

Scientific Integrity in the Era of Generative Artificial Intelligence: What Responsibilities?

Hamdis Makhoula

Blida 2 university

hamdismakhoula@gmail.com

Abstract :

Generative Artificial Intelligence (AI) is a tool capable of creating content such as texts, images, and graphics in response to a user's prompt in multiple languages. For researchers in the scientific field, generative AI serves as a sophisticated assistant that can help draft articles and identify bibliographic references. Generative AI practices range from defining research questions or hypotheses, creating methodologies, to evaluating projects and beyond. Responsibility for generated content lies with the researchers who produce the final results of their articles. Regarding scientific integrity, researchers must remain vigilant on critical issues such as reliability, ownership, and confidentiality.

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1. Introduction

The rapid progress and continuous innovations in generative AI within scientific research face ethical challenges, particularly scientific misconduct. Researchers using generative AI tools must ensure the reliability of information, respect data ownership (which may be protected by copyright), and safeguard personal data. Currently, responsibility for AI-generated content falls to the researchers who utilize these tools. Addressing responsibility implies sanctions for violating principles of scientific integrity, but regulations struggle to keep pace with advances in generative AI. Algeria, at its decision-making levels, must prioritize efforts in this area. The concept of scientific integrity has remained unchanged for decades in Algerian universities, limited to plagiarism, while developed countries have moved beyond this narrow definition. Responsibility must evolve alongside the rapid adoption of generative AI, making this a priority issue. In the 21st century, a nation's development is closely tied to its mastery of AI. As previously discussed in the article "Integration of Generative AI in Scientific Research at Algerian Universities", technological and scientific advancements underpin all innovations. However, rapid progress demands significant time from researchers, making AI a valuable "assistant tool" for saving time. Without generative AI tools, scientific researchers cannot achieve advanced progress. This follow-up article aims to highlight the rapid evolution of generative AI in scientific research and advocate for regulations to clarify responsibility for AI-generated content.

2. AI and Generative AI: Applications in Scientific Research

Artificial Intelligence (AI) mimics human intelligence through algorithms in dynamic computing environments. Types of AI include rule-based systems, weak/strong AI, supervised/unsupervised learning, reinforcement learning, and deep learning (Makboula, 2024). Since late 2022, generative AI tools like OpenAI's ChatGPT and Google's Gemini have gained popularity among researchers, despite risks to scientific integrity. Applications of generative AI in research include:

- Defining research questions/hypotheses
- Developing methodologies
- Assisting experiments and image processing
- Summarizing articles and literature reviews
- Writing, translating, and formatting texts/images
- Generating bibliographies and peer identification
- Creation of bibliographies, selection of articles
- Evaluation of projects or manuscripts, identification of peer reviewers. (Ofis, 2024)

Generative AI can propose novel research questions or methodologies unconsidered by researchers, accelerating experiments. Below are examples of AI advancements in technical and medical fields.

2.1 .Applications of AI in Technical and Medical Fields

AI's progress in medicine and technology is vast. This section focuses on remote sensing and satellite imaging.

2.1.1 Remote Sensing, Object Recognition, and Satellite Image Analysis

Remote sensing uses AI algorithms to detect and extract features from aerial/satellite images. Applications include urban planning (road networks, building footprints), emergency response systems, autonomous driving, and real-time traffic monitoring. AI also aids in meteorological and seismic forecasting (Ould Babaali, 2022). Furthermore, the use of AI-based image analysis for satellite imaging technology provides researchers with an invaluable tool for monitoring the Earth's surface. This technology allows researchers to gain a more detailed understanding of the environment, monitor changes in land and ocean use, and respond more quickly to environmental changes. "AI-based image analysis technology works by using deep learning algorithms to 'teach' computers to analyze satellite images. By training the computer to recognize patterns, shapes, and colors, AI-based image analysis technology is able to quickly and accurately identify objects, features, and terrain on the Earth's surface." It also allows researchers to monitor and analyze data in near real-time, rather than waiting for analysis to be performed manually. This gives researchers much faster access to data and allows them to respond more quickly to environmental changes. (Frąckiewicz, 2023)

