological

processes would be organized. Industrialism would be oriented towards economic development, in other words, to maximize production. On the other hand, informationalism would be oriented towards technological development, that is, towards the accumulation of knowledge and higher levels of complexity in the processing of information. The author concludes (2010, p. 17) that "while higher levels of knowledge can usually result in higher levels of production per unit of input, it is the search for knowledge and information that characterizes the technological production function under informationalism".

This makes this economic model that emerged at the end of the twentieth century to be informational, global and networked, to identify its distinct attributes and emphasize its interweaving (CASTELLS, 2010, p. 77).

Based on the comments of the authors cited above it is possible to highlight two main characteristics of the Information Society envisioned by Castells. Although with their limitations, these have their usefulness in focusing the points of analysis to be explored in the course of this thesis.

The first of these characteristics is that technological advances are not the main transforming agents of a society. The communicative impetus is something that already exists in the peoples of the planet, as Lévy's work revealed, with the advancement of communication technologies only accelerating this process. The willingness and even the need to exchange information, documents and data freely and quickly is a characteristic already present in society and not something introduced by the Internet. What the Information Society has done, then, is to help focus on this more communicative aspect of the peoples of the planet.

The second characteristic is that where these new communication technologies had a profound transformative impact was on the functioning of the production system then in force until the middle of the twentieth century. In the Industrial Society, productivity would be achieved by the generation of wealth, symbolized by the most efficient manufacturing of an ever-larger number of units of a certain consumer good. The final objective was to sell these items to the final consumer, which would generate profit for its producer. In an Information Society, on the other hand, productivity would be achieved by the generation and exchange of information. This change in the central element of the production system makes it necessary to rethink entire business models in order to adapt to a growing demand of society to communicate, which was made easier with the advent of the Internet. Companies that, in the 21st century, can be considered to

be successful are those that have the capacity to be a center for information sharing, such as Google and Facebook.

The element to be studied in the next point is precisely the information and why it has become the focal point of the productive system in the Information Society, especially in the 21st century.

2.1.2 Information in the Information Society

On information, Castells emphasizes that the characterizing element of the technological revolution in the 21st century would not be the centrality of information and knowledge in themselves, but the application of these for data processing and for the production of knowledge, in a constant feedback loop between innovation and its uses (2010, p.31). Guilherme Carboni states that at the stage of economic production that is lived after the emergence of the Internet, "the admission of knowledge as the main productive force caused a change in the economic categories of labor, value and capital" (2015, p. 2).

This is because, according to Castells (2010, p. 31), for the first time in history the human mind would be a direct productive force, not only a decisive element of the production system. He adds:

> The feedback loop between introducing new technology, using it, and developing it in to new realms becomes much faster under the new technological paradigm. As a result, diffusion of technology endlessly amplifies the power of technology, as it becomes appropriated and redefined by its users. New information technologies are not simply tools to be applied, but processes to be developed. Users and doers may become the same. Thus users can take control of technology, as in the case of the Internet. There is therefore a close relationship between the social processes of creating and manipulating symbols (the culture of society) and the capacity to produce and distribute goods and services (the productive forces).

On the same subject, Castells still justifies calling this new method ‘information production’, because in it the processing of information is focused on improving the technology of this same process. This would constitute this virtuous cycle mentioned above of interaction between the sources of knowledge and application of technology to improve the methods of knowledge generation and information processing (2010, p. 17).

Going back to the already mentioned paradigm of information technology, it is important to highlight some of its attributes. Being all of them related to information, they are useful to understand a little better the functioning of the Information Society and to establish some of its bases.

The first of them is that the information is its raw material. In this paradigm, technologies act on information, as is the case of Artificial Intelligence applications with Big Data, no longer limited to having information acting on the technology, as was the case in previous technological revolutions (CASTELLS, 2010, p. 70).

The second attribute refers to the penetration of the effects of new technologies. Castells comments (2010, p. 70) that because information is an integral part of all human activities, all processes of our individual and collective existence would be directly influenced by this new technological environment. The author, however, makes the proviso that although molded, these processes would not necessarily be determined by the new technologies that integrate the Information Society.

The third is the network logic of any system or set of relationships that use these information technologies. Manuel Castells (2010, p. 70) explains that the morphology of the network would seem to be well adapted to the increased complexity of interactions and unpredictable patterns of development arising from the creative power of such interaction. This topological configuration, the network, could, according to him, be materially implemented in all types of processes and organizations, thanks to these information technologies that would be available. In addition, the author concludes on this point (2010, p. 71) that the penalty for being outside the network would increase as its proportion grew, given the decreasing number of opportunities available to those outside the system.

Fourthly, related to networking, the information technology paradigm is based on flexibility. Castells (2010, p. 71) comments not only that the processes are reversible, but that organizations and institutions can also be modified and even fundamentally changed. The distinctive element of the configuration of this new technological paradigm would be its ability to reconfigure, a decisive characteristic in a society marked by constant changes and organizational fluidity.

Finally, a fifth attribute of this technological revolution is the growing convergence of specific technologies into a highly integrated system, within which old technological advances, that were developed in a separate manner, become literally indistinguishable. Castells (2010, p. 72) comments on this aspect:

> Furthermore, in terms of technological system, one element cannot be imagined without the other: computers are largely determined by chip power, and both the design and the parallel processing of microprocessors depend on computer architecture. Telecommunications is now but one form of processing information;

> transmission and linkage technologies are at the same time increasingly diversified and integrated into the same network, operated by computers.

In addition to information being the central element in this technological paradigm, a number of other characteristics that result from this can be traced. First, this approach means that information and information technologies are present in the daily life of the entire population, that is, they have an almost total penetrability in society. Secondly, this stimulates every relationship to participate in a network, which in this case is the internet, given the fact that more and more business is done through it. Third, this means that institutions, businesses and relationships need to become more flexible and make changes more quickly to keep pace with the network. Finally, the technologies that stimulate and depend on information tend to converge and can no longer be taken independently.

Another important aspect of information, especially if one considers the speed in which it is disseminated within a network environment, is how the way in that it is distributed greatly affects the way in which members of society communicate with each other. On the subject, claims Castells (2010, pp. 356-357):

> The potential integration of text, images, and sounds in the same system, interacting from multiple points, in chosen time (real or delayed) along a global network, in conditions of open and affordable access, does fundamentally change the character of communication.

And the element that would be the backbone of this communication that is mediated by the computer would be the Internet (CASTELLS, 2010, p. 375). To illustrate this point, the author comments (2010, p. 385):

> Thus, in spite of all efforts to regulate, privatize, and commercialize the Internet and its tributary systems, CMC [computer mediated communication] networks, inside and outside the Internet, are characterized by their pervasiveness, their multifaceted decentralization, and their flexibility. They sprawl as colonies of micro-organisms. They will increasingly reflect commercial interests, as they will extend the controlling logic of major public and private organizations into the whole realm of communication.

In other words, the centrality of information in this new technological paradigm of the Information Society affects all areas, especially communication between members of a society. Such as technological innovations, the circulation of information and communication itself tend to occur more and more through the Internet. This will lead to the generation of more and more data that can be reused by the system. This large amount of data, as has been seen before, is one of the causes of Big Data, which is one of the central elements to enable the proper functioning of Artificial Intelligence applications.

The objective in the next point, therefore, is to analyze where AI technology fits within the scope of the Information Society.

2.1.3 Artificial Intelligence and its parallels with the Information Society

The third element to complete the 'tripod' of items necessary for the proper functioning of Artificial Intelligence, as explained above, is information. This would be the input value that, when inserted into AI software, would enable it to produce an output value capable of meeting that initial demand that only the mind of a human would know how to accomplish before.

As research in the area advanced, we began to see that Artificial Intelligence applications began to show better and more reliable results as the amount of data fed into the program increased. Previously, researchers and programmers in the field used to produce the data in a curatorial process and insert it as training data. Although functional, this technique began to become obsolete when programs started to show better results when data was taken directly from a source without any filtering process. What this process required, however, was that the amount of this data be large enough to generate more accurate results.

This demand for information was met especially from the mid-1990s onwards, with the popularization of the Internet. And it is precisely from this point that one can point out a strong relationship between some of the main characteristics of the Information Society and the way in which the field of Artificial Intelligence developed so rapidly in the 21st century.

Fundamentally because, as in the Information Society, the main element of the tripod of technologies that enable the functioning of AI applications is information. However, not only the information itself, but its application for processing data and resulting in a useful output value for society. Therefore, to produce knowledge. Not that information in itself has not been relevant to the development of other technologies, but it is an integral and essential part of how Artificial Intelligence operates.

As a result, the two main characteristics emphasized above about the Information Society, due to the centrality of information, are also applicable to AI technology. First, just like the communicative impetus of society, already existing before communication technologies, Artificial Intelligence applications also need and depend on an easy access

to information. This demand did not arise only after the origin of the Internet, but is an integral part of the way the technology works.

Second, the productivity of Artificial Intelligence applications results from the output of information generated by it. As in the Information Society, the focus is no longer on creating units of a given product, but on generating quality information that adds positively to existing knowledge. Knowledge becomes the main productive force and as Artificial Intelligence applications use the available knowledge as input data for their algorithms, they also generate output results that add to existing knowledge, generating a virtuous cycle.

From this point on, it is possible to affirm that Artificial Intelligence applications, such as they exist today, derive much more from the social model proposed by Castells in his theory of the Information Society than from the mode of production of the Industrial Society. The focus of an AI application is not to produce more units of a particular product that can be marketed, but to generate data that feeds back into the system. This will have an impact on how these results are to be protected, especially when talking about works that show signs of creativity, as will be seen in the following chapters.

2.2 The International Legislation applicable to Artificial Intelligence and its adoption in Brazil

Being an Artificial Intelligence application a computer program made from algorithms of varied complexity, the determination of the legal provisions that regulate the matter is easier to be traced. Considering that the technology in itself is recent, it is possible to trace the point of origin in which the subject became available in international treaties and internal laws, as well as which area of law was chosen for this purpose. To this end, the regime of the area of law chosen to regulate the software will first be explored, with the intent to bring some of the motivations for this choice. Next, the international legislation created to deal with the issue will be analyzed in order to address the way it was adopted on Brazilian soil and what would have been the influences and justifications for it.

2.2.1 The option for the copyright regime in the treatment of computer programs

An essential definition of software to be highlighted, in order to seek a legal protection on the subject, is the one coming from the Brazilian law of number 9.609/98, which regulates the topic. It states in Article 1 that a computer program would be the expression of an organized set of instructions in natural or coded language for the purpose of making it work in a certain way and for certain purposes. Such a definition would imply two characteristics. Being a natural or coded language expression, the computer program is a written work. Being a series of instructions, this program should perform processes such as facilitating the interaction between a user and the computer, between software and hardware. Samuelson et al. would say (1994, p. 2309) that computer programs are not just texts, but a machine.

This brings a unique feature to computer programs, the fact that they are part text (i.e., a 'literary work') and part machine (in other words, a technological innovation). In the words of Net Le (2004, p. 16):

> The unique feature of software lies in its ‘half-text’, half-machine like’ nature. Intellectual property laws provide protection in two principal areas, ‘texts’ using copyright laws and ‘machines’ by patent and utility solution. However, to find an appropriate regime for half-text, half-machine protection could be difficult. Legislators then have to decide whether they should protect software under copyright, a patent or a utility solution, or a sui generis regime.

The same author will highlight the importance of a correct definition to protect computer programs due to its function for the world economy. Not only in Artificial Intelligence applications, software is present in every type of device that seeks to be improved through digitalization (LE, 2004, p. 17).

Thomas Dreier, on the issue of legal protection for computer programs, comments that respected researchers in the area would have agreed with this being done through the Copyright Law, when stating (1993, p. 219):

> Eminent scholars concurred in the finding that computer programs were indeed eligible for copyright as scientific writings, since during program development the programmer is left with a sufficient number of creative choices which are not merely dictated by the functional program specifications. Likewise, they concluded that copyright protection could attach to the preparatory design material, provided, of course, it showed sufficient originality. Moreover, the idea/form or expression dichotomy was applied to computer programs so that, on the one hand, ideas, principles, and what constituted a mere algorithm, could not enjoy protection, but on the other hand, protection was not limited to the literal copying of code alone.

From the analysis of Dreier's words, two elements stand out, which influence the characterization of the computer program as a work subject to copyright protection. The first of them is creativity. It was considered that the writing of the source code, in other words, the text description of a software, opens space for the creative process on the part of its programmer, who would have some freedom in its elaboration. His or her writing wouldn't be a merely technical process. The second element would be the possibility of expressing the writing of this source code in a medium. As one of the requirements of copyright protection is the expression of the work in a perceptible medium by third parties, the fact that the technical and artistic aspects of a computer program can be exposed so that others can perceive them would facilitate its protection through the Copyright.

Another of the advantages highlighted by Dreier, in his opinion one of the biggest, to protect computer programs by Copyright Law is that the international protection would be assured. In his words (DREIER, 1993, pp. 219-220):

> It has indeed often been stated that one, if not the major, advantage of positioning computer programs under copyright would be that international protection would be secured. But at the same time, some doubts persist that the Berne Convention, although being open to interpretation with regard to new technological subject matter, does in fact contain an obligation for Member States to grant copyright protection for, and apply the national treatment principle to, computer programs.

This would result in the international treatment that the Berne Convention imposes on its signatories, of guaranteeing the same legal protection to domestic and foreign works circulating in their member countries, also being applied to computer programs in circulation. However, it should also be noted that this pressure to protect computer programs by means of copyright provisions did not necessarily come about because it was the best legal instrument available. Countries such as the United States of America lobbied for protection to be more in line with its objectives because they were, among other reasons, one of the first countries to regulate the matter in the early 1980s[31].

One of the reasons for such a lobbying, for instance, was the difficulty of obtaining invention patents for computer programs in the US. This is how Dreier explains it (1993, p. 219):

[31] According to David Bainbridge (1991, p. 643): “The United States of America was first with amending legislation in 1980 followed by Australia in 1984 and Japan, the Federal Republic of Germany, France and the United Kingdom in 1985. Other countries followed whilst others, such as the Netherlands, perceived their existing law to be satisfactory on this count and others commissioned preliminary studies”.

> The adoption of copyright as the scheme of protection for computer programs has certainly been furthered by the fact that patent protection for computer programs was, if available at all, rather difficult to obtain. It should be mentioned here only that the US courts at the time were rather reluctant to upholding patent claims drafted to include a computer program (…).

However, Dreier would also point out some disadvantages of choosing this model for the protection of computer programs. The main one, according to the author (1993, p. 220), is the fact that because they are considered 'applied scientific knowledge', computer programs would not work in a manner consistent with the basic premises of the Copyright system.

Dreier continues that because these applications are not composed only of texts, but especially of the behavior caused by them, the authorial system would not deal with this important aspect of the act of programming (the action performed by the software), which would lead to a type of incomplete protection for computer programs. Moreover, as hardware and software are increasingly dependent on each other, as pointed out in the previous items, "the fundamental distinction between patents for hardware and copyright for software may lead to an unfounded economic disparity in levels of protection" (DREIER, 1993, p. 220).

Finally, it was pointed out that the protection given to computer programs by the current copyright system could harm the balance between the protection granted to the creator and the need for publicity of the information required by the general public, in addition to the fear of the impact this could have on creators of traditional works (DREIER, 1993, p. 220).

In any case, the choice for Copyright to be used for protecting software was because of the facilities that this system, already largely consolidated by the Berne Convention, could provide to this type of innovation. The extensive protection given to literary works, the reciprocity demanded by the international treaty in question and its wide adoption by countries worldwide were essential characteristics for the adoption of this model. Added to this is the fact that several of those interested in protecting this technology come from the United States of America, where patent protection for software was difficult to obtain, which makes the option even clearer.

With this, it will be seen in the next topics how this choice came to influence the international legislation on the subject and the Brazilian laws that deal with the subject.

2.2.2 The first international treaty to mention the Software: The TRIPs Agreement

The first mention of software in an international legal text took place in an Intellectual Property legislation called the TRIPs (Trade Related Aspects of Intellectual Property Rights) Agreement. This Agreement arose as a direct consequence of the Multilateral Trade Treaty of 1947, also known as GATT-1947. According to Wachowicz (2004, pp. 61-62) "GATT-1947 has concentrated all attempts at regulation and negotiations aimed at international trade".

The author continues (2004, p. 62) that the "General Agreement on Tariffs and Trade has become one of the main pillars of regulation of the states in the international economic field, having aggregated several states as the Negotiation Rounds followed".

Among the negotiation rounds, the one of Uruguay, which occurred between 1986 and 1994, stands out, because it brought great advancement to the international negotiations and had countries as Brazil, United States of America, Argentina, India, European countries and others in the negotiation table, who would come to compose the World Trade Organization[32]. According to Welber Barral and Geraldo Reis (1999, p. 185):

> The Uruguay Round lasted seven and a half years or almost twice as long as initially planned, revealing the complexity and level of tension of those involved. At the end of the Round, the need for the use of new legal instruments that could facilitate the process of trade liberalization was evident, at a time of accelerated globalization of the economy, especially in those areas most favorable to developed countries.

One of the consequences of this treaty was the creation of the Agreement on Trade-Related Intellectual Property Rights (TRIPs) and the World Trade Organization (WTO) in 1994. About the negotiation process to protect computer programs through TRIPs, comments Dreier (1993, p. 223):

> Ultimately, businesses in the USA and other industrialized countries convinced their governments to negotiate the issue of adequate and effective copyright protection for computer programs, together with other intellectual property issues such as patents, trademarks, geographical indications, and integrated circuits, during the Uruguay round of the General Agreement on Tariffs and Trade (GATT).

This emphasizes that there is no way to disregard the influence that new technologies, and their developers, have had on the way in which computer programs

[32] The complete list of countries that make up the WTO can be found at the link: http://www.mdic.gov.br/comercio-exterior/negociacoes-internacionais/1888-omc-paises-membros.

have ended up legally protected. Considering that several of these companies, especially between the 1950s and 1980s, came from the U.S., such as AT&T, Dell, HP among others, it is possible to conclude that the United States of America would naturally have a greater interest that an international regulation on the subject should benefit the economic interests of companies in their nation.

