The Legal Framework for Artificial Intelligence in Brazil and its relationship with the curricula of Information Technology Degrees in the Country

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Abstract
This work presents a bibliographical review highlighting the importance of including the ethics of artificial intelligence and the use of technologies in undergraduate technology courses, understanding it to be a way of raising awareness among these professionals regarding the relevance of respecting the Ethics of Artificial Intelligence and the use of Technologies, as it is about guaranteeing citizens' rights. To this end, the work conceptualizes artificial intelligence and presents the ethical debate surrounding Bill 2,338 of 2023, known as the Legal Framework for AI in Brazil, finally presenting some measures that, in the author's point of view, would support the formation of information technology professionals in Brazil.

keywords: *Ethics of Artificial Intelligence. Professional Ethics. Philosophy of Information. Legislation Applied to Technology.*

Introduction

Life in the 21st century has become inconceivable without the presence of digital technologies, services, products and practices. According to Floridi (2023), an Italian philosopher who has studied information theory for decades, the digital revolution has only just begun and humanity has the opportunity to shape it in a positive way so that it can benefit both itself and the planet. The aforementioned author's statement is coherent, mainly due to the fact that the use of digital technologies has implied biases that in several situations have put at risk the right to privacy, as well as the guarantee of citizens' civil and constitutional rights. And, for this, there is a need for society to engage constructively, following ethical principles, to analyze the challenges so that such rights and guarantees are not violated and, collectively, design the right solutions (Floridi, 2023).

In Brazil, an initiative that seeks to protect citizens' rights is the Legal Framework for Artificial Intelligence (AI). Based on an analysis from the perspective of the technological evolution brought about by AI, one of the enabling technologies of Industry 4.0, known as the 4th Industrial Revolution, it presents a proposal to define guiding principles when implementing these artificial intelligence systems. The ethical-normative debate and the impact of the use of these technologies is one of the perspectives of Bill No. 2,338 of 2023, which provides for the use of Artificial Intelligence, which is popularly known as the Legal Framework for AI, and has "the objective of protecting fundamental rights and ensuring the implementation of safe and reliable systems, for the benefit of the human person, the democratic regime and scientific and technological development" (Brazil, 2023).

The same Bill, presented by the Federal Senate (2023), which brought together a series of other initiatives and previous attempts to regulate Artificial Intelligence in Brazil, raises the issue of how to guarantee the right to prior information regarding interactions with artificial intelligence systems; or, how to have an explanation about the decision, recommendation or prediction made by artificial intelligence systems; or, how to guarantee the right to non-discrimination and the correction of direct, indirect, illegal or abusive discriminatory biases; among others.

The aim of this work is to analyze to what extent the inclusion of ethics of artificial

intelligence and the use of technologies in undergraduate technology courses, aimed at professionals in the area of Information Technology, can become a way of raising awareness among software developers who work with the application of Artificial Intelligence and a tool for Education in Human Rights.

And, as a result, an attempt to demonstrate whether the prediction of such topics in reference grids, model matrices and in national curricular guidelines, in evaluation systems, such as ENADE, can be sufficient to train professionals with the condition of minimizing biases in systems that use artificial intelligence.

Theoretical Foundation and Methodology

In this section, the objective is to present the methodology that we intend to apply in approaching this theme, being based more specifically on the review of instruments and proposals related to the theme, organized in a bibliographic review, and of official performance evaluation instruments of the Ministry of Education, which presents: (i) the concept of Artificial Intelligence and addresses in general the debate around Ethics in Artificial Intelligence; (ii) the Legal Framework of Artificial Intelligence in Brazil; (iii) the impact of the use of technologies on people's lives; and

(iv) the provision of ethics in undergraduate IT curricula.

Artificial Intelligence and the Ethics Debate

The concept of Artificial Intelligence (AI) is, broadly speaking, that of a type of artificial computer system that exhibits intelligent behavior, literally using the words of one of the most recognized precursors of Artificial Intelligence in the world, Marvin Lee Minsky (1985 apud Stanford 2020). The intention is not to restrict intelligence as if it were made by humans, that is, what is meant is that computer science has brought a range of machines that only present learning or reasoning capabilities and that excel in the automation of specific tasks (Stanford, 2020).