2.1.1.1 Advances in Remote Sensing

The rapid evolution of AI in the field of image processing, particularly in remote sensing, provides a multitude of very varied methods that allow the detection and extraction of shapes, such as road

networks, from satellite images. Among these new methods that use AI deep learning algorithms, the DAA-SSEG approach, which has successfully addressed the problem of over-learning in training neural networks to extract any type of roads. The DAA-SSEG approach uses data augmentation to create new synthetic images from old satellite images without resorting to new satellite images. These images thus enrich the training of the model, which itself uses improved semantic segmentation by classifying each pixel of the image by convolution filters to extract roads. The performance of this approach depends on the regularization and rectification techniques and the activation function of the model, this model being more robust and more generalizable for all road shapes thanks to the diversity of convolution filter sizes.

The combination of fully connected layers and transposed layers is beneficial for the model. (effective feature reduction without losing useful information) The approach can be improved while using techniques that focus on road texture such as "Fine-tuning" and hyperparameter adjustment. Finally, the time cost also remains to be improved while respecting the "tolerated" over-learning rate. (Kawthar, 2024)

2.1.1.2 ChatGPT: Innovations in Remote Sensing

The latest innovation in generative artificial intelligence in satellite remote sensing involves the use of generative adversarial networks (GANs) and transformation models to improve the resolution and interpretation of satellite images. Here are some recent developments:

1. Improved spatial resolution: GANs are used to generate higher-resolution images from low-resolution data. This allows for better analysis of geographic and environmental details without the need to launch new satellites with more powerful sensors.
2. Synthesis of missing images: When there are areas covered by clouds or other obstructions, generative models can create images of these areas based on historical data and images of adjacent regions.
3. Improved classification and segmentation: Generative models can help improve the accuracy of image classification and segmentation algorithms by generating synthetic examples to train machine learning models.
4. Multi-source data fusion: Generative models combine data from different sensors (optical, radar, infrared) to create more informative and analytically useful composite images.
5. Change detection and tracking: Generative algorithms can be used to detect and track environmental or anthropogenic changes in temporal sequences of satellite images, generating predictions about future trends.

These innovations not only improve the quality and usefulness of remote sensing data, but also reduce the cost and time required to obtain accurate and up-to-date information. (ChatGpt, 2023)

It is noted that the information from the ChatGpt source agrees with the information previously cited by researchers in the same field.

2.2- Application of Artificial Intelligence in the Medical Field

As mentioned previously, the example was the choice of the intelligent prosthesis "The Bionic Arm" to demonstrate the extraordinary advantages of AI in the field and also the recent discoveries of new antibiotics thanks to AI. For the Bionic Arm, researchers have successfully created a thought-controlled arm. This revolutionary 21st-century feat was achieved thanks to several research teams in the field, and time was the major challenge for these researchers, under pressure from fierce competition from other companies in the field.

- "The thought-controlled bionic arm" was created by a company that combines wearable robotics with stunning (and recently award-winning) design. Esper Bionics has created an AI-powered prosthesis that is highly agile, remarkably lightweight, and incomparably elegant. The Esper Hand offers comprehensive functionality that surprisingly closely resembles the natural movement of the hand. Its self-learning technology greatly contributes to enabling users to perform everyday tasks independently. (Nicholas, 2022)

2.2.1-Chatgpt: Esper Bionics' Latest Prosthetic

The latest significant developments in the field of bionic arms are often attributed to companies and research institutes that continue to innovate advanced prosthetics. One notable company in this field is Esper Bionics, which has made impressive advances recently.

A- Key Features of Esper Bionics' Latest Bionic Prosthesis:

1. AI-Powered Adaptive Control: The Esper Hand utilizes machine learning algorithms to adapt to the user's unique muscle signals and movement patterns. Over time, it learns and predicts intended movements, allowing for intuitive and natural control of the prosthetic.

2. Non-Invasive Electromyography (EMG) Sensors: Equipped with 24 strategically placed EMG sensors, the prosthetic detects electrical signals from residual muscles, enabling precise and responsive movements without the need for invasive procedures.

3. Lightweight and Ergonomic Design: Weighing approximately 380 grams, the Esper Hand is lighter than many other prosthetic hands, reducing fatigue and enhancing comfort for the user. Its anatomical design ensures a natural appearance and feel.