Blakeney (2006, p. 18) comments on the initial intent of the TRIPs Agreement and the U.S. interest in an international regulation of computer programs through intellectual property legislation:

> Although the agreement began as an initiative to deal with the trade in infringing products, which was reflected in the inclusion of 'counterfeiting and piracy' in the original title, it deals with much more. The agreement prescribes a comprehensive range of intellectual property norms which have to be implemented by all WTO Members. The advantage to the USA in the institution of an effective global regime for the enforcement of intellectual property rights is undoubted. An interesting question is how the nation, which is the largest exporter of intellectual property rights, was able to persuade the rest of the world to adopt a global regime providing for the enforcement of those rights.

This interest has led the United States of America to lobby intensively for TRIPs approval, as Blakeney continues to explain (2006, p. 18):

> Part of the answer lies in the very effective lobbying by US trade interests in Geneva to secure the TRIPS agreement. Part of the answer lies in the fact that intellectual property in the WTO context is part of a package of agreements in which intellectual property could be bargained for, say, the reduction in protectionist agricultural subsidies. Part of the answer also lies in the promise of economic benefit which is made to countries which are obliged to implement the agreement.

In other words, the interest in the protection of software with Intellectual Property legislation by the TRIPs is much more motivated by the economic interest of the USA than effectively because this is the most adequate means of protection to exist. Likewise, there is a great focus of this legislation in protecting more the proprietary aspects of the Copyright Law than the moral aspects, because of the insertion of its discussion agenda in the scope of the Multilateral Trade Treaty, and not of the World Intellectual Property Organization.

Peter Drahos and John Braithwaite (2002, p. 10) attest that in the USA, high-tech multinationals would have received the TRIPs signature with great satisfaction. The authors comment on the Agreement:

> It sets minimum standards in copyright, trademarks, geographical indications, industrial designs and layout-designs of integrated circuits. TRIPS effectively globalizes the set of intellectual property principles it contains, because most states

> of the world are members of, or are seeking membership of, the WTO. It also has a crucial harmonizing impact on intellectual property regulation because it sets, in some cases, quite detailed standards of intellectual property law.

Among these minimum standards, it stands out that every State signatory of TRIPs, for example, must have a Copyright Law that protects computer programs as literary works (DRAHOS & BRAITHWAITE, 2002 , p.10). Article 10 of this legal text, which deals with Computer Programs and Data Compilations, provides in its point 1 that "Computer programs, in source code or object, shall be protected as literary works by the Berne Convention (1971)". In the words of Reichman (1995, p. 775):

> All WTO member states must, therefore, confer copyright protection on some computer programs, just as Berne Union countries had to confer copyright protection on some 'works of applied art' after this subject-matter category entered the Berne Convention in 1948. The TRIPS Agreement, however, says nothing about the eligibility criteria that states must apply to this controversial subject matter; nor, apart from a generalized exclusion of 'ideas, procedures, methods of operation or mathematical concepts as such', which applies to all literary and artistic works in general, does the Agreement concern itself with scope of protection or other issues that have taxed domestic courts. Hence, just as WTO member states remain free to apply their own criteria for distinguishing between copyrightable works of applied art and noncopyrightable industrial designs, they might argue that the decision to treat computer programs 'as literary works' did not preclude them from modifying general principles of copyright law not addressed in the TRIPS Agreement to limit the protection of computer programs as 'applied literature'.

It is clear from the analysis of the quotation and the text of Article 10 above that it is assigned the same type of protection to a software and to other types of literary works by the Berne Convention. The focus of this legislation was on protecting any kind of reproduction, public display or other uses that allow public access to a literary or artistic work. It is worth remembering also that the Convention gives the author the exclusive right to authorize these uses. The TRIPS agreement does not bring any innovation in this aspect, but it does bring a much greater focus on the technological issue of intellectual property in its objectives:

> ARTICLE 7
> Objectives
> The protection and enforcement of intellectual property rights should contribute to the promotion of technological innovation and the transfer and diffusion of technology, to the mutual benefit of producers and users of technological knowledge and in a manner conducive to economic welfare and a balance between rights and obligations.

This article, the text of article 10 of the same legislation and the Berne provisions thus consider software as a technological innovation that deserves the same protections on reproduction and communication as literary works and that should bring benefits to

both users and developers. However, Dreier (1993, pp. 223-224) emphasizes that the mere adoption of the protection of computer programs by means of intellectual property would not be enough to protect this type of creation in a satisfactory manner. In his words:

> It has become apparent that the mere adoption of Intellectual property laws is not sufficient, but that in order to bring about satisfactory results, there need to be effective remedies and sanctions against infringement. The draft agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS) within the GATT accommodates this aspect, and it also provides for a mechanism of dispute settlement.

This need for effective remedies and sanctions is what will lead developed countries to take more proactive measures beyond TRIPs in relation to other countries to enforce the economic interests of their industry. The next item, therefore, will be dedicated to how this type of attitude has affected Brazil, what measures have been taken, and what treaties have been signed by the South American country.

2.2.3 The external pressure on Brazil for the protection of computer programs and the adoption of international treaties on the subject in national territory

Even though the U.S. has exerted great pressure to approve intellectual property measures that would benefit it, the country has continued to adopt more direct measures in its relations with other nations throughout the process. A common practice carried out by the United States was to enter into bilateral agreements directly with the countries with which it wished to see greater protection of its rights. In the words of Blakeney (2006, p. 30):

> The TRIPS agreement was heralded by the USA as a global intellectual property charter. It was grounded on the twin principles of national treatment and MFN. However, within a few years of its promulgation, the USA appears to have abandoned the agreement in preference for bilateral arrangements. The engine for this bilateralism is section 301 of the US Trade Act which provides for the imposition of trade sanctions upon those nations which are regarded by the US Trade Representative as having deficient intellectual property laws or enforcement regimes. The enforcement of s.301 may be regarded as an indication of the lack of faith by the USA in the TRIPS regime

The use of bilateral agreements and the threat of sanctions under section 301[33] of its Trade Act reinforces the idea that the intention of the United States of America to seek

[33] Section 301' is an amendment to the U.S. Trade Act that allowed a process of retaliation (such as increasing tariffs) against countries that did not adequately protect the intellectual property rights of U.S. entities (DRAHOS & BRAITHWAITE, 2002, p. 61).

the protection of computer programs through copyright was for exclusively commercial purposes.

And such an approach, reveals Thomas Dreier, ultimately proved successful. According to the author (1993, p. 222):

> In the end, however, this approach proved rather successful in that most of the states targeted, such as Taiwan, Malasya, Syngapore, and South Korea, did in fact ultimately enact copyright legislation in order to fulfill their obligations under the bilateral agreements concluded with the USA, and in some cases even acceded to the international Conventions.

In fact, Brazil itself has already been the target of US action through section 301. Until the 1980s, the Brazilian legislature refused to insert the protection of computer programs into its laws, in addition to requiring the compulsory registration of foreign computer programs before they could be marketed in the country. However, such registration would only be available for foreign software if there were no similar domestic products (DREIER, 1993, p. 222). This caused the US to threaten to trigger section 301 of its Trade Act, in the words of Denis Borges Barbosa and Ana Beatriz Nunes Barbosa (2005, footnote 41):

> The Brazilian copyright solution, when voluntarily adopted in the US and other countries (more for speed and certainty than for adequacy), was based, in the case of Brazil, mainly due to strong US induction, on threats of retaliation under Section 301 of the 1984 US Trade Act and the thinking of the aforementioned Congress. In the same month that the Brazilian law was submitted to Congress (October 1984), the U.S. President sanctioned the Trade and Tariffs Law. It is probably a coincidence with Brazilian law, there is no doubt that the law aimed to revoke a Japanese non-copyright draft - as indeed it did - and possibly not encourage sui generis solutions in other places. But on September 7, 1985, President Reagan announced that he was forcing the initiation of proceedings against Brazil based on Section 301 of the Act, to verify Brazil's computing policies, including the lack of copyright protection for software. It should come as no surprise to note that on August 26, 1986, CONIN - the national computer council - told the Brazilian president that a "modified" copyright legislation would be the correct way to protect software; the proposal of the Executive that arrived in the Brazilian Congress at the end of December 1986 referred to copyright legislation as providing protection, unless otherwise specified.

The lobbying of United States and American companies on Brazil would not be an isolated act. It will be seen in the next item that American entities such as the Motion Picture Association (MPA) would be part of pressure groups that would pressure the Brazilian Congress to vote laws that were more in line with their interests. In addition, recalling that the Uruguay Round, which culminated in the TRIPS Agreement, took place between 1986 and 1994, such threats of reprisal would also have the function of

influencing the way countries would vote on crucial points to be implemented in the TRIPS Agreement, such as the provisions on Intellectual Property.

With the approval of the final wording of the TRIPs Agreement in 1994 and given the mandatory nature of its adoption to enable a country to participate in the World Trade Organization, this treaty was eventually ratified in Brazil. However, its application did not have to be automatic. According to Mariana Valente (2018, p. 172):

> ... TRIPS entered into force on January 1, 1995, as Annex 1C of the Agreement establishing the WTO. It allowed, by its article 64, a transition period of one year, for developed members; for developing members, the term of incorporation of the rules was January 1, 2000, with the possibility of delaying the protection of product patents in areas not yet protected in the respective territories for another 5 years (January 1, 2005), being certain conditions fulfilled. In addition, the least developed countries could apply almost all the provisions from 1 January 2006. It was a binding agreement for all WTO members...

Despite the long term to adopt the treaty, in the same year of 1994 the provisions of TRIPs were ratified in Brazil. This was done through Decree nº 1.355 of December 30, 1994, which enacted the final act incorporating the results of the Uruguay Round of the GATT Multilateral Trade Negotiations.

This decree determined that the TRIPs Agreement would be implemented and complied with in its entirety and would repeal the provisions to the contrary. As a result, other Bill of Laws, such as the one numbered 1.435/96,[34] would be proposed, proposing amends to the then current Brazilian copyright law, numbered 5.988/73.

In addition to the Berne Convention (dealt with in the first chapter of this thesis and ratified in Brazil) and the TRIPS agreement, there was another relevant international legislation on the subject that deserves mention. It is the WIPO Copyright Treaty (WCT).

Mariana Valente attests (2018, p.183) that understanding the process of the Diplomatic Conference that resulted in the 1996 WIPO Treaties would be clearer if the path of the U.S. Digital Agenda had been followed since the 1990s, as the United States would have taken the lead in an attempt to harmonize the rules of Copyright for a still uncertain future.

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[34] According to Valente (2018, p. 445), this bill "amended the 1973 law to extend copyright rules of international treaties to which Brazil was a signatory for related rights. 1436/96, of the Executive Branch, extended the Copyright rules of the International Treaties to which Brazil was a signatory for the related rights. It gave exclusive rights to the rental of phonograms to producers and other rights holders. In the justification, communication of the MinC n. 039/95 established that it was a "measure of necessary legal adjustment, in view of the innovations introduced by Decree n. 1.355, of 30/12/1994, that by establishing the Agreement on Trade-Related Aspects of Intellectual Property Rights - TRIPs, annexed to the Agreement Establishing the World Trade Organization - WTO, has demanded changes in Articles 94 and 98 of Law n. 5.988".

Continues Valente, by quoting Samuelson, that:

> In December 1996, WIPO hosted a Diplomatic Conference in Geneva on three proposals "intended to respond to the challenges that global digital networks pose to intellectual property law" (SAMUELSON, 1996b, p. 369): one as a protocol to supplement the Berne Convention, another on the protection of performers and phonograms, and another on databases. The resulting treaties were the WIPO Copyright Treaty and the WIPO Performances and Phonograms Treaty, and, Pamela says, both of them, and in particular the WCT, "are more compatible with international principles of U.S. copyright than with the highly protectionist agenda that U.S. delegates initially sought to promote in Geneva" (SAMUELSON, 1996b, pp. 370-371).

In other words, the proposal of these diplomatic conferences was to create two treaties: the WCT and the WPPT, the latter of which deals with the rights of performers and producers of phonograms. According to Afonso (2008, p. 153), the WCT would have, in a smaller scope, the most central role of explaining the current norms, clarifying concepts.

The WCT mentions, regarding computer programs:

> Article 4
> Computer Programs
> Computer programs are protected as literary works, according to the meaning of Article 2 of the Berne Convention. Such protection applies to computer programs, whatever their form of expression.

Valente reports (2018, p. 25) that although TRIPS was signed by Brazil and the WIPO treaties were not, both were essential for the determination of the contents of the laws currently in force that deal with Copyright in the country, which are numbered 9.609/98 and 9.610/98, which will be studied in greater depth in the next item of this thesis.

The author continues (2018, p. 201) that both the WCT and the WPPT would have been considered by different actors when formulating and negotiating laws 9.609/98 and 9.610/98, and, despite some interpretative dissent, would have been fully incorporated into the national legal system.

This leads to the conclusion that, first, the legal protection regime given to computer programs would have been more an option of convenience than effectively the one that would have been more adequate for this type of innovation, and that it took into account the protection of economic interests, and not an adequacy to what the technology reflected from society. Second, this regime was adopted by the international legislation on the subject and later on by Brazil, counting on the participation of the USA through lobbying for the ratification of these international agreements on Brazilian soil.

2.3 The legislative process of existing Brazilian laws on the protection of computer programs

Given the international context of the emergence of software protection, it is necessary to verify how this process occurred on Brazilian soil. It is necessary to verify the motivation behind the protection of software in the Brazilian territory, its influences, active pressure groups at the time and some of the fundamental points of the debates of this process. For this, first it will be brought the Brazilian context that led to the discussion of laws 9.609 and 9.610/98 and the main points of contention. Next, the old Brazilian copyright law and some of the bills of law to modify it, as well as the changes that were proposed by them, will be analyzed. Finally, the legislative process of these laws and their main topics for discussion will be addressed, especially in relation to the provisions on computer programs and authorship.

2.3.1 The Brazilian context and the pressure groups active during the legislative process of laws 9.609/98 and 9.610/98

Although it is possible to infer from the analysis of the chapter up to this point that TRIPs has been of fundamental importance to the current copyright laws in force in Brazil, Valente (2018, p. 183) will point out that the necessary changes demanded by this agreement could be the object of a punctual reform. Its importance then, as previously highlighted, is the novelty of being the first international legislation to treat the protection of computer programs with Copyright and to be the one to effectively guide the direction that the protection of computer programs would take at the international level in subsequent years.

However, the author (2018, p. 183) highlights that:

> TRIPS is certainly not the sole or central cause, therefore, for the approval of Law No. 9.610/98. However, among the different disputes that intertwined in the preparation of the text of what would become the law, it played a central role in its approval, as the Executive Branch pressed for the rapid approval of the law, in order to meet the deadlines set out in the Treaty. Thus, it enters as one of the substantive elements, but of great impact on the progress of others, which had nothing to do with it.

It is necessary to understand at this time the Brazilian context that led to the proposition of the projects that would become the laws 9.609/98 and 9.610/98. Likewise,

it is necessary to point out which were the main actors and pressure groups that showed interest in these projects. At the international level, it was concluded that the economic interests were fundamental to determine the course of the law; it is necessary to verify what happened in the Brazilian territory.

On the history of copyright law in Brazil, says Valente (2018, p.31):

> The history of copyright law in Brazil is umbilically linked to the history of copyright associations. In Brazil, the demands for norms of copyright defense have always been linked to the associations of collective management of rights in the music sector, in part precisely because of their capacity for institutional articulation. This sector has a long and complex history of institutionalization; demands from other fields of culture are often told through the filter of disputes with music, also because this sector has, throughout the twentieth century, documented its demands in minutes, bulletins and articles in the press, in addition to exercising a prolific judicialization, recorded in complaints and decisions.

From the statement above regarding the centrality of defense associations to the history of this area of study in Brazil, especially in the field of music, one can already begin to outline what would be the main points to be defended by these groups. The centrality of the discussion of authors' rights, due to the presence of these associations, is one of the topics that would permeate the entire legislative discussion of the theme in the country.

Among the first entities to protect authors is SBAT (Brazilian Society of Theatrical Authors), founded in 1917; the ABCA (Brazilian Association of Composers and Authors), founded in 1938 by dissenting members of the former; the UBC (Brazilian Union of Composers), founded in 1942 and existing until today; and the SBACEM (Brazilian Society of Authors, Composers and Music Editors), founded in 1946 and also existing until today. This brief list of the first associations serves to demonstrate the interest of the category in ensuring adequate protection of rights over their works.

In addition to the associations for the protection of artists, another group that had an important position in the debate that took place in the second half of the twentieth century and that influenced the current laws that deal with Copyright in Brazil were the record labels and publishers, according to Valente (2018, p. 37):

> the dispute between what is understood as the interests of authors and artists, individuals, against those of legal entities – (...) the record companies entered into this equation, in addition to the publishers – would become the driving force behind the major issues of copyright policy, also in the 1990s.

As an example, the author mentions the issue of the assignment of the rights from individuals to legal entities, which would be a point of contention between artists and

publishers that went through decades and which had influence in the discussions on the reform of the Copyright Law in the 1990s, including impacts on the final wording of the legislation, as will be seen below (VALENTTE, 2018, p. 41).

On this point, and already starting to address the context in which copyright protection in Brazil was found, Valente highlights that the animosity between authors and publishers would originate from a non-transparent market practice that had developed in the first half of the 20th century (2018, p. 41). The author cites Nestor de Holanda's memories of Café Nice, a meeting point for musicians from Rio de Janeiro between 1928 and 1954. In this place, says the author when citing Holland, is that it would be developed the growing understanding of music being trade, with Café Nice as the hub for business of all kinds. In the words of Holanda (1969, p. 51):

> Despite the immense number of authentic musicians, there was an invasion of cafiolas, bicheiros, bookmakers, various offenders, even smugglers. These men bought songs, paid for singers and discotheques, spent their fortunes on orchestra leaders, and thus pretended to be composers, to hide their true profession and throw the police off the scent. As a result, a many known names, announced by radio stations, never put a comma in the lyrics of any song. They bought entire repertoires. Several of them now appear in books on the history of our popular music, cited as if they were excellent musicians. And some are already legally retired, as composers, by the National Institute of Social Security...