Historically, it is worth noting that the term "AI" has been used since the 1950s and in recent years it has been broadening its concept to encompass the context of "machine learning", "natural language processing" and "data science". In 2010, its use expanded again and, at times, almost all of computer science and even high technology are grouped under the category of "AI", which is widely used today and now represents a growing industry with huge capital investment (Stanford, 2020).

The main point of the debate regarding the ethics and regulation of AI is that artificial intelligence systems can be more or less autonomous. The focus on use does not presuppose which ethical approaches are most appropriate to resolve these issues. And on this issue, there is a relevant reflection brought by Lima (2020), "innovation is, therefore, a continuous process, with relevant intermediate milestones, but without a defined end, of improvement and adaptation to the world in which we live. This continuous improvement can trigger some ethical issues". And the same author connects the concept of innovation to the ethical and philosophical debate involved in the ethics of AI, in which he presents the point of view of the Swedish philosopher Nick Bostrom, who understands that the morals and ethics involved in these programs are reproductions of the moral restrictions to which humans are subject in their relationships with contemporary AI systems, all of which are based on responsibilities, views, biases and understandings of relationships with other beings (Lima, 2020).

In this sense, Marcato's (2022) vision contributes to the essence of the AI Legal

Framework in Brazil, arguing that the debate on ethics in AI is related to what programmers and developers, professionals who create these algorithms, must respect when presenting new artificial intelligence systems to the market. The entire issue must be centered on human beings, in order to develop greater reliability in the technological solutions used in the various social segments. The researcher continues by saying that, "in addition to being concerned with the development of systems that take into account the human condition, with all its peculiarities, ensuring that fundamental rights and guarantees are not violated," another value must be guaranteed, namely transparency (Marcato, 2022).

The correlation between ethics and artificial intelligence and its impact on citizens' lives can be analyzed from several points of view. According to Marcato (2022), one of them "is the bias of data processing, its respective legal regulation and how this impacts citizens' lives", as well as the way in which those who use these systems will appreciate the data resulting from AI analyses. The researcher continues:

Outra perspectiva ética a ser observada é em relação ao programador do sistema que utiliza a inteligência artificial como tecnologia para realização de tarefas [...] e quais seriam os paradigmas necessários a serem observados pelo programador para que o resultado final seja justo [...] o foco é a metodologia utilizada pelo programador, para construção do sistema e, ainda, a análise do resultado dessa aplicação: o algoritmo (Marcato, 2022).

Therefore, this is why one of the objectives of this research is to review the literature and present what has been studied in Brazil and in part of the world about Ethics in AI and Autonomous Systems, in a reality in which humans and non-humans already coexist and man "is no longer the center, but one of the actors in this complex universal system" (Moura, 2024a).

The Legal Framework for Artificial Intelligence in Brazil
The popularization of the use of artificial intelligence technologies has completely changed the way people, in various areas of human activity, deal with their processes. In addition, there are several predictions indicating that artificial intelligence (AI) will cause profound economic and social changes in the coming years (Brazil, 2023). A natural consequence of this transformation is the need for regulation. The very justification for Bill 2,338 of 2023, which presents a proposal for a Law that provides for the use of Artificial Intelligence, is the result of the consolidation of several initiatives related to the topic of regulating the use of AI in Brazil (Brazil, 2023).

The aforementioned Bill is fully aligned with the UNESCO recommendation (2021), where the United Nations Educational, Scientific and Cultural Organization presents a series of points of attention regarding the rapid advancement of artificial intelligence technologies and the impacts on the market and the lives of citizens:

Recommends that Member States voluntarily implement the provisions of this Recommendation by taking appropriate measures, including any legislative or other measures that may be necessary, in accordance with the constitutional practices and governmental frameworks of each State, to give effect, within their jurisdictions, to the principles and standards of the Recommendation, in accordance with international law, including international human rights law (UNESCO, 2021).