4. Modular and Customizable Components: The prosthetic features five individually movable fingers, allowing for a range of grips and gestures. Users can customize grip patterns and control settings via a dedicated mobile app, tailoring the hand's functionality to their daily needs.

5. Cloud-Based Learning Platform: Through the Esper Platform, data from the prosthetic is continuously analyzed in the cloud to refine movement predictions and improve performance. This system enables the hand to become more intuitive over time, aligning closely with the user's habits and routines.

6. Durability and Touchscreen Compatibility: Designed for everyday use, the Esper Hand is built to withstand environmental factors like dust and

moisture. Its fingertips are compatible with touch screen devices, allowing users to interact seamlessly with modern technology.

7. Aesthetic and Lifestyle Integration: Beyond functionality, the Esper Hand boasts a sleek and modern design, earning recognition such as the Red Dot Award: Best of the Best 2022. Its appearance is crafted to empower users, turning the prosthetic into a statement of personal style. (ChatGpt4, 2023)

B- Developments and Outlook:

These innovations are among the latest advances in the field of bionic prosthetics and point to a promising future for people requiring such technologies. Continued efforts in the research and development of bionic prosthetics aim to further improve their functionality, comfort, and accessibility. For the latest specific updates from Esper Bionics or other bionic prosthetics companies, it is recommended to consult recent publications or press releases from the companies concerned. (ChatGpt4, 2023)

2.2.2-Chatgpt: The Latest Discoveries of New Antibiotics

Also, another example in the medical field, one of the latest innovations in generative AI regarding antibiotics is the use of deep learning to discover new antibiotic compounds and optimize existing ones. Here are some notable advances:

1. **Discovery of New Antibiotics:** Neural networks, including GANs and transformation models, are used to generate new chemical compounds with potential antibiotic properties. For example, machine learning models recently helped discover antibiotics such as halicin, which has shown efficacy against bacteria resistant to traditional treatments.

2. ****Optimization of Existing Antibiotics****: Generative AI can also be used to modify and optimize the chemical structures of existing antibiotics to improve their effectiveness and reduce bacterial resistance. This helps extend the useful life of current antibiotics. 3. ****Prediction of Bacterial Resistance****: Generative models can be used to simulate and predict how bacteria might develop resistance to new antibiotics. This allows researchers to design more robust antibiotics early in the development process.

4. ****Rapid Compound Synthesis****: Generative AI makes it possible to rapidly design and synthesize new antibiotic compounds in the laboratory. This accelerates the process of discovering and developing new drugs.

5. ****Personalization of Antibiotic Treatments****: AI models can analyze genetic data from pathogens and patients to generate personalized antibiotic treatment recommendations, optimizing efficacy and reducing the risk of resistance.

These innovations help address the urgent need for new antibiotics in the face of rising bacterial resistance, while making the drug discovery and development process faster and more efficient. (ChatGpt, 2023)

2.2.3-Confirmation of Generative AI Data by Recent Discoveries

A new antibiotic discovered using artificial intelligence in 2020. This major discovery in the medical field. Presented by its developers as capable of killing highly resistant bacteria, a new antibiotic molecule was discovered for the first time using a deep learning neural network. (Logeon, 2020)

Four years after this discovery, the announcement of the discovery of a new class of molecules unearthed by artificial intelligence stunned the medical world. More than 12 million compounds were screened by neural networks trained to identify antimicrobial activity. A method

that opens up prospects for addressing antibiotic resistance. (Jacquin, 2024)

2.3-The Benefits of Generative AI in the Humanities and Social Sciences

Today, a language model developed by Open AI, "ChatGpt," and other more powerful languages, are attracting attention, especially from the general public. Thanks to their ability to generate natural language texts that can be difficult to distinguish from those written by humans, these generative languages have become versatile and very powerful tools, as are AI applications such as automatic customer response, text generation, and machine translation. Since their availability in November 2022, not a day has passed without these generative languages appearing in conversations and the media, arousing their share of curiosity, questions, and fears. (Flandrin, 2023)

2.3.1- Integration of Generative AI in Scientific Research

Since its emergence in 2022, generative AI has sparked major debates, ranging from criticism to its use in schools to scientific research. What is new, however, is its availability to the general public since December 2022. This is the first time a "conversational robot" has been made available to the public; it has learned to "speak well" in different styles and languages. Its learning base is primarily English-language and limited to 2021. That said, it has a database independent of other databases for the time being. Its primary mission is to produce text in a personalized manner, responding to a "prompt." It should be noted that this generative software is not a search engine or a knowledge base. It can provide references to the bibliography it has referenced in its texts. (Makboula, 2024, p. 19)