Valente says that in this passage Holanda referred to the practice of “selling the authorship itself” and that at other times he would also mention problems in relation to the business of selling the ownership of rights to publishers (2018, p. 42). It were practices such as this that have encouraged the creation of associations to protect authors.

However, with the creation of SADEMBRA (Brazilian Musical Execution Rights Administration Society) in 1956, musical authors and publishers would be (only until that year) already represented by 4 associations, adding the three mentioned above with this one. This would bring a problem that would become part of the routine of these entities, that of overlap. Thus, brings Valente, mentioning the work of Almendra, when discussing the existence of these 4 associations (2018, p. 42):

> There was a growing problem that would also never leave the field: that of overlaps (and consequent inconsistencies) between the repertoires of different societies - now, with the existence of Sadembra, the challenge began that some compositions had the author in one society and the editor in another, and the execution of a composition then generated a duty of payment to two distinct entities (ALMENDRA: 2014, p. 18).

This situation would be aggravated by the fact that in 1960 SICAM (Independent Society of Composers and Music Authors) got founded in São Paulo, which according to

Valente only complicated the institutional field of Copyright. Moreover, this fragmentation was already beginning to attract the attention of public authorities, which was not desired by societies. Complements Valente (2018, p. 45) with a quote from Santiago:

> The societies rejected entirely any initiative that could represent state intervention in their activities. In the 1946 book, for example, Oswaldo Santiago repudiated the Chilean model, in which the collection was state-run, affirming that "there is almost nothing to be charged, the music of the land - the cueca - is not known anywhere in the world and the authors and composers live in amateurism and anonymity"; the state structure would be a "certificate of minority to Chilean authors and composers" (SANTIAGO, 1985, p. 149).

With the beginning of the military dictatorship in Brazil in 1964, the pressure exerted by the government on societies to protect artists increased, especially regarding the collection of royalties, which was exercised individually by each of these entities. In addition, the development of new music reproduction technologies made it even more difficult to collect and distribute money. According to Valente (2018, p. 50):

> The development of the record and the radio was provoking great turbulences in the institutional field of copyright collection in the country. Contrary to the publishers, who were holders (derived from rights assignment contracts) of copyrights (including phonomechanical rights, i.e. those paid by record companies to the authors of the compositions), the phonographic producers (record companies), in the 1950s and 1960s, were not part of the societies - in this period, the societies were also mandataries of the authors (composers) in relation to the negotiation of phonomechanical rights (resulting from the sales of recordings).

The difficulty in collecting and distributing values related to the performance of musical works, coupled with the fact that new technologies brought new actors and groups interested in the amount collected, began to stimulate the military government to act. In the words of Valente (2018, p. 48):

> The unification of the collection was not the only factor of pressure on societies by the military regime: at that time, a discussion began on the creation of a Code of Copyright and Related Rights. Given the context of little dialogue, societies were unclear as to what role they would play in these discussions. The Minister of Justice of Castelo Branco, Mem de Sá, initiated the elaboration of a draft of the Copyright and Related Rights Code; in May 1967, the Minister of Justice Gama e Silva, already in the Costa e Silva government, commissioned Antonio Chaves, Cândido Motta Filho and Milton Sebastião Barbosa to review the draft, and the jurists would open space for suggestions for amendments.

Such bill would eventually lead to the enactment of Law 5.988 in 1973, which regulated copyright in Brazil until the advent of Law 9.610 in 1998. According to Valente (2018, p. 58) in reference to Chaves:

> The two great novelties that Law no. 5.988/73 brought to the institutional field of copyright were the creation of Ecad (Central Office of Collection and Distribution), to centralize the activities of societies without dissolving them, and the creation of CNDA (National Council of Copyright), an organ of inspection, consultation and assistance that should guide all government policy in matters of Copyright (CHAVES: 1979, p. 41).

The author also complements (2018, p.58), mentioning the reception that the creation that these entities had, this time quoting Almendra:

> If, on the one hand, copyright associations repudiated the CNDA for understanding that it was undue interference in private affairs, and that the interference would be authoritarian, it affected the violations of freedoms that the country was going through (ALMENDRA, 2014, p. 27), other actors in the field celebrated it as a great advance.

It is possible to see that the centrality of the debates that concerned the Copyright Law in Brazil focused especially on the issue of distribution of music royalties and the debates of associations for the protection of authors' rights. The focus was on the most appropriate way to protect and guarantee the rights of artists against usurpers and new technological means of distribution of works and this was what led to the creation of a large number of entities claiming to protect these works. However, this deregulated growth of the associations ended up attracting the attention of the public authorities, who, in a period marked by social control, opted to enact a law that would create a central office for collection and distribution and a national council to oversee it. The next item will focus on the consequences of this law, and the debates that led up to laws number 9.609/98 and 9.610/98.

2.3.2 Law 5.988/73 and the bills for its reform

Despite the regulation of Copyright made by Law 5.988/73, debates on the appropriate way to protect this matter continued. New and more modern technologies for the reproduction and dissemination of works continued to be developed and the clashes between the pressure groups formed by the associations for the protection of authors, and the record labels and publishers did not cease. The point of contention continued to be the appreciation of the author and ways of paying him for the creation of his art.

In this sense, after negotiations between members of some of these associations for the protection of copyright and members of the CNDA with the then deputy José Genoíno (PT/SP), the Genoino Project (PL 2.148/89) was proposed by him on April 27, 1989. Speaks Valente (2018, p. 88) that this project would not have served as a basis for

laws 9.609 and 9.610 of 1998 and that its provisions and structure would not have been used either. However, the author points out the reason for its centrality in the discussion of the current copyright laws:

> It is that it represents a specific social project of Copyright Law, which can be called "the author as creator". This social project is linked to notions that, given the weight of the cultural industries and their globalized character, it is necessary that the law guarantees authors and artists, particularly performing musicians, spaces of autonomy and strengthening of their positions. To this end, specific institutes and notions related to creative work are mobilized, which invoke certain justifications historically linked to Copyright Law.

This was due to the 1973 law allowing the authorship of legal entities, a measure that benefited publishers, record labels and the 'bicheiros' mentioned above by Holanda. The analysis of the provisions of this law that deal with the matter will clarify this issue:

> CHAPTER II
> Authorship of intellectual works
> Art. 12 To identify himself as an author, the creator of the intellectual work may use his civil name, complete or abbreviated up to his initials, pseudonym or any conventional sign.
> Art. 13 It is considered author of the intellectual work, with no evidence to the contrary, the one who, by one of the modalities of identification referred to in the previous article, has, in accordance with the use, indicated or announced this quality in its use.
> Sole paragraph. In the absence of any indication or notice, the author of the intellectual work shall be presumed to be the one who has publicly used it.
> (...)
> Art. 15 - When it is a work carried out by different people, but organized by an individual or collective company and in its name used, the authorship of the work shall be the responsibility of the company.

Articles 12 and 13 indicate, in summary, that the author will be the one who is publicly recognized as such. Article 12 explains the way such identification may be carried out, while Article 13 and its sole paragraph take as author the one whose identification is affixed to the work or to the one who uses it publicly. On the other hand, article 15 determines that if a company is the organizer of the work, it will be responsible for its authorship. As the creative process of a song involves several actors, from writers, through interpreters to editors, effectively transforming it into a collective work, such legal provision tends to benefit those with the power to finance this process: the publishers. The existence, therefore, of the Genoíno Project, which brought this type of issue to the surface, was fundamental to the debate on Copyright in Brazil.

About this project, it is still important to contextualize, according to Valente (2018, p. 158):

> The Genoíno Project was proposed soon after the great national mobilization that represented the Constituent Assembly, and the whole process would take place in a context of democratic and economic opening after twenty years of military dictatorship, the first direct election since 1960, that is, at a time of country experimentation.

The author says it to be imperative to recognize the role of the United States of America in this period as a propagator of the expansion of intellectual property, especially given its concern with the economic, piracy, and advertising aspects that intellectual property could generate. Likewise, the USA would have participated in lobbying actions in the approval of new Brazilian laws through the MPA (Movie Pictures Association). However, “the actions of MPA were given indirectly, via, for example, the ABC (Brazilian Cinematographic Association)” (VALENTE, 2018, p. 254).

In this sense, in parallel with the Genoíno Project, another project emerged in the Brazilian Federal Senate, which had been idealized from the opposite side of the dispute: the phonographic industry, the publishers and broadcasting. This is the Bill n. 249/89[35], proposed by Senator Luiz Viana Filho, which popularized the name of the PL as 'Luiz Viana Project'. This project had great influence from the phonographic industry, as can be seen in this excerpt from Valente (2018, p. 205):

> The text proposed in the Senate is generally attributed to a work of the record labels with Senator Luiz Viana Filho, especially Henry Jessen, who died in the early 90s, who, having been director of Odeon in the 60/70s in Brazil, was an influential propagator of the interests of the phonographic industry, and by João Carlos Muller Chaves, who assumed this central position in subsequent years - which confirms the information.

And in the same way in this excerpt from the same author (VALENTE, 2018, p. 207):

> The reason (...) for a new legislation would be to adapt to the "technological evolution since 1973", which would have introduced "certain specific aspects that require a new update of the protective legislation" - and PL 249/89 would substantiate this update, "without changing its essence, however". It is precisely the view of actors in the phonographic industry, who are widely recognized as the authors of the project: both João Carlos Muller Chaves and João Carlos Éboli, lobbyist and lawyer in the phonographic industry, respectively, state that the essential thing was to clarify some concepts, and not produce structural changes...

This is because the very beginning of the Justification of this Project would have already made it clear that its proposal was contrary to that of José Genoino: while this criticized the lack of participation of the major stakeholders (remembering that this was a proposed legislation in the military period), Luiz Viana praised this same legislation for

[35] In the Chamber of Deputies this project became the PL 5.430/90.

promoting a strong protection of the rights of intellectual creators (VALENTE, 2018, p. 206).

The critique of the advocates of the Genoíno Project that the PL of the Senate Luiz Viana would be a project of "strengthening the business community to the detriment of the author" (VALENTE, 2018, p. 218) would be highlighted in an analysis made of the provisions of this text. Here, it will be focused in two points, considered of great relevance for this work: the provisions of Project Viana regarding technological innovations, and the ones relating to authorship.

On the amendments proposed by the PL of Senator Viana resulting from technological progress comments Valente (2018, p.214):

> The Project proposed conceptual updates to adapt to new technological processes, such as replacing "cinematographic works and those obtained by means analogous to cinematography" with "audiovisual works", since the current processes would go beyond "simple reproduction in celluloid films"; and changed definitions of "collective works", "phonogram and videophonogram producer" and "audiovisual producer". In addition, it included computer programs in the exemplification of works protected by Copyright (...)

On the question of authorship, it is stated (VALENTTE, 2018, p. 216):

> There was an important difference in the authorship regime proposed in the Luiz Viana Project in relation to Law no. 5.988/73, arising, according to the Justification, from the constitutional text. Art. 15 of the law then in force affirmed that the company could have authorship of the collective work; the Luiz Viana Project did not contain this provision, although it also did not state that the author was an individual, thus staying in a middle ground; it determined that the organizer had ownership of the property rights, and consolidated the constitutional provision according to which the individual participations in the collective works are protected[36] - here, however, with the exception that the use could not cause harm to the collective work, which would be owned by the organizer (which, following the Law of 1973, could be a legal entity).

Only with these two questions is it possible to see why there is divergence between the two projects. As for the first issue copyright protection associations claimed that the absence of mention of software in the Genoíno Project would be conscious, it was argued that "the computer industry would be wanting the copyright protection bonuses - the terms especially - without the burden, that is, the scope and extension of the author's moral rights, which set limits to the industry" (VALENTE, 2018, p. 233). With regard to the second point, the very fact that this bill failed to mention the authorship of legal entities and left this issue open was a point that pleased the record companies and publishers, by

[36] CF/1988: article 5, item XXVIII - "the protection of individual participations in collective works and the reproduction of the human image and voice, including in sports activities, are protected under the terms of the law".

making it easier for them to become owners of musical works, which displeased the associations for the protection of copyright.

The processing of Project Viana, also in the words of Valente (2018, p. 203), took place as follows:

> A simplified way to understand its path would be: passed in the Senate, it was sent to the Chamber of Deputies, where it got the number 5.430/90. It was distributed in 1992 to the Commission of Science and Technology, Communication and Informatics (CCTCI), where it was dormant until 1995, when the then deputy Aloysio Nunes Ferreira from PMDB-SP was appointed as rapporteur. Aloysio Nunes Ferreira gave a favorable opinion to the project, analyzed the appended ones, and offered a first substitute. On September 12, 1996, the President of the Chamber of Deputies decided to set up a Special Commission for the discussion of Bill no. 5.430/90 and its appendices, and in this commission, Aloysio Nunes Ferreira - who had already transferred to the PSDB at that time - offered a new substitute on September 10, 1997. Aloysio complemented the vote on November 6 by adopting minor amendments suggested by MPs José Genoíno (PT-SP), Jandira Feghali (PCdoB-RJ) and Marta Suplicy (PT-SP), and a new substitute was adopted. Once the substitute was approved, the bill went to the Full Bench of the House, and was discussed in a single session on December 5, 1997, with 74 amendments. It returned to the Special Committee, which offered a new opinion on December 10, the same date on which it was voted in plenary. Approved by the House, it was sent to the Senate, where it was approved on February 5 and sent to the presidential sanction.

However, the author continues (2018, pp. 203-204) that the analysis of this short history of the processing of the Luiz Viana project would hide more relevant aspects:

> The first of these is that, although Law No. 9.610/98 inherited, in terms of its organization, the structure of the Luiz Viana project (which is fundamentally the structure of Law No. 5.988/73, then in effect), in terms of content it received much from the Genoíno Project, and therefore from the discussions held in that committee of the CNDA.

The chronology of the proposition of both projects helps in the argument that one would be antagonistic to the other. While the Genoíno Project was proposed in April 1989, being the pioneer in discussions for the reform of law 5.988/73, the Luiz Viana Project was proposed in August 1989, being "clearly an opposition strategy" and a "response from radio and television," highlights Valente (2018, p. 207).

Aloysio Nunes Ferreira, then the rapporteur of PL 5.430/90, who proposed a new copyright legislation for Brazil, commented, regarding the rapporteurship of the law, that he would have encountered "great difficulties to reconcile the divergent proposals and the contradictory interests of the sectors involved, which prevented the process of modernization of the Brazilian legislation on Copyright from following its normal course" (ALMENDRA, 2003, p. 9).

This would be reflected in the way the final version of the law would be edited, as will be seen in the item below. In any case, from this conflict between both bills it is already possible to perceive the great focus that was given to the way the royalties from the performance of musical works would be managed and distributed. This point ended up influencing the debates of the law in the question of who could be the author or holder of the work, because this, in practice, would influence the power of interference that publishers and record companies could have over the musicians. This is an important aspect, because the result of this debate ends up influencing the way in which the issue of authorship of works made by Artificial Intelligence applications will be approached.

2.3.3 The main points from the approval of Laws 9.609/98 and 9.610/98

In presenting his Substitute for discussion in the Brazilian legislature, which brought the two original bills together in a single document, on September 10, 1997, Aloysio Nunes Ferreira "would have been surprised that actors from different sides of the dispute were generally defending the same points", and there was even a general perception by advocates of both bills that this substitutive would have competently reconciled the interests of both sides (VALENTE, 2018, p. 261). In the words of the rapporteur of the draft, as quoted by Valente (2018, p. 261):

> My substitute is, of course, in line with protecting the copyright holder, that is, protecting the copyright holder and the trade rights holder. If the holder is not protected, first of all, there is iniquity by depriving him of a good result of his work. In the capitalist world, property results from the accumulation of surplus value, but the creator's property over his good is that which results from labor. So it has to be protected, because it results from the imperative of equity, besides being a constitutional norm. If there is no effective protection, the creator is discouraged from producing. On the other hand, we must also take into account the complexity of the cultural industry and the need, in some way, to reconcile interests. If there is no strong cultural industry, there is no point in having a beautiful system of protection for creation, because it will not be able to express itself in economic terms because of the lack of those who disseminate it.

That is, the rapporteur made it clear that there would be, in law, not only the need to protect the intellectual creator of a work, but also the economic interests of those who exploit it for commercial purposes. Withholding the systematization of Project Viana and some of the ideas of Project Genoíno would have achieved this balance. It should also be noted here the emphasis that Nunes Ferreira gives to the economic aspect of the exploitation of the artistic work by mentioning the need for expression of creation in economic terms.

With the advancement of Nunes Ferreira's Substitute in the House and Senate, some issues were still pending. Among them stands out the most relevant for this work, which is the issue of the regulation of computer programs.

This is because it was debated whether this issue would be present in the same copyright law or whether it would be regulated in specific legislative text. In the words of Valente (2018, p. 327):

> If any discussion about software was registered in the process of discussing the law, it was in the sense of deciding if the regulation of software protection would take place within the same copyright law, or in specific law. The CCTCI Substitute contained provisions on software, encompassing its regulation in the text itself of what would be the copyright law. In its letter to the rapporteur Aloysio Nunes Ferreira, the CDA opposed, on the grounds that "the Government intends to maintain a specific legal standard for computer programs". Thus, for example, mentioning them without further ado in the list of protected works could "generate misinterpretations about the extent of protection".

The author continues that the Executive effectively sent a text suggestion in the sense that computer programs would be protected by a specific diploma, a point that was adopted in another Substitute that would come after Aloysio Ferreira's.

On December 3, 1997, PL 5.430/90 was taken to the Plenary and approved, having been followed by the Federal Senate, a process that, according to Valente, took place quickly (2018, p. 356):

> The process of passing the law in the Senate was quick. The Replacement of the Chamber arrived at that house on December 15, 1997, was read in Plenary on January 7, 1998, sent to the CCJ, where, on January 15, Senator Romeu Tuma (PFL-SP) was appointed as rapporteur. On February 5, 1998, the Senate Plenary was already discussing the rapporteur's opinion and voting on the matter definitively.