The Legal Framework for AI in Brazil, currently being processed by the National Congress, has clear objectives, namely, to establish and guarantee rights to protect the most vulnerable party in this complex, which is the natural person, the citizen, who is daily impacted by artificial intelligence systems. Whether from a routine recommendation of content and targeting of advertising on the Internet, very common on social networks; or even "by providing governance tools and an institutional arrangement for monitoring and supervision, it creates conditions for predictability regarding its interpretation and, ultimately, legal security for innovation and technological development" (Brazil, 2023).

Regulation of the use of AI concerns all stages or life cycles of these systems. In other words, the issue must cover everything from research, design and development to implementation and use, the latter being the one that most affects the masses, the one that most affects the vast majority of citizens. Regulation must include maintenance, operation, trade, financing, monitoring and evaluation, validation, end of use, dismantling and termination of these systems (UNESCO, 2021).

When analyzing Bill 2,338 of 2023, which deals with the Legal Framework for AI in Brazil, it is clear that it is in line with the Recommendation on the Ethics of Artificial Intelligence, published by UNESCO in 2021, in which, in its scope of application of these recommendations, the aforementioned organization states that AI actors can be defined as any actor involved in at least "one stage of the life cycle of the AI system, and can refer to both natural and legal persons, such as researchers, programmers, engineers, data scientists, end users, companies, universities and public and private entities, among others" (UNESCO, 2021).

Therefore, from an analysis for the release of credit to a simple printing of a post on a citizen's social network timeline, AI is present. That is why the focus here is on presenting what exists, and what is sought, regarding regulation for the protection of fundamental rights such as democratic values, privacy and protection of personal data; in addition to non-discrimination and the centrality of the human person, the latter term coined in the Federal Constitution of 1988, in its art. 1.

When considering the topic from a broader perspective, it is possible to glimpse why it is associated with Human Rights or, in the proposal of this work, with the Ethics of Artificial Intelligence and the use of Technologies as an arm of Human Rights Education. This approach is based on what the National Plan for Human Rights Education (PNEDH) itself, a guiding document for the discipline for national education, launched in 2003, brings as a general vision of respect for values that preserve fundamental rights and guarantees that must be worked on at all levels of education, formal and informal (Brazil, 2018).

The aforementioned Plan is based on international and national documents, from which Brazil's insertion in the history of the affirmation of human rights is established and defining the following guiding objectives:
   a) strengthen respect for human rights and fundamental freedoms; b) promote the full development of the personality and human dignity
   b) foster understanding, tolerance, gender equality and friendship among nations, indigenous peoples and racial, national, ethnic, religious and linguistic groups; d) stimulate the effective participation of people in a free and democratic society governed by the rule of law; e) build, promote and maintain peace (Brazil, 2018).

Another point worth highlighting is that the proposal for the Legal Framework for AI in Brazil is aligned with the "debate that has been taking place in the world and aims to

guarantee the fundamental rights of the population, supported by universal and philosophical principles, which do not, in themselves, imply harm to the development of AI in the country" (Miranda, 2024).

It is also important to emphasize that, as established by the PNEDH itself, "the implementation of the National Plan for Education in Human Rights aims, above all, to disseminate the culture of human rights in the country" (Brazil, 2018). And, from the perspective of training technology professionals, the affirmation of principles that defend the human person is directly connected to the proposal of the Legal Framework for Artificial Intelligence in Brazil, as we have intended to highlight so far in this work.

The Impact of Technology on People's Lives

The AI Legal Framework has as one of its premises the "centrality of the human person", art. 2, I, of Bill 2,338 of 2023. What is understood from what is stated is that in order to center the implementation and use of artificial intelligence systems in Brazil on the human person, it is necessary to guarantee and preserve fundamental rights and guarantees, including privacy. The use of digital technologies in the most diverse areas of people's lives also has repercussions in the sphere of continuous surveillance, that is, at all times there is an artificial intelligence system processing data captured from people.