Faced with this extraordinary feat, two distinct attitudes have emerged toward generative language software, especially in academic and academic circles. Those who present its use in the preparation of a

dissertation or thesis as cheating, and those who see it as a very beneficial working tool for students and researchers. We will not go into these details, as the purpose of this research is to focus on the responsibility of AI-generated texts regarding scientific integrity.

In all fields of scientific research, every researcher needs more time to achieve the goals of their research project. For now, AI generative software cannot replace the researcher in the practical application of fieldwork, but it can do so for the theoretical side. This cooperation between generative software and scientific researchers is among the proposed solutions to the "time" challenge faced by researchers around the world, particularly those in our Algerian universities. Note that it is practically impossible to detect texts generated by AI even using the most efficient software designed in the field, so it is better to legalize these languages in academic circles but under the control of qualified and highly competent people.

2.3.2-Generative AI, a powerful assistant in scientific research

A - The advantages of using ChatGpt according to generative AI software

- Automatic text generation: Natural language processing models such as GPT can automatically generate text from training data. This can be useful for researchers looking to generate data summaries, hypotheses, experimental protocols, etc.
- Automatic data annotation: Natural language processing models can also be used to automatically annotate text data, which can help researchers quickly identify trends and patterns in their data.
- Sentiment analysis: Natural language processing models can be used to detect sentiments expressed in a text, which can be useful for social media studies, satisfaction surveys, etc.

-Question-answer generation: GPT can generate automatic answers to questions, which can facilitate user interactions within applications.

-Improved efficiency: It can help researchers and apprentice researchers complete certain tasks more quickly and accurately, allowing them to devote more time and energy to more complex and creative tasks. (Cousi, 2023)

B – Benefits of ChatGpt according to researchers and users of the software

- Enlighten the researcher on a specific topic
- Writing/Editing: can refine your writing (rewording, etc.), can also rewrite passages, and can create summaries (including French summaries of English articles)
- Make suggestions for research topics, research questions (initial research), titles, future directions, etc.
- Sentiment analysis (detect the sentiments expressed in a text, e.g., on social media)
- Improve efficiency (accomplish certain tasks faster and more accurately) by using it as an assistant
- Create tables (by asking it how you want them and what you put in them), generate items and questionnaires from these items . (Cousi, 2023)

Finally, the future will tell how the academic (and research) world has taken ownership of these tools, of which ChatGPT is only the beginning of the era of "accessible" artificial intelligence.

C- Encourage and train in academia

Personally, I believe that the use of generative AI, with explicit mention in the content produced by the software, lends credibility to any research work. To this end, integrating AI courses into university curricula and training teachers on the subject is necessary. This training is beneficial from both a technical and ethical perspective.

Students must be taught to critique texts produced by AI with a view to improving

their "Becoming Smarter Than a Robot" skill (as cited below) in order to engage and encourage users. ChatGpt can generate summaries of specific texts and introduce researchers to new areas they might not have known existed. Moreover, the model can generate research ideas and hypotheses that can inspire new avenues of research previously overlooked. Not forgetting the "Time" factor for researchers, because the time they can spend carrying out their field investigations, which this robot cannot currently do for them, is very important in the development of scientific research.

Since the discovery of generative AI and its availability to the general public and researchers, nearly a third of the latter use generative AI in their work according to a study conducted in 2023. The rapid arrival of generative artificial intelligence in the world of work has disrupted many professional habits in certain sectors of activity. Tools such as ChatGPT are now used by researchers, 31% of whom, according to a study, use them regularly. Motivated by an overall desire to save time, the scientific disciplines most represented among users of generative AI are engineering (44%) and social sciences (41%). (Defer, 2023)

3 – Generative AI between Ethics and Responsibility

The ethics and professional conduct of researchers is a body of rules contained in charters, guides, codes of ethics, professional conduct, good practices, or good conduct, and is specifically aimed at members of the scientific community. This particular normative form, which constitutes the ethics or professional conduct of researchers, takes on its full significance within a scientific community relatively compartmentalized by its activity and by the sharing of common objectives and values.