Soon after the Senate's approval, the text was passed to the presidential sanction. There, the CDA/MinC (Coordination of Copyright of the Ministry of Culture), at the request of the Sub-Chief for Parliamentary Affairs of the Presidency of the Republic, prepared two technical notes, one on the Software Law and the other on the Copyright Law, with the purpose of substantiating the presidential sanction. Reports Valente (2018, p. 372):

> About the Software Law, he affirmed that the discipline was adequacy to TRIPS and the new WIPO treaties, and that, although the CDA had defended that the matter be treated within the Copyright Law, it had been defeated and saw no reason for any veto. As for the Copyright Law, the considerations were more extensive. The main problem identified by the CDA was that, similarly to Law 5.988/73, the text approximated copyright and related rights, "prejudicing, at times, the exercise of the rights conferred".

Inocêncio Oliveira, then a federal deputy, would have praised the laws, especially regarding the separation of the discipline of computer programs, justifying "because a computer program today is current, and in an hour may no longer be so. Therefore, this has to be defined in a specific law" (VALENTH, 2018, p. 344).

Laws 9.609/98, which regulates the software, and 9.610/98, which deals with copyright, were sanctioned on February 19, 1998 by then President Fernando Henrique Cardoso. From the former president's speech some points are highlighted, as quoted by Mariana Valente (2018, pp. 373-376):

> First, if I may, I always like to mix the solemnities with things a little bit, even sometimes small and personal, but it gives me great joy today to be able to sign a law here that regulates the issue of intellectual property regarding software.
> (...)
> Today, we are here in Brazil regulating software and Minister Vargas has just said that we are selling software for robot, 25 million dollars. It's not much, but it's something. So, the leap is immense. That is to say, in the course of a lifetime, we pass from the absolute inexistence of any more sophisticated instrumental analysis, in terms of computing, to the regulation of intellectual production, not more of hardware, but of software. I mean, it's an extraordinary thing.
> It is understandable, for this very reason, that we, Brazilians, have strugled a lot in this matter. Many of us, myself included, defended the old computer law as the salvation of everything, because we thought we had to recreate gunpowder and we thought we needed, then, protection from competition and redo everything here. The data show - as Minister Vargas said - that, with the change in our attitude, there was an increase in production.
> As a senator, I was able to participate, together with the then senator Nelson Wedekin and with the senator Roberto Campos, in an attempt to modify this matter. And I remember, I was leader of MDB and indicated Senator Nelson Wedekin to be the rapporteur, Senator Roberto Campos was very scared, because both I and the Wedekin had a vision, which will see (sic), of Senator Roberto Campos, he thinks the same thing today. A vision that wasn't what you today call neoliberal. And it's not until today. So he was afraid that we wouldn't be able to understand the necessary process of openness. We understood. We understood and began to modify a number of regulations.
> (...)
> I think that, consequently, we can say that, by signing these two legal diplomas, today, we are reaching a great advance, in the respect that we have to have for the intellectual creator to whom the rights are granted, guaranteeing the freedom of creativity, the expansion of the spirit. And it is known that, today, more and more cultural goods are economic goods, they have repercussions in the economic area. We need, also for this reason, although it is not the only one, and often not the main one, to guarantee conditions that allow greater investments, but we cannot allow this investment to liquidate the right, and even the material interests of the individual producer, of the person who is really producing, because in these areas, whether in science and technology, or in the cultural area - although, like every human product, it is a social product, and therefore depends on relations, institutions, etc... - are areas in which there comes a time when the individual imagination is irreplaceable, and therefore has to be properly valued, too, because that is how it is.

On President Fernando Henrique's speech, Mariana Valente summarizes well its main points (2018, p. 376):

> The discourse of the then president Fernando Henrique Cardoso expresses, on the one hand, the perception that there was a conflict between a model of economic exploitation and, on the other hand, the harboring of the "individual imagination". It also expresses the idea of modernization and openness behind the government's agenda to reform intellectual property laws, that its concerns were closer to the approval of the Software Law than the copyright law, and how the agenda on software in Brazil was linked to those conflicts of the 1980s, over market reserve, and the American pressures that Brazil suffered.

The excerpts from the former president's speech and Valente's quotation above make it clear the concerns and problems that laws 9.609/98 and 9.610/98 were expected to address. It is very clear that the laws were the result not only of a foreign influence in Brazil, but also of antagonistic groups operating on national soil, which could be very well represented by record labels and publishers on the one hand, and by the artists' defense associations, on the other side of the spectrum.

In the same way, one realizes that the greatest and main purpose of the laws was to protect economic interests. The point highlighted above on the definition of authorship was so much debated fundamentally because of financial interests of those who would have then greater control over a work to be able to make better use of it. Regarding computer programs, U.S. influence and the threat of section 301 execution played a role in this process.

The fact is that the field of copyright law in Brazil has undergone major changes since 1998, and few of them have been due to the new laws. In the words of Valente (2018, p. 380):

> ... the international field of Copyright Law was in a state of strong boiling point, with the industrialized countries, and especially the United States, paving the way for what would be decades of great conflicts around the subject; the second, that at that time the Brazilian public sphere was not discussing Copyright Law, and that there was little mobilization beyond the expected groups, people and organizations that had already been active in the field in previous decades (...).
> The fact that, in the 2000s, "Copyright started to be discussed at the breakfast table", in the words of Cláudio Lins de Vasconcelos, was linked to two other factors: one, more invisible, the consolidation of the treatment of intellectual property as an issue of international trade, since the adoption of TRIPS and the subsequent negotiation of other bilateral or regional trade treaties, which would invariably involve intellectual property - the FTAA would be one of them. The second is the radical transformation that the expansion of the Internet and the development of digital technologies has brought gradually to the forms of production, distribution and consumption of intellectual goods.

In the following chapter, it shall be seen how laws whose justification for their existence are the economic protection of individualized goods are compatible with a technology that can only develop and prosper with the constant sharing of information. Would the Brazilian Copyright Laws, designed for an industrial society paradigm of

protection of the units sold and the value of the music royalties collected, be able to protect a technology thought in a context of an Informational Society of free dissemination and circulation of this type of good? How would this regulation be made?

3 THE TUTELAGE OF WORKS MADE BY ARTIFICIAL INTELLIGENCE IN BRAZIL

The understanding of the motivations behind any topic is instrumental in deepening the knowledge on a given subject. The perception of the centrality of information for both Artificial Intelligence technology and Information Society theory, the American influence on TRIPs and that of different pressure groups in Brazilian laws that deal with Copyright law allows having a global view of the studied object and the most appropriate ways to approach it.

With the definitions and motivations of the main elements of this thesis duly explained, the focus is shifted to the way the institutes of Copyright Law would be applied to protect the works made by Artificial Intelligence applications in Brazil. In the end, it will be sought to answer the question of what would be the most appropriate way to regulate programs of this type on national soil.

For this purpose, it will first be discussed the provisions of laws 9.609/98 and 9.610/98. These will be the devices that deal with creative work, authorship and ownership. The aim is to draw conclusions on how these institutes are applied on Brazilian territory.

The next step will be the analysis of the work created by an Artificial Intelligence program. Based on Ulmer's theory that a protectable work is a creative intellectual expression, a point-to-point analysis of this theory will be made, comparing the AI creation with the law, in order to determine whether it could be protected by the Brazilian Copyright Law in force or not. At the end, the compatibility and merit of the Brazilian copyright laws that apply to works created by AI applications will be discussed.

As a final topic of this thesis, proposals will be made to regulate the matter. In the first place it shall be analyzed how other countries have already been dealing with the subject, in some cases with the existence of specific protection on the topic since the 1980s. Two solutions will then be proposed which could be applied to national law. The first a more friendly application of the Brazilian law towards creative works of Artificial Intelligence applications. The other one that rules out this possibility, giving greater emphasis to the protection of other elements of its production chain.

3.1 Work, Authorship and Ownership according to Laws 9.609/98 and 9.610/98

The first step in verifying the compatibility between a law and society is to explore its articles in order to verify its regulations and what type of conduct they prescribe or propose. In this sense, it is necessary to read and analyze the laws 9.609/98 and 9.610/98 in the most relevant aspects to this work. As with the Berne Convention in the first chapter, first the provisions on the definition of a work or creative work will be verified; then the definition of authorship for Brazilian legislation shall be assessed; and finally, the provisions of the laws on ownership will be analyzed. For all these three elements, conclusions will be drawn as to how they should be applied, based on what has been said so far and on the provisions of the laws.

3.1.1 Creative work in accordance with laws 9.609/98 and 9.610/98

The concept of a protected work has remained generally unchanged since its conception in the Berne Convention. In this international text, in order to be protected by copyright, the work should be an expressed intellectual creation and, moreover, be original. Or, according to Ulmer's definition, be a creative intellectual expression.

This definition was maintained by the former Brazilian copyright law, number 5.988 of 1973. This conclusion can be drawn from the reading of art. 6 of this law, which dictates that the creations of the spirit expressed in any manner are intellectual works,. This is also what José de Oliveira Ascensão (1997, p. 27) states:

> Art. 6 teaches us that "intellectual works are the creations of the spirit which are in any form externalized," and then inserts a long list of such works. Similarly, the Berne Convention, in which this precept is inspired, includes in the "literary and artistic works" all productions of literary, scientific or artistic domain, whatever the mode or form of expression.

With respect to the changes from Law 5.988/73 to Law 9.610/98, specifically regarding the issue of the protected work, Valente comments that some specific modifications have been made regarding the detailing of this concept, to include (2018, pp. 269-270):

> A. "Expressed by any means or medium, tangible or intangible, known or invented in the future."
> B. the replacement of the term "cinematographic works" by "audiovisual works, whether or not sounded, including cinematographic works";
> C. The inclusion of landscaping among the protected works (although Aloysio Nunes Ferreira has not adopted the exclusion of "engineering", also suggested);

> D. Suggestion for clarification that (i) computer programs are subject to specific legislation, and (ii) the protection of databases does not cover the data or materials themselves;
> E. Inclusion of an article on what is not protected by copyright and related rights, adopted in full as art. 8 of the substitute. In the words of the Executive's document, "the proposed wording follows the system of the TRIPs agreement and clarifies which works are not protected by Copyright. Due to the absence of an authorial culture in the country, this article is important and the copyright laws recently edited are very important." One of the points of the article, the provision that individual titles and names are not protected by copyright, was also suggested by MPA to CDA.

Thus, the wording of the excerpt of law 9.610/98 that deals with protected works, art. 7, is as follows:

> Art. 7º The creations of the spirit are protected intellectual works, expressed by any means or fixed in any support, tangible or intangible, known or invented in the future, such as:
> I - texts of literary, artistic or scientific works;
> II - conferences, speeches, sermons and other works of the same nature;
> III - the dramatic and dramatic-musical works;
> IV - choreographic and pantomimic works, whose scenic performance is fixed in writing or in any other form;
> V - musical compositions, whether or not they have lyrics;
> VI - audiovisual works, sounded or not, including cinematographic works;
> VII - photographic works and those produced by any process analogous to photography;
> VIII - works of drawing, painting, engraving, sculpture, lithography and kinetic art;
> IX - illustrations, geographic maps and other works of the same nature;
> X - the projects, sketches and plastic works concerning geography, engineering, topography, architecture, landscaping, scenography and science;
> XI - the adaptations, translations and other transformations of original works, presented as new intellectual creation;
> XII - computer programs;
> XIII - the collections or compilations, anthologies, encyclopedias, dictionaries, databases and other works, which, by their selection, organization or disposal of their content, constitute an intellectual creation.
> § 1º Computer programs are protected by specific legislation, subject to the provisions of this Law that apply to them.
> § 2º The protection granted in item XIII does not cover the data or materials in themselves and is understood without prejudice to any copyright that subsists in respect to the data or materials contained in the works.
> § 3º In the field of sciences, the protection will fall on the literary or artistic form, not including its scientific or technical content, without prejudice to the rights that protect the other fields of immaterial property.

With regard to what is not protected by the Copyright Law, this is mentioned in Article 8[37]. The specific legislation on computer programs, of n. 9.609/98, provides on the concept of this type of work:

[37] Art. 8º It is not the object of protection as copyright that this Law deals with: I - the ideas, normative procedures, systems, methods, projects or mathematical concepts as such; II - the schemes, plans or rules to perform mental acts, games or business; III - the blank forms to be filled by any kind of information, scientific or not, and their instructions; IV - the texts of treaties or conventions, laws, decrees, regulations,

> Art. 1 Computer program is the expression of an organized set of instructions in natural or coded language, contained in a physical support of any nature, of necessary use in automatic machines for processing information, devices, instruments or peripheral equipment, based on digital or analog techniques, to make them work in a way and for specific purposes.

The same software legislation, however, emphasizes its subjection to law 9.610/98 when emphasizing in its article 2 that the protection regime to the intellectual property of computer program is the one granted to literary works by the copyright legislation in force in Brazil.

From the analysis of these pieces of legislation it is possible to reach some conclusions:

I. The longevity of the concept of protected work

As highlighted above by Ascensão, the concept of protected work was one that remained largely unchanged from the Berne Convention to the Brazilian copyright legislation of 1973. The same can be said when transposing it into law 9.610/98. Thus, the concept discussed in chapter 1 of a protectable work being a creative intellectual expression, as per Ulmer, would still be applicable, with the addition that creative is all that is presented as being original and useful at the same time. The only relevant addition was the clarification that the expression of this work can be made in any way and on any medium, which leads to the second conclusion:

II. The effort of the law to demonstrate that the expression of the work takes place in any way

One can see the great effort of the law and legislators to emphasize that the expression of the work can be through any means, whether tangible or intangible, including a list of 13 exemplifying items that can be considered as works. This great emphasis, however, has its function, since article 8 of the same law highlights that ideas are not protected by the Copyright Law. In this way, the highlight has the usefulness of emphasizing to the constituents the need to express their ideas in some medium so that they can enjoy protection by the law.

III. Database protection

A relevant point added to law 9.610/98 was the protection of databases. By providing in item XIII of article 7 that these are in the list of works protected by the

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judicial decisions and other official acts; V - the information of common use such as calendars, agendas, registers or subtitles; VI - the names and individual titles; VII - the industrial or commercial use of the ideas contained in works.

Copyright Law, this is one of those articles that can pave the way for the proper way to protect the protection of works created by Artificial Intelligence applications. Given the reliance of AI on data for it to function properly and the growing use of software, as well as entire business models that depend on Big Data, having an express prediction in law regarding databases can help in this regard.

However, it is necessary to pay attention to Paragraph 2 of Article 7 of Law 9.610/98, since not necessarily the data used to train an AI application to perform a given function can be used freely. Thus, even if a compilation, or the algorithm trained in this case, can be protected by the Copyright Law, this does not mean that it can be used for any and all purposes without first obtaining authorization from the owners of any works used as input for a given computer program.

A criticism made by Ascensão to this type of work is that because it is of a utilitarian nature, "it would be necessary to add the requirement of originality, in the terms previously mentioned. There will therefore be a particular requirement for the remaining works. This will make the protection of the database by copyright rare and unsafe" (1997, p. 674).

IV. Adaptations to concept of protect work for the concept of software

The definition of a computer program provided for in article 1 of Law 9.609/98 is familiar to that of a protected work under Law 9.610/98 in the sense of providing that the expression of the work is one of its central tenants. Denis Borges Barbosa argues that this definition would make evident the connection of software with the usual means of technology transmission because in addition to the instructions of machines, there would be instructions directed to the human receiver, and the whole would be software (2017, p. 1851).

However, it is necessary to highlight a fundamental difference between the protection of computer programs to other types of works by copyright law. For this, it is necessary to refer to art. 2, § 1º, of law 9.609/98:

> § 1º The provisions on moral rights shall not be applied to the computer program, except at any time for the author to claim his right of paternity of the computer program and the author's right to object to unauthorized alterations involving deformation, mutilation or other modification of the computer program which damages his honor or reputation.

In other words, while other types of works receive the protection of the provisions of the Copyright Law in their entirety, namely in the modalities of property rights and

moral rights, computer programs will only receive proprietary protection. On the subject, Barbosa comments (2017, p. 1946):

> The restriction of moral rights is applicable, in postulating that such rights do not constitute an ineradicable constitutional element of intellectual rights. They are personal rights, but not necessarily emanations of constitutional guarantees (...). As such rights are not a peculiarity of copyright law (...) and - as we insist - the constitutional rooting of the protection of computer programs is art. 5, XXIX[38], of CF88, nothing more natural than applying to software a more restricted protection...

Creative work in Brazilian law, as it was in the Berne Convention, is every creative intellectual expression, in which to be creative it is necessary that a certain work be original and useful. Law 9.610/98 adds protection to databases, which becomes relevant considering the AI's dependence on information. With regard to the specific protection of computer programs, all provisions relating to copyright, with the exception of moral rights, apply to them. Having said that, the question of authorship now arises.

3.1.2 The authorship of creative works in accordance with Brazilian laws

If the discussion around the definition of protected work was one of relatively few clashes at the time of the legislative process of laws 9.609/98 and 9.610/98, the same cannot be said of the concept of authorship. There was a great dispute between the associations of copyright protection and the record companies and publishers from the drafting of the concept of authorship present in law number 5.988 of 1973 onwards. This happened because this law would allow the authorship of legal entities, as already pointed out earlier[39].

On the possibility of authorship by companies present in the law of 1973 comments Ascensão (1997, pp. 86-87):

> This is the perspective that, in a not entirely happy way, art. 15 has in mind, by mentioning the work "organized by singular or collective company". This entity, which is both singular and collective, is the entrepreneur; and can be plural, because there can be several entrepreneurs.

[38] Article 5, XXIX, of the Brazilian Federal Constitution of 1988 provides: the law shall ensure the authors of industrial inventions temporary privilege for their use, as well as protection of industrial creations, trademark ownership, company names and other distinctive signs, in view of the social interest and the technological and economic development of the Country.

[39] Article 15 of that law says: In the case of a work carried out by different persons, but organized by singular or collective company and used on its behalf, the authorship of the work is going to belong to this company.

> Thus, in the collective work, the right originally belongs to the entrepreneur (...). In fact, the entrepreneur can be simultaneously creator, but this is irrelevant for the classification of the collective work.

Considering the creative process of music, which sometimes involves several parties, the possibility of companies being effective authors of this type of works caused an opposite pressure from groups of artists. This was one of the reasons for the change in the section on authorship in the new law.