It is believed that it is possible to agree that advances in technology and the digital transformation of businesses have a positive impact on the economy and increase productivity, whether by reducing costs or even by cutting waste, of time or raw materials. However, this revolution, on the other hand, has been putting pressure on the labor market in terms of people's space, since, at an unprecedented speed, as a consequence of recent advances, "machines and intelligent algorithms are taking over everything from repetitive and routine tasks to cognitive ones" (CNI, 2020). In other words, machines are occupying some spaces that were previously exclusive to people. Likewise, from the perspective of computer systems, tens of thousands of robots, bots, are in operation working in place of people, with data collected from people, while the latter maintain their presence in digital networks, virtual worlds

One point of view that can be inferred from the excerpt presented from the research that portrays the digital divide in Brazil, produced by PwC (2022), is that these new professionals, trained in a scenario in which there is urgency for their insertion in the productive sector, highlight the importance and need for a focus on the development and application of tools that respect, above all, Human Rights, the Rights of Men and Citizens.

The topic is controversial and divergent, hence the proposal for analysis from an ethical-normative perspective, following the opinion of Nigel Cameron, senior researcher at the University of Ottawa (2017 apud CNI, 2020), whose view is a little more pessimistic regarding the advancement of AI, who "warns that the human worker will be competing with another 'species', cheaper to employ and with the additional advantage of continually evolving into more intelligent forms; the risk is that not enough opportunities will be generated for humans whose skills will no longer be relevant".

Artificial intelligence is one of the pillars of Industry 4.0, one of the enabling technologies of Industry 4.0. Machine learning techniques, "Machine Learning", "Deep Learning" and others, automatically improve systems and increase the accuracy of prediction capacity, as well as facilitate customization. Artificial Intelligence algorithms, as presented in the work of the National Confederation of Industry, are:

They use databases, identify trends and simulate scenarios, contributing to supply chain planning, seasonality forecasting, better understanding of consumer expectations, among countless other benefits. By adding value to human work, AI is transforming tasks and functions, processes and business models (CNI, 2020).

What we want to do in this article is to present a perspective on how the Legal Framework for Artificial Intelligence in Brazil, from the point of view of the ethical-normative debate and the impact of these technologies on people's lives, can help with the consolidation of principles that protect the human person, once these principles start to be worked on as a discipline or content in training programs for information technology professionals.

Shifting the approach slightly from the occupation of people's space to the risk of invasion of privacy or harm to fundamental rights or guarantees, it is observed that Bill 2,338 of 2023 is still concerned with the assessment of algorithmic impact, when it allocates an exclusive section to this topic, in which, it mentions in its art. 23, caput, that there is a need for "algorithmic impact assessment to be carried out by a professional or team of professionals with the technical, scientific and legal knowledge necessary to prepare the report and with functional independence" (Brazil, 2023).

What we want to highlight in this work is that for these professionals to be prepared to fulfill this task of analyzing the algorithmic impact of these artificial intelligence tools, it is necessary that they are sensitive to the principles brought by the Legal Framework for Artificial Intelligence, that is, it is necessary that the curricula of training programs for information technology professionals foresee and encourage the development of this responsible vision and the ethics of AI systems.

The forecast of Ethics in the curricula of Undergraduate Degrees in Information Technology

Higher education programs in technology are governed by the Ministry of Education (MEC) and have their minimum content established in the National Curricular Guidelines (DCN) for undergraduate courses, when at the bachelor's level, or in the National Catalog of Higher Education Courses in Technology (CNCST), when at the technological level. The aforementioned guidance instruments regarding the minimum content to be met by Higher Education Institutions (IES) in Brazil in the curricula of undergraduate courses, in this section, focused on information technology, provide that the exercise must be ethical, responsible and subject to the regulations of professional practice.

The CNCST, as mentioned, expressly states that for acting as a Technologist, "ethics and respect in professional practice" are fundamental (Brazil, 2024) and, similarly, the National Curricular Guidelines (DCN) for undergraduate courses in the area of Computing establishes in its art. 4 that "bachelor's and teaching degrees in the area of Computing must ensure the training of professionals with: I - knowledge of social, professional, legal, ethical, political and humanistic issues;" (Brazil, 2016).