Moreover, while the Research Code contains certain principles common to all scientific activities, the principles that govern scientific activity as a whole are largely absent from the Code. Thus, the behavior of scientific integrity expected of researchers or reviewers is largely ignored by the legislature. Faced with the legal gaps in the field of scientific research, ethical and professional standards appear to be useful substitutes that allow, first, the expression of shared values within the scientific community, second, the establishment of a standard of conduct for the participants in this community, and finally, serve as a benchmark when ethical or disciplinary bodies must rule on a problematic protocol or behavior and issue opinions, or even impose sanctions. Defined by researchers, ethical and professional standards become acceptable because, in a sense, they are agreed upon by those subject to them. This acceptability helps ensure compliance with these standards. (Vergès)

That said, responsibility, which is one of the general principles of scientific integrity, is closely linked to these standards, which are defined, agreed upon, and accepted by the scientific community, not by the state legislature. The problem of defining and determining responsibility becomes more complex when it comes to text and scientific research generated by artificial intelligence.

3.1 – Scientific Integrity and AI: Concept, Principles, and Types

Generative AI represents a true revolution in content production and the assistance it can provide to scientific research, particularly for researchers and apprentice researchers who have to write academic papers. If this AI is used wisely, with ethics and scientific integrity, it can become a true assistant to apprentice researchers, but also to (teacher-)

researchers. The problem is whether it is possible to respect the principles of scientific integrity when researchers use generative AI tools to achieve their research goals.

3.1.1- Ethical Standards of Scientific Research

The contours of scientific integrity revolve around several texts that address ethical standards that concern the scientific community as a whole. These standards apply to all researchers, regardless of their scientific discipline, nationality, or status. However, the difficulty lies in defining the contours of scientific integrity. Indeed, there is no text adopted by the scientific community as a whole that defines a common ethic, either at the national or international level.

As an example of scientific integrity based on charters and codes of ethics with a general purpose, we have the European Charter for Researchers. This charter is a text drawn up by the European Union and which was the subject of a recommendation by the European Commission on 11 March 2005. In its preamble, the charter is defined as a "set of general principles and basic conditions which specifies the roles, responsibilities and prerogatives of researchers and of employers and/or funders of researchers". (Vergès, p. 139)

Examples of certain ethical principles include:

a) The principle of freedom of research

This principle is formulated in the charter as follows: "Researchers should focus their research on the good of humanity and the expansion of the frontiers of scientific knowledge, while enjoying freedom of thought and expression, as well as the freedom to determine the methods that enable problem solving, in accordance with recognized ethical practices and principles". (Le Havre, 2023)

This principle contains several general prerogatives already recognized by law: freedom of thought and expression. But it also defines freedom of research more precisely, granting researchers freedom to determine the methods that enable the resolution of scientific problems. The ethical rule here is therefore more precise than the legal rule. It gives the principle of freedom of research an additional dimension: methodological freedom. (Vergès, p. 141)

b) The Principle of Responsibility

The charter states that "researchers must be aware that they are responsible to their employers, funders, or other related public or private organizations, and are also responsible, for more ethical reasons, to society as a whole."

This article addresses two categories of responsibility. The first concerns the responsibility of researchers to employers and funders. The second responsibility is that the principle evokes a responsibility to society "for more ethical reasons." The principle of responsibility is thus established as a consequence of freedom of research. (Vergès, p. 142)

c) The principle of dissemination and exploitation of results

Dissemination is the planned process that provides information on the quality, relevance, and effectiveness of project results to key stakeholders. It is pre-planned and continuously implemented. This process can be understood as the cross-functional activity of promoting the project and its results to a broader audience beyond the project consortium. Disseminating and communicating project results (such as reports, tools, events, learning materials, etc.) allows partners to better understand the project objectives, activities, and results, as well as the needs they address. Dissemination activities also support the exploitation of project results by encouraging stakeholders to initiate new

initiatives, become involved in existing ones, use project results, and share them with their networks. (Sagesse, 2017)