In Law 9.610/98, the provisions on the authorship of intellectual works can be found in Chapter II of Title II between articles 11 and 17, of which it stands out:

> Art. 11 Author is the individual creator of literary, artistic or scientific work.
> Sole paragraph. The protection granted to the author may apply to legal entities in the cases provided for in this Law.
> Art. 12 In order to identify himself as an author, the creator of the literary, artistic or scientific work may use his civil name, complete or abbreviated up to his initials, pseudonym or any other conventional sign.
> Art. 13 It is considered author of the intellectual work, with no evidence to the contrary, the one who, by one of the modalities of identification referred to in the previous article, has, in accordance with the use, indicated or announced this quality in its use.

From the analysis of the articles highlighted, it is possible to reach some conclusions:

I. Consistency with the definition of author of the Berne Convention

As occurred with the definition of protected work, the definition of author of law 9.610/98 also has similarities with that of the Berne Convention. Both do not define who the author is, in his place establishing the presumption that the one who has his or her name indicated in the work in a usual way is the author.

About this definition, Ascensão says first of all that the principle to be clearly established is that the author is the intellectual creator of the work. In his words: "the literary or artistic work requires a creation, in the spirit: the author is the one who realizes this creation. There are exceptions (...), but this does not mean that the principle should not be clearly proclaimed" (ASCENSÃO, 1997, p. 70). This is what Article 2 of Law 9.610/98 provides for in general terms[40].

Next, Ascensão comments on the determination of authorship to always have to assume an identification and that this could be done in any form. According to the Portuguese author (1997, p. 71):

[40] Article 2 of Law No 9.610/98 reads: The author has moral and patrimonial rights over the work he has created.

> This is how art. 12 states that, in order to identify himself as an author, the creator of the intellectual work may use his civil name, complete or abbreviated even by his initials, pseudonym or any conventional sign. This precept has a mixed character, since it respects both the right of persons, in the chapter of the name, and the Copyright Law itself.

In relation to article 13, Ascensão comments that the Copyright would be attributed to those who were named in the work in a universally adopted manner and complements such impression to be corroborated by article 15, paragraph 1, of the Berne Convention[41] (ASCENSON, 1997, p. 72). Thus, the presumption of authorship of a certain work remains until the opposite is proved, as it was in the Berne Convention. However, in the case of Brazilian law there is a fundamental difference, as will be seen below.

II. The determination of the law 9.610/98 of authorship only for individuals

Valente reports an explanatory note dated 1996 from Otávio Afonso, former CNDA (National Copyright Council) employee with great knowledge of the functioning of the entity. During the legislative process of the current Brazilian copyright laws he would insist on the proposal that the author, in these new laws, be the individual. In the words of Valente (2018, p. 262):

> The Note argued that "the principle that authorship is the prerogative of the individual creator of the work" was evident in the legislation of several countries, such as Germany, Spain and Switzerland, and that the absence of such a provision opened up the "possibility that legal persons entrusted not with the creation, but only with the production and commercial distribution of the work may be considered authors".

The final wording of article 11 of law 9.610/98 provides that the author is the individual creator of creative work and, in its sole paragraph, that the protection granted to the author could be applied to legal entities in the cases provided by law. Valente (2018, p. 262) comments that the executive's justification for the writing to remain that way was: "this proposal reflects an international trend of approximation between the institutes of 'copyright' and 'droit d'auteur'".

This explanation is relevant, given the fact that the insertion of the sole paragraph of Article 11 was made at the time when the bill was being processed in the Special Committee of the House (under rapporteur Aloysio Nunes), this already in 1997, and had

[41] Article 15(1) of the Berne Convention provides as follows: for the authors of literary and artistic works protected by this Convention to be, until proven otherwise, considered as such and consequently admitted before the courts of the countries of the Union to take legal action against the factors, it is sufficient that their names be indicated in the works in the usual manner. This paragraph applies even if the names are pseudonyms, provided that the pseudonyms adopted do not leave any doubt as to the identity of the authors.

received a proposal to change the executive power. Such a proposal would have been influenced by private sector actors, as Valente puts it (2018, p. 254):

> It is reported that, "with the private sector's contributions in hand, the Executive began the process of discussion with the rapporteur and the various parties involved in the negotiation of this matter". Aloysio Nunes Ferreira made reference to this interlocution in the presentation of the Substitute at CESP on September 10, 1997.

Among the contributions of the private sector, the following stand out: the ones from ABC (Brazilian Cinematographic Association, which represented the interests of the North American MPA in Brazil), ABEM (Brazilian Association of Music Editors), ABPC (Brazilian Association of Film Producers), ASSESPRO (Association of Brazilian Software and Computer Services Companies) and CNI (National Confederation of Industry) (VALENTE, 2018, pages 252-253).

The author continues that the Special Commission would have held a series of meetings with these private sector actors, as did personally the rapporteur of the then PL 5.430/90 Aloysio Nunes Ferreira (2018, p. 254). This influence is even more evident if a timeline is drawn with the main legislative proposals that integrated the PL that led to the current copyright laws, according to the table below that highlights the wording of article 11 and its sole paragraph of law 9.610/98 throughout the legislative texts (VALUE, 2018, pp. 436-437):

PL of the Senate n. 249/89	**Substitutive Aloysio Nunes at CCTCI in the Chamber, 1995**	**Executive Proposal**	**Substitute Aloysio Nunes in the Special Committee in the House**	**Law n. 9610/98**
Absent	Absent	Art. 12 - Author is the individual creator of **literary** or **artistic** work. Sole Paragraph - The protection granted to the author may **be extended** to legal entities in the cases provided for in this law.	Art. 11 - Author is the individual creator of **literary**, **artistic** or **scientific** work. Sole Paragraph - The protection granted to the author may **apply** to legal entities in the cases provided for in this law.	Art. 11 - Author is the individual creator of **literary**, **artistic** or **scientific** work. Sole Paragraph - The protection granted to the author may **apply** to legal entities in the cases provided for in this law.

TABLE 1 - Comparison between bills (VALENTE, 2018, pp. 436-437)

Regarding authorship, it is possible to notice that, in general, Law 9.610/98 adopts provisions similar to those of the Berne Convention. In both legislative texts the author is

considered to be the one who has indicated his or her name in the work in a usual way. This presumption admits questioning, with the presentation of evidence.

A vital difference from Berne is the provision of Article 11 of the Brazilian law which provides that only natural persons may be authors of literary, artistic or scientific works. In this and the last chapter, it was observed that this had been a conquest of associations for the defense of authors, who had managed, through lobbying, to make this provision appear in law. This article has the function of ensuring that the rights of authors, especially musicals, are not usurped by publishers and record companies.

However, industry actors also had a strong lobby and pressured for a law that would bring copyright and *droit d'auteur* institutes closer together. Thus, through meetings with the executive and with the PL rapporteur at the time, they managed to ensure that an exception was present in law so that the protection given to authors could also be applied to legal entities in the cases provided for by law[42].

This means that despite the provision that the authorship belongs only to natural persons, there are still legal possibilities of this being assigned to legal persons, especially when they fulfill the function of organization, edition or production of works.

3.1.3 Ownership of creative works in Brazil

Article 5, item XIV, of Law 9.610/98 provides for the original owner of an intellectual work to be the author, the performer, the phonographic producer and the broadcasting companies. As seen in chapter 1, the holder is the one with the capacity to exercise the Copyright as if he were the author. However, he does not need to have effectively created any creative work and may, for example, have acquired the rights to a certain work through assignment or license.

Similarly, according to article 14 of the same law, "whoever adapts, translates, arranges or orchestrates a work that has fallen into the public domain is the holder of the Copyright, and may not oppose another adaptation, arrangement, orchestration or translation, unless it is a copy of his own" and, according to article 17, paragraph 2, the organizer is entitled to the ownership of the property rights over the collective work as a

[42] Among the cases provided for by law, the following stand out: the legal entity may be the organizer of a collective work (art. 5, VIII, h); the publisher of a literary work (art. 5, X); the producer of an audiovisual work (art. 81); the broadcaster (arts. 91 and 95) or the phonographic producer (art. 93), both holders of related copyright (art. 89).

whole. Furthermore, it is important to observe the provisions of article 27 of the same law that the moral rights of the author are inalienable and unwaivable.

Finally, in article 40 of Law 9.610/98: “In the case of an anonymous work or pseudonym, it will be up to those who publish it to exercise the property rights of the author. Sole paragraph. The author who makes himself known shall assume the exercise of the property rights, except to the rights acquired by third parties”.

In relation to Law 9.609/98, another article is emphasized, which is:

> Art. 4 Unless otherwise stipulated, the rights related to the computer program, developed and elaborated during the validity of the contract or statutory bond, expressly destined to research and development, or in which the activity of the employee, service contractor or servant is foreseen, or even resulting from the very nature of the charges related to these bonds, shall belong exclusively to the employer, contracting party of services or public agency.

The following conclusions can be drawn from an analysis of the above provisions from Laws 9.609/98 and 9.610/98:

I. Not every holder is entitled to all the rights to a work.

Considering that the author's moral rights are inalienable, this is an issue that affects certain types of ownership of works, as Fragoso says (2009, p. 197):

> The type of transmission of the Copyright, either by *inter vivos* act or by *mortis causa* determines the derived ownership, in which those who hold the prerogative of the exercise of the Copyright and its related rights are invested. The ownership derived by an *inter vivos* act, as in the cases of assignment of rights, is given by the transmission of the property rights of author since the transmission of moral rights by an *inter vivos* act is forbidden. There is also the typical example of derived ownership where only the right to exercise is transferred, not the property right itself, as occurs in publishing contracts, through which there is no real acquisition of the property rights of the author by the publisher...

In other words, in copyright, which can be subdivided into two major areas, those of moral nature and those of patrimonial nature[43], the holder who does not fit as original creator can only own the rights of this second category. This provision also has influence on the issue of original acquisition of the Copyright Law by a person other than the creator.

[43] "The content of the Copyright Law finds its expression in the double manifestation of its attributes, represented by a set of prerogatives of patrimonial and moral nature, which characterizes it as a *sui generis* right. The property aspects or property rights are closely intertwined with the moral rights, forming a characteristic set in relation to the work as such and its economic exploitation through various modes of use - exploitation that has attributes of availability by its own economic nature; on the contrary, the moral rights are unavailable, due to the fact that the link is indissoluble in nature with the personality of the author, and are intended, basically, to defend it" (FRAGOSO, 2009, p. 199).

On this subject, Ascensão wonders whether the intellectual creator could divest himself of his right over a work in such a way that it would be attributed from the beginning to a third person, so that the intellectual creator was never, legally, an author. In his words (ASCENSÃO, 1997, p. 109):

> The problem is related to another one that is sometimes confused with it, and has been considered by the Brazilian doctrine: the ceding of the right to the name. In any case, strictly speaking, in the ceding there would be no original attribution, because the right would have been born in the ownership of the intellectual creator, who only then would get rid of it: there would therefore be transmission. This is a consequence of the fact that the Copyright Law is acquired, both in the personal aspect and in the patrimonial aspect, right at the moment of the creation of the work.

The Portuguese jurist continues that these two problems would be effectively connected, since the original acquisition of the Copyright by a third party would represent an additional factor in relation to the assignment of the right to the name. On the other hand, the treatment of the subject would necessarily involve aspects related to the personality of the author. Completes Ascensão (1997, p. 110):

> We will conclude that today it is not possible to give up the right to the name once and for all. If contracts by which the intellectual creator authorizes others to publicly arrogate themselves to this quality are admissible, this does not mean that the right to the paternity of the work is lost: the intellectual creator can at all times make public its quality and come to claim authorship. There is therefore a nucleus attached to the personality of the agent which is never lost.

Thus, in the Brazilian Copyright Law, due to the presence of moral rights only the original holder may enjoy in its entirety the prerogatives on a certain creative work. Any other type of acquisition of ownership of a work will only be of the property rights of that work.

II. In principle, only property rights apply to anonymous works.

A relevant issue that will be useful throughout this chapter is the protection of anonymous works[44] and pseudonyms[45] by Brazilian law. About the reason for their existence comments Ascensão (1997, p. 117):

> The author has the right to the name; but he has no obligation to the name. Many reasons may lead the intellectual creator to hide his authorship, either by omitting any designation (in which case the work will be anonymous) or by publishing the work under an assumed name (in which case the work will be pseudonymous). The law does not in any way supervise the reasons that the author may have for doing so: he is sovereign in terms of his identification. And it allows you to widely

[44] Article 5, item VIII, paragraph b, of law 9.610/98: for the purposes of this Law, an anonymous work is considered - when the name of the author is not indicated, either by his will or because it is unknown.
[45] Article 5, item VIII, paragraph c, of law 9.610/98: for the purposes of this Law, a pseudonym work is considered - when the author is hidden under an assumed name.

> use the name, complete or abbreviated to the initials, the pseudonym or even a conventional sign.

Because of this, the Lusitanian author teaches that these would not represent new categories of literary or artistic works. On the contrary, all possible categories can be anonymous or pseudonymous. "The anonymous work or pseudonym does not imply any speciality regarding the attribution of the Copyright - the Copyright is attributed, in normal terms, to the intellectual creator. It is only a question of determining his identity" (ASCENSÃO, 1997, p. 117).

The problem does not concern the paternity of the work, because that is a moral right of the intellectual creator[46]. The main question in this case would be how to exercise the rights over a work for which the author is not known. About this, Ascensão argues (1997, p. 117):

> The law attributes the exercise of rights to those who disclose the work. Also here, the publication has the generic sense of disclosure, normal in Brazilian law. Whoever appears to practice acts of disclosure of the work is legitimized for the exercise of the right. It covers not only heritage faculties but also personal faculties. It is a very important particularity, which removes this *ex lege* representation from voluntary representation. Whoever exercises the right is also legitimized to exercise the ethical options of the intellectual creator, because the law starts from the principle that he does so by indication of the author.

That is, in the absence of the author, the one who discloses the work assumes the ownership of it and all the property rights that would be applicable to the original creator of the work. However, it is reserved to him to assume his authorship at any time, which would then transfer to him the property rights over a work, except for those acquired by third parties.

III. The legal guardianship of the software is the most beneficial for legal persons

On the creation of the software, Medeiros (2017, p. 351) comments that a computer program could be created from the individual commitment of a programmer, but that its development would be more common through the participation of several people, in the form of collective or collaborative works. And it is more frequent for a company to hire a programmer or a group of programmers specifically to develop software for the contracting company.

It is in this line that article 4 of law 9.609/98 assists legal entities much more: by establishing that the rights related to the computer program belong to the employer, unless

[46] Article 24, item I, of law 9.610/98:it is the author's moral right to claim, at any time, the authorship of the work.

otherwise stipulated. Regarding the theme, Wachowicz (2010, p. 16) highlights that the creation and development of the software are performed by different people, but could be organized by a company in the IT area, configuring a collective work, about which a specific contract would be necessary. This makes it possible for a company to hold the copyright on a computer program, provided that there is express contractual provision with the individuals who created the program.

In the same vein, Denis Borges Barbosa (2017, p. 1915) comments on the possibility of software authorship by a legal entity:

> ... it is urgent to understand that authorship itself is not necessarily granted to the parties who perform the work of analysis, programming, etc., but to the one who exercises the choice between the forms of codification and structuring, who finally determines among the free alternatives to which it should be applied in each case; and the fact that the alternative is technical does not disfigure authorship.

As owner, the company would be entitled to all the property rights over a computer program, which include the exclusive right to use and dispose of it, as provided for in Article 28 et seq. of Law No. 9.610/98. This gives absolute control of an application to the company that ordered its production.

Due to the provision of art. 2, § 1º, of law 9.609/98 that only the provisions relating to property rights apply to computer programs, the ownership of this type of work by a legal entity is facilitated. The inexistence of the moral right to software, except for the recognition of its paternity, allows, in practice, for a company that hires employees to produce a computer program to be the owner of it.

At the end of this item it is possible to see that the protection of creative works by the Brazilian legislation does not differ so much from that of the Berne Convention, with some exceptions. As for the work, the possibility of database protection was added to the Brazilian legislation and it was determined that only the provisions regarding property rights apply to the computer program. On authorship, there was the highlighted addition of art. 11 in law 9.610/98, which determines that only individuals could be authors, but opening a gap in its sole paragraph that a legal entity could enjoy the same protection in the cases referred to in law. This affects the issue of ownership by facilitating, for example, that companies be considered in practice as authors of computer programs.

It should also be noted that many of these legislative additions were due to the work of pressure groups in meetings with the executive and the committees discussing the then PL which led to the laws of numbers 9.609/98 and 9.610/98. In particular, article 11 of the latter, in which the caput can be considered as a victory for artists' protection

associations, but whose sole paragraph could be credited to the lobby of business groups. Thus, from now on, it will be seen in the items below the application of these laws to works created by Artificial Intelligence applications.

3.2 The work of an Artificial Intelligence application for the current Brazilian law

Based on the conclusions presented above, it is intended to explore whether a work produced by an Artificial Intelligence application could currently be protected by the Copyright laws in force in Brazil. The treatment that national law gives to the subject was presented and it was also observed that a work is a creative expression of the intellect. Now the objective is to analyze whether the work resulting from an AI program could meet these three requirements, especially the last two, given the fact that the mere existence of a work of this type already proves its expression. First it will be verified whether an application of Artificial Intelligence can be considered creative and then whether it can manifest an expression of the intellect. Finally, comparing law and technology, it will be verified whether they can be considered compatible or not.

3.2.1 The possibility of an Artificial Intelligence application being creative

In order to determine if an Artificial Intelligence application could be creative, it is first necessary to highlight the concept of creativity presented in this work. Chapter 1 introduced Runco and Jaeger's definition that creativity requires the work to present both elements of originality and effectiveness.

About the first, Okediji (2018, p. 17) comments that Artificial Intelligence takes the debate about originality even further by questioning the utility or the need for copyright protection for works created totally or with the aid of intelligent, precise and programmable machines.