Along the same lines, analyzing the process of evaluating the performance of undergraduate students in information technology, whether technological, bachelor's or licentiate degree; it is noted that there is still a concern with the prediction of such themes when assessing how their training process was during their undergraduate degree. Here, in question, the test guidelines and the specific components required for graduates in the area of Computer Science, Bachelor's degree modality, within the scope of the National Student Performance Exam (ENADE), 2021 edition, the last one held for the area, which

occurs triennially, which highlights in its art. 5 that "the 2021 Enade test, in the specific component of the area of Computer Science - Bachelor's degree, will take as a reference the following characteristics of the graduate's profile: [...] III - ethical and reflective in relation to the impact of computing and its technologies on society and the environment" (BRASIL, 2021a).

However, even though ethics and responsible use of technology are included in the curricula, this is not what is found in the ENADE assessment applied. It is not possible to say whether this is due to the extent of the content to be covered or the size of the test, which is limited, or whether it is simply due to the lack of priority given to the topic. What can be said is that in the latest editions of the National Student Performance Exam (ENADE) for the Information Technology area, there were no questions that addressed the topic of ethics or responsible use of technology (BRASIL, 2021b).

For this reason, the importance of training in these topics in technology undergraduate courses is highlighted, highlighting the role of teachers and institutions, as well as that of the government. Teachers, as the first professionals with whom future developers of artificial intelligence systems have contact, are responsible for understanding how important such understanding is, in the institutional context and of the collegiate bodies to which they belong, supported by institutional policies of the HEIs; and that of the government, in the terms brought by the PNEDH, in strengthening practices in which individuals and society generate actions and instruments that favor the promotion, extend the protection and promote the defense of human rights, as well as the reparation of violations.

Professionals working in Information Technology need to understand, from their undergraduate years, the importance of their participation in this intersection between ethics, artificial intelligence and the space that has been occupied by multi-agents, also called non-humans (Moura, 2024b), mainly from the perspective of the transdisciplinarity that ethics has with applied technologies and with artificial intelligence itself.

Results and Discussions
This section presents the results and some analyses based on the research strategy proposed as a methodology.

Analysis of the National Curricular Guidelines
Based on the review of the instruments that establish guidelines for undergraduate courses in information technology, as well as the evaluations of these courses applied by INEP (2021b), it is possible to verify that the normative instruments, the content guidelines and the performance evaluation of professionals who graduate from undergraduate programs in information technology, as well as the macro objective of the National Plan for Education in Human Rights, which "aims, above all, to disseminate the culture of human rights in the country" (BRASIL, 2018), provide for training in ethics and professional responsibility for graduates in information technology. However, it must be accepted that it is not an exaggeration to predict here that it is possible to reinforce strategies to raise awareness among professionals regarding ethics and the responsible use of technology in their training programs

This is the conclusion reached after reviewing the guiding documents, namely, the National Curricular Guidelines (DCN) for undergraduate courses in the area of Computing (Brazil, 2016); the test guidelines and specific components required for graduates in the area of Computer Science, bachelor's degree, within the scope of the National Student

Performance Exam (Brazil, 2021a); and the National Catalog of Higher Education Technology Courses (Brazil, 2024). In the review of these documents, it was possible to demonstrate that they all provide for the theme of ethics and responsibility as a technology professional, however, in the National Student Performance Exam for the area of Information Technology, no question addressing the theme was addressed (Brazil, 2021b), hence the statement that it would not be an exaggeration to conclude that it is necessary to include the ethics of artificial intelligence and the use of technologies in undergraduate courses in information technology.

The objective here is not to affirm negligence on the part of any of the actors involved in the process, but rather to reinforce that there is work to be done to improve the role of the Teacher, the Higher Education Institution and the Government, in this context here, expanded to the sense of Public Power.