However, the ethical rule here sets out two imperatives that are both complementary and contradictory: on the one hand, the obligation to disseminate knowledge, which is part of the principle of "open science," and on the other, the obligation to exploit results, which is linked to the knowledge economy. The two objectives are rarely reconcilable, because economic exploitation is often linked to the exclusivity of the exploitation of results (through patents) and the expensive nature of knowledge, whereas the dissemination of knowledge through publication aims to generalize the exploitation of results freely and without charge. (Vergès, p. 142)

3.1.2- Types of AI Ethics

It is clear that the notion of artificial intelligence (AI) ethics differs from that cited above. Researchers in the field are considering the hypothesis that four forms of AI ethics exist, such as computer ethics; algorithmic, robotic, or artificial ethics; digital ethics; and the ethics of AI uses. These forms differ for several reasons analyzed in the research. But let us focus only on the concept of these four types of AI ethics.

A – Computer Ethics

The term "computer ethics" refers to the work of mathematicians and computer scientists. It concerns the writing of code and is conflated with a dual desire expressed by this class of scientists and engineers: on the one hand, to understand and master the functioning of their own inventions; on the other, that of ensuring their safety, and providing a guarantee of their quality for reliable use.

B – Algorithmic, Robotic, and Artificial Ethics

The terms "Algorithmic ethics," "Robot ethics," and "Artificial ethics" encompass reflections on all questions concerning the

(current and future) status of artificial beings and their relationships with each other, with humans, and with other natural beings. This sector of academic work focuses more on meta-ethical reflections or moral theory than on applied ethics. They refer to the approach that considers the design and programming of intelligent machines. These initial considerations allow us to affirm that the ethical task considered here involves computer scientists and roboticists programming artificial beings, anthropomorphic or not, currently partially autonomous. Algorithmic ethics "concerns the 'choices' of machines", that is to say, since the latter are not endowed with true autonomy (i.e. the capacity to give themselves their own rules of action), it is a question of knowing "which moral principles to implement in autonomous cars, military robots or sex robots". (Ménissier, 2023)

C – Digital Ethics

In its narrow conceptual scope, digital ethics (or digital ethics) concerns the evaluation of interactions generated by human activity on networks and platforms. Digital ethics is that of information, but broadens its conceptual scope by considering it not as an applied ethic, but as a fundamental ethic. An even broader approach is also possible for digital ethics, which extends its spectrum of understanding and action to the whole of AI. Considering that digital ethics itself embodies the ethics of AI seems a legitimate claim, given the phenomenon that one author has eloquently identified as "the global digitization of systems supporting human activity." This claim is also endorsed by the authors (most of whom are computer scientists by profession) of the reference work "For a Digital Ethics," recently published by the National Ethics Committee responsible for these issues. (Ménissier, 2023)

D – Ethics of AI Uses

This ethics complements the three other discursive formations, attached to the design and deployment of technological devices derived from algorithms, robotics, and digital technology. Although the first three ethics of AI are not without taking into account the user perspective, this emerging type of evaluation is likely to deliver results that cannot be reduced to those of the first three. The ethics of AI use sets itself three unique tasks.

It involves, first, determining the purposes and values of AI by considering the use of algorithmic systems through the meticulous observation of use cases; second, understanding the conditions (psychological, economic, and political) underlying these uses; and third, supporting and evaluating the redefinition of human activity implied by the adoption of algorithmic systems. (Ménissier, 2023)

3.2 – Generative AI: Roles and Responsibilities

Technological advances in artificial intelligence over the past decade have created unprecedented excitement due to the benefits of AI's latest feats. From AI mimicking human intelligence to solve problems, to generative AI used to generate new content, to predictive AI used to predict future events. Machine learning (ML) is integrated into all of this.

The role of AI in all its forms in scientific progress and its interaction in daily life requires answering the essential question of the function of this intelligence: that of responsibility, especially since Saudi Arabia granted Saudi nationality to a humanoid. Law and responsibility are highly controversial, but they present a truly new legal problem for experts on the subject.

3.2.1- Roles

Today, we are witnessing revolutionary progress in the field of artificial intelligence. This is a glimpse into

the role of AI technology in the 21st century.

A - Artificial Intelligence (AI): Mimics human intelligence to solve problems.

B - Generative AI: Uses a sophisticated algorithm to create new content (text, images, video, audio, etc.) based on natural language prompts.