Considering that the originality requirement presented by this thesis demands that a certain product be innovative and not just a mere copy of something already existing and that an application of Artificial Intelligence is constituted by a software running on a hardware using Big Data as input value, one would expect that the results, given the algorithmic nature of the invention, would be predictable. However, according to Joel Lehman et. al., this is not always the case (2018, p. 5):

> At first, it may seem counter-intuitive that a class of algorithms can consistently surprise the researchers who wrote them. Here we define surprise broadly as observing an outcome that significantly differs from expectations, whether those expectations arise from intuitions, predictions from past experiences, or from theoretical models. Because an algorithm is a formal list of unambiguous instructions that execute in a prescribed order, it would seem sufficient to examine any algorithm's description to predict the full range of its possible outcomes, undermining any affordance for surprise. However, a well-known result in theoretical computer science is that, for many computer programs, the outcome of a program cannot be predicted without actually running it. Indeed, within the field of complex systems it is well-known that simple programs can yield complex and surprising results when executed.

This is due to the way modern Artificial Intelligence applications operate. Given the presence of machine and deep learning algorithms, which can analyze and process input data repeatedly before giving a definitive result, these applications, by the very way they were programmed, will produce unexpected results.

A possible counterargument could be that no AI application would be capable of real originality, because all work it produces is the fruit or derivation of the information used as input value in its algorithm. However, Marco Aurélio de Castro Júnior (2013, p. 85) answers that in human beings "every creative idea would simply be a matter of juxtaposition or combination of information previously existing in different configurations", so that there would not exist, in principle, any barrier so that AI applications could be considered creative.

Along the same lines, Lehman-Wilzig (1981, p. 442) argues that:

> In addition, there may be no such thing as 'true creativity' since neither man nor machine are able to create information. Given that all 'creative' thought is merely a matter of juxtaposing or combining previously existing information into different configurations (ie recycling 'matter' into different forms of energy), there is consequently no bar in principle to the development of artificial intelligence. In reality, computers do only what you program them to do in exactly the same sense that humans do only what their genes and their cumulative experiences program them to do.

The creative process of the work, that is, everything that occurs before the disclosure of the final result of a given creative work, is also the object of study of some authors, such as Cecilia Almeida Salles[47], who argues (1998, p. 25):

> To discuss art from the point of view of its creative movement is to believe that the work consists of an infinite chain of aggregation of ideas, that is, in an infinite series of approaches to achieve it (...). Art is not only the product considered finished by the artist: the public has no idea how much splendid art it loses by not

[47] PhD in Applied Linguistics and Language Studies from the Pontifical Catholic University of São Paulo. Professor of the Graduate Program in Communication and Semiotics at PUC/SP. Author of works such as Unfinished Gesture - Process of Artistic Creation and Networks of Creation: Construction of the Work of Art.

> watching the rehearsals (...). The artifact that gets to the shelves of bookstores, exhibitions or stages is the result of a long journey of doubts, adjustments, certainties, successes and approximations. Not only the result, but all the way to him is part of the truth...

In this line, just like the application of AI created to produce art, the work of the human artist is also an amalgam of previous creative works seen and learned by the artist. This means that art as a whole cannot be enclosed in episodic moments, the ‘works of art’, but must be taken in its entirety, taking into consideration also the creative process and influences that led a work to take this or that direction. On the subject addresses Salles (1998, p. 88):

> The creative path observed from the point of view of its continuity puts creative gestures in a chain of relationships, forming a network of closely linked operations. The creative act thus appears as an inferential process, to the extent that every action, which shapes the system or the new "worlds", is related to other actions and has equal relevance when thinking of the network as a whole. Every move is tied to others and each one gains meaning when nexuses are established.
> Notes, sketches, watched films, remembered scenes, annotated books, everything has the same value for the researcher interested in understanding the creative act, and is somehow connected.
> The inferential nature of the process means the destruction of the absolute beginning and end ideal. For this discussion, the emphasis is on the impossibility of determining a first link in the chain; however, the realization that the creative act is a chain necessarily implies equal indetermination of last links. It is always possible to identify an element in the continuous process as closest to the starting point and every stop is potentially a restart.

As far as the originality of a work is concerned, regardless of whether it has been produced by a human or an application, it must be taken as innovative when it succeeds in continuing the creative flow that inspired it. This would enable AI applications to display original creations.

Regarding the second aspect, effectiveness, for a work to be considered creative, it should be remembered that this means that a certain creative work must be considered as such by the community in which it was published. When talking about works of art, the verification of their acceptance can be done in some ways.

Here is a case mentioned by Lehman et. al. in which programmer Peter Bentley had developed a system called Generic Evolution Design capable of combining a series of "building blocks" in complex and functional configurations, which aroused the interest of a group of musicians. In the words of the authors (2018, p. 16):

> In 1999 Bentley was approached by a group of musicians and developers who wanted to generate novel music through digital evolution. Dance music was popular at the time, so the team aimed to evolve novel dance tracks. They set different collections of number-one dance hits as targets, i.e. an evolving track would be scored higher the more it resembled the targets. The evolved results, 8-

> bar music samples, were evaluated by a musician who selected the ones to be combined into an overall piece, which was then professionally produced according to the evolved music score. The results were surprisingly good: the evolved tracks incorporated complex drum rhythms with interesting accompanying melodies and bass lines. Using bands such as The Prodigy as targets, digital evolution was able to produce intricate novel dance tracks with clear stylistic resemblance.
> In 2000 the group formed a record label named J13 Records. A highly specialized distribution contract was drawn up and signed with Universal Music, stipulating that the true source of the music should not be revealed, even to the distributors (because Universal Music's CEO believed that no-one would want to buy computer-generated music). Sworn to secrecy, the companies produced several dance tracks together, some of which were then taken by other music producers and remixed. Some of the music was successful in dance clubs, with the clubgoers having no idea that key pieces of the tracks they were dancing to were authored by computers.

In another case, "an impression generated by an artificial intelligence (AI) was sold for US$ 432,500 by Christie's auction house in New York, USA" (PEARSON, 2018). The case occurred in October 2018 and had a sales value 40 times higher than expected.

The report, authored by Jordan Pearson, continues:

> The image is called Edmond de Belamy and (...) is actually the product of months of work by three guys who share an apartment in Paris - one of them a PhD candidate in machine learning - who collectively call themselves Obvious.
> The inclusion of the work in Christie's auction has caused some consternation in the art world and also among artificial intelligence experts who resent the implications that an algorithm can be an artist in itself - especially the relatively monotonous variety used to create the impression, "Generative Adversarial Networks (GANs)". The GANs were developed in 2014.

Regardless of the concerns about both works exemplified above having been actively produced by AI applications, it can be seen that they could be appreciated by the public. Both the music tracks, of which the fact that they had been created by an Artificial Intelligence program was unknown, and the painting, of which there was ample knowledge, had great commercial success. Moreover, the painting was sold for a much higher value than originally intended.

Thus, it is possible to conclude that Artificial Intelligence applications would have, in principle, the ability to demonstrate creativity in the creation of works. Both in terms of originality and effectiveness, programs of this type have the conditions and means to produce works that escape the ordinary and that can be appreciated by the public as art.

3.2.2 The possibility of an Artificial Intelligence application having an intellectual expression

The second criterion to be examined to see whether a work produced by an AI application could be protected under Brazilian law is whether it can be considered as intellectual. In other words, could a program imbue a creative work with its personal traits in order to be considered an author?

Okediji (2018, p. 18) comments on this issue:

> With respect to authorship, scholarly debate is mounting about whether intelligent, productive machines can (and should) be considered the legal "authors" of their respective works under copyright law. This debate continues to grow as the computer power of sophisticated, learning machinery burgeons; according to AI experts, the technology has a 50 percent chance of reaching human-level intelligence by 2040 and a 90 percent probability by 2075. The more sophisticated the technology becomes, and the less human intervention is involved in the generation of artistic works, the more difficult the authorship problem becomes.

This is because, as we have seen before, on the one hand AI applications are already capable of producing creative works just like humans, with little or no human intervention. On the other hand, these applications are still composed of algorithms programmed by some human programmer who gave them this function. Furthermore, as Okediji explains, "AI often creates works in conjunction with human users, who can provide some degree of instruction to guide the software" (2018, p. 18). It is this dynamic between programmers, users and machine that creates a complex issue to be resolved by current copyright laws.

José de Oliveira Ascensão comments that when a computer program reaches results completely undetermined by its operator, occurred in the case of works created by applications of Artificial Intelligence, there would be no right of that operator on the result produced. In the words of the Lusitanian author, when dealing with the result of the creation (1997, p. 664): "intellectual creation is individualized creation; it is the expression of an idea, which must necessarily be anticipated with a specific content. It is not equivalent to putting into operation a machine from which indiscriminate products are derived".

The possibility of this work belonging to the machine operator is also not considered by the author, when stating (ASCENSÃO, 1997, p.664):

> It can then be claimed that the authorship of the work or result is from the person who created the computer program itself. But it's not like that either. Whoever creates the program has the authorship of the program itself. But it does not have

> the authorship of its results, because the creation should be specific and not generic. It presupposes, as we have said, an individualized forecast, and it is not enough to put in place a process from which this creation will then result. A process is not a work, and works are not a category.

This is because, according to the Portuguese author, considering that the Copyright Law would necessarily protect creations of the spirit, "every relevant work is a human work" (1997, p. 27). This would result from the Copyright Law, which states in art. 7 of law 9.610/98 that intellectual works are creations of spirit by any means exteriorized. "Admitting the identity between intellectual creations and creations of the spirit, the reference to creations of the spirit must be carefully analyzed" (ASCENSÃO, 1997, p. 27).

For Ascensão, therefore, intellectual creation could only be done by the human spirit, which alone would be able to attribute cultural value to a creation, transforming it into a work protected by law (ASCENSÃO, 1997, pp. 27-28):

> Consequently, the literary or artistic work belongs to the world of culture. It is only captured through the spirit. An animal is completely opaque to literary or artistic work, only reaching the perception of scattered physical manifestations, such as colors, sounds or movements.
> Therefore, all copyright is necessarily cultural law. The cultural component has to be very strong here, not allowing itself to be absorbed by commercialist or egocentric concerns, for example.

Eugen Ulmer has a congruent opinion with the Portuguese author regarding the impossibility of the authorship being attributed to an entity other than a human, but disagrees with the statement that the work would also not belong to the controller of the machine, if it were made without the creative activity of a person. According to the German lawyer (1980, p. 128):

> In computer art, the question of protectability is combined with that of the author's person. (...) It is possible, among other things, that in musical composition the computer is only the means for the composer to explore the possible consequences of a rule or the variants of cines schemas. More rarely is the so-called automatic composition, the composition that is output by the computer. The easiest cases are those in which the result is clearly determined by the program created by the composer or on the basis of his instructions. It is possible, however, that the computer is equipped with a random generator, which makes it a program with aleatoric functions. The computer can then develop a number of versions from the program. Even in such cases, however, the author is not the apparatus, but the person who created the basic pattern and determines the definitive version (or versions); if there are several persons, they can be co-authors. Accordingly, it is mutatis mutandis in the case of the use of a computer in the creation of works of fine arts and of linguistic works.

Denis Borges Barbosa follows the same argumentative line when stating that “the author is essentially he who has decision-making power over the expression” (2017, p.

1911). The author uses this argumentative line to substantiate the question of authorship of computer programs. This, as seen above in accordance with Law 9.609/98, does not require the protection of moral rights and leaves a margin, in its article 4, for companies to be, effectively, owners of software.

Barbosa comments: "Thus, it can be understood that the author is the one who exercises the freedom of choice between alternatives of expression. The exercise of this freedom not only shapes the creation, but indicates its originator" (2017, p. 1915). In an analogue application of this author's theory, for someone to become the original owner of a work created by an Artificial Intelligence application:

> ... it must be created by initiative, organization and responsibility of an individual or legal entity, which publishes it under its name or trademark and which is constituted by the participation of different authors, whose contributions are merged into an autonomous creation.

To substantiate his point, the author quotes Piola Caselli[48] (BARBOSA, 2017, p. 1912):

> It can happen that whoever commissions another to elaborate a work will also provide the general outline, the necessary materials and guidance, monitor and correct the various intellectual operations, from which the work itself, be it a book, a statue, a painting, etc., will emerge. In such a hypothesis, the intellectual interference of the principal in the creation of the work may be so important that he must be considered a true co-author.

Supporting this same argument, but under another aspect, Okediji (2018, p. 19) comments that from an economic point of view, predictable legal provisions are necessary to maintain a considerable level of investment in the creative industries:

> The bundle of rights associated with copyright is more easily regulated through entities with the legal ability to manage the rights and duties associated with copyright. Most importantly, however, drawing on the utilitarian view of copyright, it would seem that machines (at least as they exist today) do not require the same incentives to create and, therefore, are not proper subjects of the authorial privileges associated with the copyright monopoly.

That is, the maintenance of the authorship in the hands of individuals or legal entities that have used Artificial Intelligence applications to produce creative works would have the purpose, in the author's opinion, of maintaining legal security and the maintenance of investments, by providing a reliable legal environment. On the subject, concludes Okediji (2018, p. 19):

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[48] Referring to the book *Trattatto del Diritto di Autore e del Contratto di Ediziome* – page 22.6 (BARBOSA, 2017, note 174)

> This status quo with respect to the human authorship question may change, especially as machines achieve more human-like decision making capacity. Policymakers might avoid confronting the legal and political hurdles associated with granting copyright to nonhuman subjects by vesting copyright directly in the programmers of the intelligent machinery.

As demonstrated throughout this work, the emergence and alteration of legal provisions depends largely on lobbying by entities interested in protecting their economic interests on an aspect or another covered by the law. This is no different when it comes to the authorship of Artificial Intelligence applications over their works, which law and doctrine attribute, for the most part, as being of their operators, given the convenience and absence of pressure on the part of groups opposed to this measure. The emphasis of this debate will continue on the next point, when it will be discussed whether the Brazilian laws in force would be compatible with the way an AI application operates.

3.2.3 The compatibility between the operation of an Artificial Intelligence application and the Brazilian Copyright Laws

As demonstrated at the beginning of chapter 2, the Artificial Intelligence field was conceived and depends on a line of reasoning that values the free circulation of information. As the three elements that make up the AI are the software, the hardware and the data used as input values (music, books, films, paintings, etc.), the greater and better the availability of the latter, the better results can be produced by this type of applications.

It is for this reason that from the 1990s onwards a rapid advancement of technology began, which has lasted until the second decade of the 21st century. This was largely due to the emergence and popularization of the Internet, which allowed a pace of circulation of information never seen before. It is also in this meantime that the term Big Data is created to designate the massive amount of data that could circulate and be collected from the Internet. It was precisely this free availability of information circulating on the Internet that allowed the creation of more efficient Artificial Intelligence applications that produced more satisfactory results.

For this reason, it was argued that the technology of Artificial Intelligence has developed in a paradigm of the information society, because it benefits and prospers based on an information technology and, therefore, depends on this free circulation of data. Even though it arose in a pre-internet period, the need for higher quality data in this type

of applications was one of the reasons behind the so-called AI Winter, which was only overcome when free access to information became daily. In other words, this technology thrives in an environment of free access and circulation of the items that make up its input such as books, films, among others.

On the other hand, it was observed that the Copyright laws applicable in Brazil, from the Berne Convention to 9.610/98, arose from pressure groups that instigated legislators to produce laws more restrictive to the circulation of their works. In the case of the Berne Convention it was to regulate literary production, in the case of Brazilian laws especially the issue of music production. Being made in a paradigm of the Industrial Society, the great concern of these laws was to ensure that the profit from the sale of copies (individualized parcels of intellectual property) was directed to the correct recipients. It was observed that there was little concern in determining who was the author of the work, except when this impacted on the economic rights of any of the pressure groups.

However, in general, the great motivating force behind the provisions of the Copyright Laws currently in force in Brazil, including more drastic changes such as article 11 and its sole paragraph of law 9.610/98, was the guarantee of economic rights from copies of works sold, in an industrial paradigm.

For this reason, it is argued that the Brazilian copyright laws are not adequate to protect the technology of the Artificial Intelligence area, nor the creative works resulting from its applications. The very functioning and dynamics of AI technology presuppose and depend on the constant flow of information, while the legislation was put in place to protect and regulate the distribution of individualized copies of these works, giving little or no room for the free circulation of copies, which was tremendously enhanced by the Internet.

There is, therefore, a schism between the paradigm of the information society, the basis for Artificial Intelligence technology, and the industrial model used as a reference for the emergence of the Copyright laws currently in force in Brazil. This would make this legislation inadequate to protect AI technology and its fruits, because of the difference in its founding paradigms.

On this subject, comments Ascensão (1997, p. 695):

> The needs of the information society in all cases require the unimpeded - which does not mean free - management of data.
> The individual and prior authorization is irreconcilable with the system, because the value of the information is in its universal character.

> Authorizations negotiated collectively by collecting societies are meaningful only if they mean the expropriation of authors' rights for the benefit of those collecting societies, since they can only represent their clients.
> It must be recognized that the newness of the technique requires the renewal of the juridical structure. The only solution is a general exemption of prior authorization for the uploading of works. Even so, if such use were costly, new problems would be created, as it would be strange to remunerate the authors of all the works entered, from the most widely used to those that have no use at all.

In other words, this incompatibility tends to have real repercussions, considering that either existing legal institutes are reinterpreted to accommodate the new modalities of use of the works, or completely new legislative texts are created, already providing for new modalities of use of works such as Big Data, for example.

In the same sense, Wachowicz (2012, pp. 1-2) argues:

> Currently, the effects of the new revolution in information technology are being experienced, with the change from less individualistic to more collaborative models of knowledge production, there is a transition from new knowledge paradigms, whose normative framework arising from the Berne and Paris Conventions shows itself to be ineffective and unable to meet the extension of social dynamics.
> The Internet has drastically reduced the barriers of space and time, facilitating the development of the information society based on knowledge, cutting-edge research and access to information. However, it is evident that each technological achievement is accompanied by the emergence of new challenges for the Law. (...)
> It is necessary to build a new Copyright Law capable of contemplating the complexity of the information society, with a legal theory of public and private dimensions that achieves a new balance of private economic interests and public interests of access and dissemination of knowledge.