What stands out here is why there is a correlation between the prediction of ethics in artificial intelligence and the use of technologies in undergraduate technology courses, as it involves working at the origin, that is, working on the training of professionals who develop these artificial intelligence systems.

The role of the Professor in Information Technology Undergraduate courses
The teaching staff of a Higher Education Institution (HEI) are the first professionals in the field in which students intend to graduate with whom they have contact. Therefore, from a career perspective and in terms of ethics in the exercise of their profession, they are references for those who will be future professionals in the technology area. That is why the emphasis here is on the importance of preparing these professionals.

In addition to being a professional reference for students, teachers are part of committees that have the autonomy to adjust programs and, more than that, establish pedagogical proposals for application in teaching, research and extension that contribute to the comprehensive training of the undergraduate professional. An example of a committee that can be mentioned is the Núcleo Docente Structurante (NDE) of the course, which "is made up of a group of teachers, with academic monitoring responsibilities, active in the process of designing, consolidating and continuously updating the pedagogical project of the course" (Brazil, 2010). It is important to emphasize that the NDE also has the responsibility of "indicating ways to encourage the development of lines of research and extension, arising from the needs of the undergraduate program, the demands of the job market and in line with public policies related to the area of knowledge of the course" (Brazil, 2010).

The professor of undergraduate technology programs is a central figure in the training of this future professional who will develop artificial intelligence systems. Their performance from the perspective of Human Rights, Ethics and the responsible use of technologies is what the PNEDH, in the conception and principles of Higher Education, highlights when it mentions the relationship between higher education and continuous collaboration in the training of professionals and in the maintenance of "a relationship of service and reciprocity with society" (Brazil, 2018). This can also be understood when it encourages the "development of transdisciplinary and interdisciplinary pedagogical methodologies for human rights education in HEIs" (Brazil, 2018).

The teacher, in this context, becomes an extremely important agent in the process of ethical training in the use of technologies for this future professional graduating from the undergraduate course in the area of information technology.

The role of regulatory bodies and public authorities

When considering the regulatory scenario, the definition of curricular principles and guidelines, and the provision for assessing the approach to such themes during programs, it is important to highlight that, as provided for in the PNEDH itself, in higher education programmatic actions, it is the responsibility of the public authorities to "support the creation and strengthening of forums, centers, committees and research and extension centers aimed at the promotion, defense, protection and study of human rights in HEIs" (Brazil, 2018).

Here the theme is the proposition of structured actions by the public authorities to maintain and disseminate the culture of care for fundamental rights and guarantees by future technology professionals who will graduate from these HEIs and, in this sense, how Human Rights Education can have its role consolidated as, lato sensu, "strengthening individual and social practices that generate actions and instruments in favor of the promotion, protection and defense of human rights, as well as the reparation of violations" (Brazil, 2018).

Final Considerations

From the review of the instruments that establish minimum content for information technology training programs, it is possible to see that the discipline of ethics and responsible practice is provided for in the curricular guidelines, in the training and assessment phases. However, it is important to note that there is room for improvement in the approach to these topics, from the perspective of emerging technologies such as Artificial Intelligence and, in general, regarding the use of emerging technologies as a whole.

The conclusion is based on the provision of the theme of ethics and responsibility as a technology professional, but even though they are provided for in the curricula, this is not what is found in the performance assessment applied. As highlighted throughout the work, it is not possible to say whether this is due to the extent of the content that needs to be covered, the limited size of the test, or whether it is simply due to the lack of priority given to the topic. Therefore, the emphasis is on the role of teachers and institutions, as well as the government. Teachers, the first professionals with whom future developers of artificial intelligence systems have contact, are responsible for understanding how important such understandings are, in the institutional context and in the collegiate bodies to which they belong; and that of the public authorities, in the terms brought by the PNEDH, the strengthening of practices in which individuals and society generate actions and instruments that favor the promotion, extend the protection and promote the defense of human rights, as well as the reparation of violations, through support for the "creation

and strengthening of forums, centers, commissions and research and extension centers aimed at the promotion, defense, protection and study of human rights in Higher Education Institutions".

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