The author argues that the need to build a new Copyright Law would be due to this system not having been conceived for the intrinsic changes arising from the information society. In his words (WACHOWICZ, 2012, pp. 2-3):

> The digitization process has not only brought about new contours for intellectual property, but has also led to the emergence of new assets, which have rapidly gained legal importance, in particular computer assets.
> Thus, from computer programs to electronic databases, from multimedia products to integrated circuits, from computers to global interconnections to Internet databases, all emerge in an unprecedented technological environment.

These computer assets would cause the existing legal framework to reveal a growing lack of effective protection of intellectual assets on the Internet, since they can be "transmitted, copied, summarized, exchanged and even adulterated without any control by their legitimate owner and the state or even international authorities" (WACHOWICZ, 2012, p. 3).

The author also recognizes the existence of economic interests behind the preparation of legislative texts in the area of Copyright Law, which would have led to the

creation of laws with a maximalist view of protection, which placed, as mentioned, the defense of the copy of a work above, sometimes, even the author's own rights. Comments Wachowicz (2012, pp. 3-4):

> The immanent technological advance of the information society does not develop dissociated from private interests of the world economic order. This has led the industrialized states to concern themselves with establishing new global guidelines for technological development for the protection of private financing and investment in innovation. Thus, in addition to the Paris Convention (1883), with special attention to the revision of Stockholm (1967), when the World Intellectual Property Organization (WIPO) was created, the World Trade Organization (WTO) was founded in 1994. At the end of the GATT Uruguay Round, and on the occasion of the discussions on the global protection of intellectual property, a maximalist vision of protection of great importance and impact on the global market was established. The result was the creation of comprehensive protection rules on trade-related aspects of intellectual property law.

However, this approach from the economic point of view is insufficient, especially if it is thought in a context of information society, because "intellectual creation is not an hermetic act, which is closed between the author and the intellectual good, but, above all, is designed for communication" (WACHOWICZ, 2012, p. 4). This is enhanced when talking about internet and Artificial Intelligence applications, because in the case of a program that produces works, such as the Obvious project for example, it will have a better result the more works it can use and the more works it can communicate to the public. That's because, for Wachowicz (2012, p. 8):

> The discussion about the intellectual property of these new technologies culminates in the transformation and creation of new intellectual goods in a virtual and collaborative environment, unprecedented in the history of humanity. The new technological paradigm is organized based on information generated in the digital technological environment, which is susceptible to access and dissemination of knowledge and culture at a global level. It is in this aspect that the question of how to balance the relationships between the freedom of information to all, in favor of the dissemination of knowledge and culture, and the exclusive rights of copyright holders is established.

This leads the author to conclude that (WACHOWICZ, 2012, p. 11):

> ... the limits based on parameters dictated by the Berne Convention are insufficient and ineffective in the information society, since they were erected in a technological reality arising from the Industrial Revolution, which is inadequate to the digital reality of reproduction and transformation of intellectual property protected by the Copyright Law.

This discrepancy between the reality of the legislative process of the Copyright laws applicable in Brazil and the entire construction that culminated in the Artificial Intelligence technology makes the application of this legislation to this technology and its works difficult to execute. The law and technology were created with different

objectives in mind and tend not to become compatible as more and more legal issues on the subject arise. While technology emerges in the context of an Information Society and seeks the dissemination of information and communication of its results, the laws, the result of an economic paradigm of the industrial revolution, seek precisely the control of copies of this communication and the limitation of its dissemination.

This difference influences practical aspects, such as whether an Artificial Intelligence application can be considered an author. It was noticed that the concept of creativity required by the law so that a certain work can be protected as creative work has not changed since the Berne Convention until the law 9.610/98, being enough that the work is original and useful.

As for whether it could have an intellectual expression, the only substantial change promoted by the Brazilian laws in comparison to Berne was the result of pressure groups of artists who lobbied to make it appear in article 11 of law 9.610/98 that an author could only be an individual. Industry groups have put equal pressure on the addition of the sole paragraph of this article, which gives certain rights to legal entities. This tends to give this article a low practical effect, because of the considerable possibilities that a legal entity has of becoming the original owner of a certain work.

In conclusion, the possibility that an application of Artificial Intelligence would have to become the author of its own work would be through pressure on the competent legislative bodies and, in the short term, this possibility is not glimpsed in the Brazilian territory. Until then, creative works developed by AI applications will have to submit to an incompatible law created in a diverse paradigm by the influence of pressure groups that thought about economic gains, and not the diffusion of these works.

3.3 Proposed solutions for the legal protection of creative works made by Artificial Intelligence applications

Despite the fact that the current Brazilian copyright laws were idealized under a paradigm incompatible with the one that served as the basis for the technology of Artificial Intelligence, the prospect of change of these in the short and medium terms is distant. In any case, there is a worldwide trend towards increased use of AI technologies, and the field of creative work production will not remain oblivious to this change. This emphasizes the need to work on alternatives to the regulation of this issue based on the existing legal system. This item will first look for examples of comparative law on the

protection of works created by computer programs in order to verify the manner in which this protection is carried out outside Brazil. Two proposals for the regulation of this issue in the Brazilian territory will follow: one that admits that the work produced by an application of AI can be protected by the current national legislation of Copyright and another that rules out this possibility.

3.3.1 Solutions from other legal systems for the authorship of works created by computer programs

Although the direct adoption of provisions of foreign law in the Brazilian legal system is reckless because it does not consider the local reality and conditions, its analysis is useful. Considering the global nature of Intellectual Property Law, and especially of Copyright Law, the verification of external solutions to the question of authorship of Artificial Intelligence applications or computer programs in general helps in the elucidation of global trends and interests for the matter. This topic has been addressed in foreign law in some cases since the 1980s, as will be seen in the cases presented below:

I. The British Copyright Act of 1988

One of the first foreign laws to address this issue was the Copyright, Designs and Patents Act (CDPA), the UK law of 1988 protecting the rights on creative works in the UK. In section 178 of this legislation it is possible to find the definition of what would be a work created by software: "'computer-generated', in relation to a work, means that the work is generated by computer in circumstances such that there is no human author of the work" .

As a consequence, section 9 (3) of the CDPA provides: "in the case of a literary, dramatic, musical or artistic work which is computer-generated, the author shall be taken to be the person by whom the arrangements necessary for the creation of the work are undertaken". In other words, British law considers as author the person responsible for making the computer program produce the creative work. In addition, another consequence, established by sections 78 and 81 of the same law, is that works created by computer programs are not subject to moral rights.

On the Copyright, Designs and Patents Act of 1988, Okediji (2018, p. 20) comments that "these provisions do not imply or assume a human author in the absence of one; rather, they expressly create a legal fiction of authorship by means of which copyright vests as a matter of law in a party who is not the author-infact". This model,

although it does not assign authorship to a computer program, does admit the protection of works created by applications of this type on behalf of third parties.

II. United States of America and the USPTO

The analysis of what happened in US law is interesting, because there is no mention in the legislation of that country of the authorship of works by computer programs. Nor does its case law have specific discussions on the matter. However, the United States Patent and Trademark Office (USPTO) has a specific resolution on the subject which dates to 1984.

The USPTO is a federal agency of the U.S. government responsible for granting patents and registering trademarks. It is broadly equivalent to the Brazilian National Institute of Industrial Property (INPI). A marked difference, however, is that the USPTO also registers copyrightable works. Although this type of registration is not mandatory for the work to be protected under U.S. law, it is necessary if someone wishes to bring a copyright infringement action before the U.S. courts, which makes it essential in practice.

This entity has an internal regulation, called Compendium, in which it establishes a series of rules and criteria about what can be registered by the entity or not. Section 306 of this document, entitled "The Requirement of Human Authorship", reads (USPTO, 2017, p. 4):

> The U.S. Copyright Office will register an original work of authorship, provided that the work was created by a human being. The copyright law only protects 'the fruits of intellectual labor' that 'are founded in the creative powers of the mind.' … Because copyright law is limited to 'original intellectual conceptions of the author,' the Office will refuse to register a claim if it determines that a human being did not create the work.

According to Ryan Abbott, to substantiate this section the USPTO mentions the case of 1886 Burrow-Giles v. Sarony. In the words of the author (2018, p. 116):

> In that case, a photographer, Napoleon Sarony, sued the Burrow-Giles Lithographic Company for copyright infringement of a famous photograph of Oscar Wilde. The company alleged that the photographer could not be the photograph's author because a photograph is just a mechanical reproduction of a natural phenomenon. The Court held that any form of writing by which a mental idea is given visible expression is eligible for copyright protection.

The author continues that this case would explicitly have dealt with the question of whether the use of a machine would deny authorship and, implicitly, whether a camera could be considered an author. In addition, this policy was relevant to a Ninth Circuit of California Court case involving the "Monkey Selfies". In the words of Abbott (2018, p. 117):

> In that case, a crested macaque in Indonesia took pictures of itself using equipment belonging to a nature photographer, David Slater. Mr Slater promptly claimed copyright in the photographs. Eventually, the United States Copyright Office clarified that because only a person could be an author, that copyright could not subsist in the Monkey Selfies. People for the Ethical Treatment of Animals (PETA) sued Mr Slater in the United States Federal Court for copyright infringement on behalf of the macaque, alleging that the primate should be the copyright owner of its own photographs. The case ultimately settled, with Mr Slater agreeing to donate 25% of future revenue from his use of the photograph to charities dedicated to protecting crested macaques in Indonesia.

This judicial imbroglio motivated the alteration of section 313.2 of the Compendium, which deals with works that lack human authorship. Since the office would not register works produced by nature, animals or plants, it started to mention as the first example that a photograph taken by a monkey would not be subject to registration within this government agency.

Likewise, the USPTO mentions in the same section of its Compendium the fact that "the Office will not register works produced by a machine or mere mechanical process that operates randomly or automatically without any creative input or intervention from a human author" (USPTO, 2017, p. 17). It is emphasized that this device provides an alternative in which a work would not be protected if it did not have a human author or if it was not creative. This leaves room for question of what to do if a work made by a computer program showed clear signs of creativity. In any case, it is clear that this model, unlike the British one, does not consider it possible to protect the work created by a computer program.

III. Report from the European Commission on Artificial Intelligence for Europe

European copyright laws and directives fail to mention a way of protecting works created by computer programs or Artificial Intelligence. However, a report dated December 2018 by the European Commission's Integrated Policy Science Research Centre, published by Max Craglia, acknowledges the existence of gaps in the legal systems of European countries regarding the protection of Artificial Intelligence applications.

The report (2018, p. 66) contains information on the protection of works created by AI programs:

> The protection of AI-generated works or inventions seem to be more problematic. In light of the humanist approach of copyright law, it is questionable that AI-generated works deserve copyright protection. (…) While some copyright scholars clearly advocate for AI-generated works to be placed in the public domain, others have put forward a series of proposals aimed at ensuring a certain level of

> protection. With notable exceptions, these proposals are still too vague. They do not always sufficiently detail the possible elements underpinning such protection.

The Commission also raises concerns about the economic consequences of attribution of authorship to works created by AI applications, when stating (2018, pp. 66-67):

> There is no doubt that certain AI-generated creations/inventions may share the characteristics of information goods – non-excludable and non-rivalrous nature – that justify the creation of quasi monopolistic rights to foster innovation and commercialisation. However, there are concerns whether incentives are needed, especially in cases where the investment cost is low, and what consequences such rights might have on the market, including on creations or inventions made by humans. Would more property rights encourage or rather deter innovation? We clearly need to investigate these issues further from a law and economics approach before favouring one solution or another.

In any case, even if the EU does not provide a definitive solution to the issue of Artificial Intelligence applications, the recognition that it is necessary to look at this issue more closely from a legal point of view is a very important first step. In this sense, the last two items from this thesis will tackle two ways to solve this issue in Brazil from a legal point of view, in order to contribute to a debate that is certainly very necessary.

Just like the comparative law models, these proposals for Brazil will also assume two possibilities to protect works created by Artificial Intelligence applications. One that recognizes the existence of a creative work that can be protected by the law and one that does not consider this possibility.

3.3.2 Proposal for Brazil 1: apply Copyright Law to the works created by Artificial Intelligence applications, but with limitations

Regarding the first case, it would be recognized that works created by Artificial Intelligence applications could be protected directly by the Copyright Institute in Brazil. However, given the absence of a human creative mind in its making, not all the provisions of law 9.610/98 would be applicable to this type of work. To facilitate the explanation of this proposal, it is divided into three parts: one focused on the work itself, the second on authorship and the third on guardianship applicable to it.

I. The work of an Artificial Intelligence application

In this first proposal it would be admitted that the creation of an application of Artificial Intelligence could be protected as a work by the Brazilian legislation in force

on the subject. In other words, it would meet the legal requirements so that certain AI work could be protected.

Analysis of both the Berne Convention and law 9.610/98 reveals that the concept of work remained unchanged from one legal text to another. This was well summarized by Eugen Ulmer as the creative expression of the intellect.

The expression demands that a certain work is not only in the field of ideas, that is, it must be able to be appreciated by third parties other than the author. Examples described throughout the work reveal that applications of this type are already capable of producing from songs to pictures, which can be easily found by interested people.

The criterion of creativity requires of a given work that it is not merely a copy or plagiarism of existing works, but that it adds something to the state of the art. Runco and Jaeger deepen the explanation of the concept of creativity by predicting that it is an item that should be considered both original and useful.

Originality in the sense of being a new creation and this is possible to be done by AI applications. An example, mentioned above, is of the program used to create dance songs, which managed to create several hits in the early 2000s. Utility means that a creative work that is intended as such must be perceived as a work of art by its target audience. The example of the painting created by the Obvious collective sold in an auction house by thousands of dollars reveals that the public already perceives works created by AI applications as being of value.

The criterion of intellect established by Ulmer is the most difficult to be established and ends up becoming a point of contention in the doctrine. Given the fact that the laws do not define what is a creation from the intellect, several interpretations are possible for this issue. For this proposal it is adopted mainly the notion established by Salles that every work is the result of a process of creation that encompasses everything that a certain author saw, read and experienced, and cannot be limited only to the final result, be it a painting, music or film.

It is argued that only a human being could produce an intellectual creation, because only he would be able to imbue his persönlichen geist to a certain creation. Only he would have a spirit capable of being perceived in the act of admiring a work. But if all creation, including human creation, comes from previous inspirations, the way machine and the human mind achieve an artistic result retains sufficient similarities to be considered equal.

The main difference is that the creative process in the case of an Artificial Intelligence application is very well documented. Because programs such as these depend on input values, which can be filtered or not, to be able to produce a work, it is easy to see where the inspiration for the creative work of a software comes from. The same cannot be said of a human creation, in which the inspiring elements of a certain art are not always clear. In any case, the similarities in the creation processes should be sufficient for a computer program to meet the intellect requirement and meet the requirements established by law so that a work can be protected by national copyright laws.

II. The Authorship of works fruit of the creative work of an AI application

Given the provisions of art. 11 of law 9.610/98, it is not necessary to say that an application of Artificial Intelligence cannot effectively be the author of her art. The Brazilian law is very specific in that this article provides that only the individual who creates a literary, artistic or scientific work may be the author. However, the law itself leaves room for different solutions to be found in this case.

As with the concept of work, the concept of authorship has remained largely unchanged since the Berne Convention. Like the international treaty, Brazilian law also stipulates that the author of a work shall be considered the one who presents himself as such, with evidence to the contrary being admitted. In other words, it is presumed that the one with his name on a creative work such as a book, game or film is its author.

This would make it easy for a natural person to claim authorship over a work from an Artificial Intelligence application. It would be enough to present this work as if it were his own in order to enjoy all the available rights. However, this would not be correct, because as Denis Borges Barbosa said, an author would be the one who exercised the freedom of choice between alternatives of expression. As the one who would exercise creative choice in this case would be the AI program, it alone would have that right.

Even with this limitation, the individual could still become the owner of this type of work, since there would occur, in a certain way, an act of acquisition of copyright on this creative work in the act of its conception. As the original holder would be the application of Artificial Intelligence and it would not be able to exercise these rights, the person would act as its trustee, being able to enjoy only the property rights over the work.

And at this point, it should be noted that the sole paragraph of Article 11 benefits and allows legal entities to enjoy the protection granted to the author in the cases provided for by law. This means that they could also become holders of works created by Artificial Intelligence applications.

This is because law 9.610/98 determines in its article 5 that the original owner is the phonographic producer and the broadcasting companies and in article 17 that the organizer is entitled to the ownership of the property rights over the collective work. Considering these items and the fact that art. 4 of law 9.609/98 gives the employer the rights related to the computer program, a legal entity could also become holder of a work created by an Artificial Intelligence application. Depending on the branch of activity, it could even be regarded as the original owner of such a work, if it were a collective work, for example.

III. Protection applicable to works created by Artificial Intelligence applications

Since the work of an AI program is a work protected by copyright, without an individual author and made by software, two types of provisions could help in the type of protection that this work could obtain.

The first one comes from law 9.609/98, whose article 2 comments on the property regime applicable to the computer program to be the same as that applicable to other types of work, but with the exception in its § 1º that the provisions related to moral rights do not apply to the computer program. The second comes from art. 40 of law 9.610/98, which provides that if it is an anonymous work, it will be up to those who publish it to exercise the property rights of the author and art. 43 of the same law that stipulates a protection term of 70 years from the date of publication of this work.

The computer program, under Brazilian law, is already protected by means of the patrimonial right of the author, not being applicable the provisions referring to the moral rights. This is well complemented by the provisions on anonymous works, which have no known author and for which only the provisions on property rights apply.

Therefore, it would not be creating or assigning a new right to the works created by this type of program that it would not already have. To a creative work resulting from an Artificial Intelligence application would be applicable the same rights of its author: those of patrimonial character. The rights of its holder would not differ either, because given the absence of an author, an individual would not be able to come and claim the right of paternity over a work of the type, which is one of the corollaries of the anonymous work. This would make the protection through this first proposal a safe bet for companies that develop this type of program, for not radically altering the way the protection of intellectual property rights would happen.

One criticism that should be made about this proposal, however, has already been raised above by the European Commission. It is the fact that the economic impact that

this type of attribution of rights would have in the long term is not known. This is because unlike a human author, an already trained Artificial Intelligence application could produce hundreds of thousands of different works in the same period of time that its counterpart of flesh and blood takes to produce only one. This could affect the entire copyright ecosystem implemented since the Berne Convention, which is currently in force. For this reason, a different proposal will also be presented below for the protection of an AI work.

3.3.3 Proposal for Brazil 2: protect the trained algorithm, not the end result of the creation of an Artificial Intelligence application

This second proposal, unlike the first one, considers that there is no work to be protected by the Brazilian Copyright Law when it is created by an Artificial Intelligence application. The differences in paradigms in the creation of the law and technology mean that the current legislation is not able to protect this computer asset, considering the fact that it was proposed thinking of goods created under an industrial logic. What would be protected in this case is the trained algorithm with the ability to produce this type of work.

Just like in item 3.3.2, the exposure of this proposal will also occur in a threefold fashion. First, the work to be protected, then its ownership, and finally the applicable protection.

I. What is protected when there is no protectable work of an AI application

For this second proposal, it would be considered that a work produced by an application of Artificial Intelligence could not be protected by the Copyright laws currently in force in Brazil. Returning to Ulmer's concept of protectable work being a creative expression of the intellect, by this proposal the creation of an AI program would fail precisely at the point of greater dispute of the doctrine, which is the intellectual part.

Authors such as José de Oliveira Ascensão attest that only a human being would have the capacity to produce intellectual creations. In his opinion the Copyright Law would not be applied to works produced by computer programs (ASCENSÃO, 1997, p. 664):

> In this case, it should be noted that the works produced in this way are not subject to copyright. This necessarily presupposes human creation, and therefore extends through a moral or personal right of authorship. Just as there is no Copyright on the work of nature, there is also no Copyright on the work of the machine.

The Portuguese author then highlights that the discussion could be transferred to the ownership of the medium created by man that would allow the production of such works. The objective, through this second proposal, is to follow this path.

The first chapter of this work explained that an Artificial Intelligence application is a computer program capable of performing activities just like a human, by means of a complex algorithm that uses a technique called machine learning. Throughout the second chapter, it was noticed that these computer programs are protected by the same copyright laws applied to other types of works, but with certain limitations. These limitations refer to the fact that the provisions regarding moral rights do not apply to the software, with the exception of those relating to paternity.

Similarly, in-depth analysis of the technology applied in the area of Artificial Intelligence revealed its dependence on large amounts of data so that it could produce the desired results. With the advent of the Internet, this massive amount of information was given the name Big Data. AI algorithms use this information as an input to train a program of this type to produce an output. Depending on the purpose for which an application is searched, different types of data must be fed into the system.

Article 7 of Law 9.610/98 introduced another type of work which could also be protected by copyright, the database. That is, if the selection of content to be fed into an AI application is creative, it could enjoy legal protection. However, the law emphasizes in § 2º of the same article that what is protected is the creative disposition of the collected information, but not the data itself. This means that if the training data of an AI program are artistic works, their use would still depend on the authorization of their holders, even if the way in which they are available for the use of a software is innovative.

Despite this, it is possible to conclude that the law would have the necessary tools to protect the Artificial Intelligence application even if its works could not be protected. The Brazilian legislation in force allows the protection of both an application of the type and the databases used as input values, and this would already award a reasonable level of protection to its holders.

II. Ownership of an AI application

Since this proposal does not provide for the protection of works of an AI application, but rather of the application itself, and considering that they are computer programs, the issue of ownership is easier in this second case. This is because both the software and the database have clear provisions about their ownership in the Brazilian legislation.

Law 9.609/98, as already mentioned above, provides that the rights relating to a computer program developed under employment or statutory subordination belong exclusively to the contracting party. On the subject, Barbosa (2017, p. 1915) comments that “almost as a principle, the generation of software is done as simultaneous creation of several authors, organized for purposes and under specific methods. (...) In such cases, ownership is triggered automatically and originally in favor of the person organizing the production”. In other words, the organizer of this collective work, whether an individual or legal entity, will hold the property rights over the computer program in its conception.

Similar guardianship is assigned to the matter of the database. Article 87 of Law 9.610/98 states that the holder of the property right over a database shall have the exclusive right to express the structure of the said database.

The holder of a trained Artificial Intelligence application would be the one who organized the production of its algorithm and who proposed an innovative compilation of data to use as input value of this program. This holder would be responsible for the property rights of such application, in accordance with the provisions of the law.

III. Protection applicable to the case

There is no doubt that the protection of an AI application is adequately guaranteed by Brazilian law. Laws 9.609/98 and 9.610/98 both provide for the protection of the property rights of all the elements of a program of the type, both of its algorithm and of the database used by it.

However, this second proposal demands, more than the first, a revision of the Brazilian laws on Copyright, in order to protect these computer assets of which the works created by AI applications are part. They could not be considered as protectable works because they did not meet the intellectual requirement of creation, but their artistic value could not be disregarded by the law, even if the main element, its creator software, was already considered.

In any case, there are alternatives for the protection of these creations that could be considered by holders of this type of application. Article 87 of Law 9.610/98 comments that the holder of the rights over a database will have the right to authorize or prohibit: I - its total or partial reproduction, by any means or process; II - its translation, adaptation, reordering or any other modification; III - the distribution of the original or copies of the database or its communication to the public; IV - the reproduction, distribution or communication to the public of the results of the operations mentioned in item II of this article.

Although it could not be considered as a work by this second proposal, it is undeniable that the creation of an Artificial Intelligence application is the result of an adaptation of the database used as input by the program. This would result in its holder having at least the exclusive right to reproduce, distribute or communicate this work to the public.

A criticism to this proposal is the little protection that it would give to the works created by Artificial Intelligence. In an AI sector that moved around 22 billion dollars globally in 2018 (IDC, 2018), companies in this area that work with creation and distribution of artistic content would not passively accept this proposal. It was perceived in chapter 2 how the lobbying power of certain pressure groups can influence the legislative process of a law, and in this case it would be no different.

This was the reason why two potential proposals for the protection of the theme were presented to Brazil, because it was perceived that both have positive and negative elements that would have economic and social consequences. Even though Brazil is late in protecting the subject, it is noted that in the rest of the world this is a point of debate that will still require much discussion before getting to at a definitive solution for the legal protection of creative works made by Artificial Intelligence applications.

CONCLUSION

Knowing how the Artificial Intelligence technology works is fundamental to promote an adequate legal regulation of it. Likewise, understanding how certain legal institutes have been implemented assists in their interpretation and application in borderline cases such as the one studied in the present thesis.

The question of how to protect creative works made by Artificial Intelligence applications is a difficult one to answer, because there is not yet, at least in Brazil, legislation capable of doing so. The solution, therefore, was to look for different ways of interpreting the existing legal institutes that would be applicable to the case and look for useful parallels that would assist in the work. For this, it was necessary, fundamentally, to understand the legislative path taken by the current Brazilian law of protection of the computer program, which is, as seen above, a fundamental component of an AI application, to see how the institutes for the protection of works created by software could be interpreted.

In order to reach this point, however, it was necessary, first and foremost, to study basic concepts which would be taken up throughout the work. This proves its usefulness by elucidating the object of study of the research and thus facilitating its analysis.

In order to study these concepts, it was necessary, in Chapter 1, to present the Berne Convention, one of the first international agreements about copyright. The concepts of creative work and authorship were extracted from this legislation.

Work or creative work would be, first of all, the one externalized in some medium which allows it to be perceived by third parties. Secondly, the work must be creative, which means that it must present originality, effectiveness and be accepted by the society in which it was created as such. Finally, this work must be a creation of the intellect.

Regarding authorship, this legislation only requires that a person put his or her identification in a certain work to be recognized as an author. This does not necessarily mean that the usufructuary of the copyrights on a work is its creator, allowing the ownership over it to be taken by third parties.

Still in Chapter 1, another concept presented was that of Artificial Intelligence. This is the area of study focused on solving problems, which previously only the human mind would know how to respond, through the creation of computer programs,. Soon after, it was seen that Artificial Intelligence is already present in the modern society of the 21st century in various ways, ranging from voice recognition to computational vision.

Similarly, it was found that given its capacity to perform human tasks, the actions of this type of application have the capacity to resonate legally, which requires attention on the part of the operators of law.

In the last item of Chapter 1, the three fundamental components were presented, which guarantee the good functioning of the Artificial Intelligence technology. The first one, the algorithm, is, in essence, its programming. It is the sequence of orders or instructions that will guide the activities performed by a given program. In the case of AI, it uses more advanced methods such as Machine or Deep Learning, which seek to emulate the ability of human reasoning.

The second component is the hardware, i.e. the computer on which a particular AI application is run to fulfill its functions. It was possible to conclude the existence of the need to have strong equipment capable of making all the calculations required by more complex algorithms. It is not enough that only the technology of the algorithm is advanced, it is necessary that these other elements are also in an advanced stage of development, which leads to the third basic item for AI.

This is about data and information, used by AI applications as input value, which are interpreted and allow the production of different results, depending on the purpose for which a given program is used. In the case of applications with the ability to produce works of art, the input, as a rule, will consist of other artistic manifestations. The advancement of this third component occurred in an exponentially fast way with the emergence of the Internet, because this enabled the massive sharing of information in a virtually instantaneous way through the network. This large amount of information came to be called Big Data and its quality is fundamental to ensure good results from the use of an AI application.

Given the definitions of creative work, authorship and Artificial Intelligence, it was then sought to understand how the relationship between these concepts would be, given the intrinsic function of the laws in regulating society and establishing behaviors, and the symbiotic existence between this and those, with one influencing the other. Would the laws of Copyright be thought from the same paradigm under which the technology of Artificial Intelligence was developed?

To answer this question, the beginning of Chapter 2 focused on the author used as a theoretical framework for this work, Manuel Castells, and his theory of the Information Society. Castells is a Spanish sociologist who argues that the development of new technologies does not alter the bases or foundations of a given society, but rather enhances

existing issues and processes. The centrality of information both for his theory and for the technology of Artificial Intelligence has made Castells' thinking ideal to explain the relationship of programs of this type with the society that created them.

From his theory of the Information Society, two main characteristics stand out. The first is that it preaches that technological advances are not the main transforming agents of a society. The communicative impetus is something that already exists in the peoples of the planet and communication technologies have only accelerated this process. The emergence and rapid development of the Internet, in this context, was not a coincidence. The will and even the need to exchange information, documents and data in a free and fast way is a characteristic already present in society, and not something introduced by the network.

The second characteristic that the theory predicts is the impact of these new communication technologies on the functioning of the production system then in force until the middle of the twentieth century. In an Industrial Society, productivity would be achieved by the generation of wealth. The final objective was the sale of copies or individualized items to the final consumer, which would generate profit for the producer. In an Informational Society, on the other hand, productivity would be achieved by the generation and exchange of information. This change of the central element in the production system brought the need to rethink entire business models, in order to adapt to a growing demand of society to communicate, which was facilitated due to the advent of the Internet.

And the main element of this paradigm, according to Castells, would not be the information itself, but rather the application of this for data processing and for the production of knowledge, in a constant feedback loop between innovation and its uses. The author justified calling this new method of ‘information production’ because of the focus on the constant improvement in information processing technology.

Considering the centrality that data and information also have for the technology of Artificial Intelligence, with it being seen as one of the three items necessary for its operation, soon after were drawn parallels between the technology and the theory of Information Society. The two characteristics of this paradigm emphasized above would also be applicable to AI.

Firstly, just like the communicative impetus of society, already existing before the communication technologies, since its inception the applications of Artificial Intelligence need and depend on an easy access to information. This demand did not arise only after

the origin of the Internet, but is an integral part of the way the technology works. So much so that one of the causes for the AI Winter mentioned in Chapter 2, and that also ended up becoming one of the elements of its solution, was the availability of data. The lack of reliable input values made the technology obsolete in the 1970s and 1980s because AI applications did not have the capacity to produce reliable results for complex problems. Since the processing power of these applications increased, as well as the availability of data, the investment in the area saw an exponential growth that lasts until the second decade of the 21st century.

Secondly, the productivity of Artificial Intelligence applications is measured through the results of information generated by it. Just like in the Information Society, the key is not to generate more units of a given product, but to generate quality information that adds positively to existing knowledge. Knowledge becomes the main productive force and as Artificial Intelligence applications use the available knowledge as input data for their algorithms, they also generate output results that add to the existing knowledge, generating a virtuous cycle. This makes Artificial Intelligence applications, such as they exist in the 21st century, be much closer to the social model proposed by Castells than to the mode of production of the Industrial Society.

Having reached this conclusion, it was still necessary to verify what would have motivated the protection of the software, another of the fundamental elements for the IA, to occur through the Copyright Law. It was also seen in Chapter 2 that the choice for the protection of computer programs by the Copyright System occurred because of the facilities that this system, already largely consolidated by the Berne Convention, could provide to this type of innovation. There were great economic interests of companies from countries such as the U.S. in the protection of software by means of copyright and this was what the TRIPs agreement, to which Brazil would become a signatory, came to determine. The extensive protection given to literary works, the reciprocity demanded by the Berne Convention and its wide adoption in the countries of the world were essential characteristics for the adoption of this model.

The economic interests of different agents would also become determining factors in the legislative process that resulted in laws 9.609/98 and 9.610/98. The closing of Chapter 2 revealed that the great engine behind the legislative changes that resulted in these laws was the clash between different agents in the field of music, namely between the associations of protection of artists, and publishers and record labels.

The dispute was great, especially in what referred to the concept of authorship. Not so much for the effective concern about who would be the author of a certain work, but more for the economic advantages that could be reaped depending on the type of limitation of authorship that would be implemented in law. However, what was seen, already in Chapter 3, is that the practical effects of this dispute would not significantly alter the provisions of the current laws regarding the concept of creative work and authorship, if compared to what was determined by the Berne Convention.

In the Brazilian legislation, the definition of creative work continued to be a creative expression of the intellect, just as the German jurist Eugen Ulmer defended. The only additions to be emphasized promoted by current laws were the protection that the law 9.610/98 started to give to the databases and the exception that the law 9.609/98 made of not applying moral rights to computer programs.

Regarding authorship, law 9.610/98 would provide in its article 11 that the author of a creative work could only be a natural person, a point added after lobbying of associations for the defense of authors. However, industry actors also had a strong pressure group and pressured for an exception to be included in law that the protection given to authors could also be applied to legal entities in certain cases, which made it easier for companies to act as original copyright holders.

After exposing the provisions of the Brazilian laws that dealt with the concept of creative work and authorship, it was analyzed whether an Artificial Intelligence application could be creative and could express itself intellectually, so that its works could be protected by the Brazilian Copyright Law. It was concluded on the first point that applications of Artificial Intelligence would have the ability to demonstrate creativity in the creation of works. As much in the aspect of originality as in the aspect of effectiveness, programs of this type would be able to produce works that would escape the ordinary and that could be appreciated by the public as art.

In relation to the capacity of an application of Artificial Intelligence to express itself intellectually, this is a point of greater contention in the doctrine. It was noticed at this point that there were authors such as Ascensão who say that only a person could have an expression of the intellect and defended that a work produced by computer could not be protected by the Copyright Law. Others such as Ulmer and Barbosa, who agreed with Ascensão on this first point, say that these works could be protected in their patrimonial aspect, because they could have owners. There are also those such as Okediji who do not

see the possibility of an AI application becoming an author because there are no economic interests to do so.

After this analysis, it was noticed that the discrepancy between the reality of the legislative process of the Copyright laws applicable in Brazil and the entire construction that culminated in the Artificial Intelligence technology makes the application of this legislation to this technology and its works difficult to execute. While the technology emerged in a context of Information Society and the search for the facilitated dissemination of information, the laws, the result of an economic paradigm of the industrial revolution, seek precisely the control of how this information is disseminated through its copies. This proves the initial part of the hypothesis of this work about the incompatibility between law and technology. However, considering the billionaire values that the Artificial Intelligence sector moved in 2018, and considering the constant growth of the area, this response alone was not satisfactory.

For this reason, at the end of Chapter 3, there were proposals for solutions for the legal protection of creative works made by Artificial Intelligence applications, starting with some examples that comparative law have on the subject. There were two distinct situations in foreign law. On the one hand, British law protects works created by computer programs by establishing a legal fiction in which the person who used the program becomes the owner of a work created in this way. On the other hand, not only does American law say nothing about the subject, but the USPTO clearly states that works created by computer programs without human intervention are not subject to registration within the entity. It was also found that even though there is no such legislation in Europe, this legislative gap and potential alternatives for its solution are already being discussed in commissions.

Beyond that, two ways to protect the issue in Brazil have been proposed, taking into account the Brazilian legislation in force. The first proposal proposes that the creation of an AI program can be protected by Brazilian copyright legislation because it meets the requirements of being a creative intellectual expression. There would be no authorship in this case, because the Brazilian legislation is very clear in determining that only individuals can be authors, but it would be possible to apply the same provisions of an anonymous work, so that it could have holders. It was pointed out as a criticism the lack of knowledge over the economic impact of this proposal, given the fact that a trained AI application would be able to produce hundreds of thousands of different works in the same period of time that a human would take to produce only one.

The second proposal, on the other hand, does not envisage the possibility that the work created by AI technology could be protected by Brazilian law. This is because it would not be considered capable of expressing itself intellectually. The emphasis of protection, in this case, would remain in the algorithm trained with the databases, because both already have clear provisions in law about the subject that give its holder full control of property rights over these assets. Still, in this situation, the owner of the work created by the AI program would have the exclusive right to reproduce, distribute or communicate this work to the public, because the law protects the result of an adaptation of the database used as input by the program. As a criticism, it was pointed out the legal insecurity that this proposal could bring to a sector that moves billions of dollars, by not considering as a work of art a creation that certainly would have required considerable investment.

Regarding the need for the creative work created by an Artificial Intelligence application to have some kind of regulation, the second part of the initial hypothesis of this work is considered as proven. Although legislation and technology have incompatible paradigms, there is no doubt that the importance of the sector demands some kind of legal protection for its actors. The legislation, although inadequate, already has sufficient elements to award some degree of legal protection to those who seek to venture into the creation of works by means of AI.

Society cannot and should not wait for the will of the legislator to be able to innovate. Innovation is precisely the disruption of what is in place, and it is the role of the operators of the law to perceive these changes and make the necessary adaptations. This thesis is expected to have contributed to the debate in a branch that is extremely necessary and that certainly tends to affect more and more life in society.

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