C - Predictive AI: Also called "predictive analytics," predictive AI uses machine learning algorithms based on historical data to identify patterns and trends, make predictions, and forecast trends.

D - Machine Learning (ML): A branch of AI that uses data and algorithms to mimic human learning functions, continually improving itself.

E - Natural Language Processing (NLP): ML technology that synthesizes natural human language.

F - Cognitive Automation: Cognitive automation, another term for intelligent automation, mimics human behavior and intelligence to facilitate decision-making and perform complex tasks.

G - Business Process Management (BPM): A tool that allows companies to automate, manage, and optimize their processes.

H - Robotic Process Automation (RPA): Mimics human ability to perform tasks.

I - Intelligent Automation (IA): Combines BPM, AI, and RPA technologies to automate processes. (Redbond, 2023)

3.2.2- Responsibilities

A – Responsibility Of conversational Robots and Humanoids

The citizenship granted to the humanoid Sofia by Saudi Arabia in 2017 sparked a highly controversial debate, making it the first state in the world to grant citizenship to a robot. Sophia is a humanoid robot, equipped with artificial intelligence activated in 2015. This robot was specifically designed to learn and adapt to human behavior and work with humans. As robots and artificial intelligence take over all fields of activity, granting citizenship to

a humanoid raises many questions, particularly from a legal perspective.

Legal personality is traditionally characterized as the "capacity to be the holder of rights and subject to obligations that belongs to all natural persons, and under different conditions to legal persons."

Citizenship is defined and attributed to a "person who, in a democratic state, participates in the exercise of sovereignty, either in indirect democracy through the election of representatives, or in direct democracy through attendance at the people's assembly".

Thus, legal personality, and in particular citizenship, would seem difficult to accept in the case of a robot equipped with artificial intelligence that mimics human capabilities. However, it seems hard to believe that robots like Sophia could participate in the exercise of sovereignty, in "public affairs." Faced with the new era based on artificial intelligence, new legal rules must be established to address disputes related to these new technologies. At the time, the European Parliament addressed the issue and considered that:

"Thanks to the impressive technological advances of the last ten years, not only are contemporary robots capable of successfully performing tasks that previously fell exclusively within the competence of humans, but the development of certain autonomous and cognitive functionalities (such as the ability to learn from experience or make quasi-independent decisions) also brings these robots closer to the status of actors interacting with their environment and capable of significantly modifying it." (...) In such a context, the question of legal liability in the event of harmful actions by a robot becomes a crucial issue";

The robotics charter should establish the fundamental ethical principles that must be respected from the design and development

phase in the field of robotics and artificial intelligence. (Rebecca, 2017)

At the time, the European Parliament made a request to the Commission regarding the long-term possibility of creating a special legal status for robots, in order to clarify liability in the event of damage. Liability is, in fact, the main focus of the recommendations, and calls for the creation of a specific legal personality for robots. To date, it has not been possible to determine which actors will be held liable for the actions of robots and for compensation for damages caused by them.

The European Parliament's resolution, aside from addressing the new challenges of artificial intelligence and robot autonomy, does not address practical questions of civil liability. It appears to place liability on the user responsible for the robot's education or on the teacher. Given the inevitable arrival of robots, it is imperative and necessary that any damage caused by a robot can be repaired. To this end, the European Parliament proposes implementing the robot's (personal) liability through the legal channels that would be assigned to it. Thus, legal personality would be of a nature to engage the responsibility of robots. (Rebecca, 2017)

For over a decade, the issue of legal personality attributed to humanoids has posed the essential problem of liability for damages caused by these robots. Today, we are talking about conversational robots like Chatgpt from Open AI or Gemini from Google, or others equipped with generative and predictive artificial intelligence. These robots use deep learning through a smartphone and can easily integrate a humanoid that can interact seamlessly with its environment. This humanoid will be a highly useful member of a research team, and in any field, it will be able to handle both the theoretical and practical aspects of

the research project, saving researchers valuable time. Therefore, the risk of damage caused by these robots during their scientific activity is very likely, involving civil and professional liability.

B - Generative AI and Professional Civil Liability

Today, conversational robots are very attractive to legal professionals. Reading thousands of legal articles and court decisions in a few minutes saves valuable time. However, the legal framework remains to be identified in the event of an error in the consultation "co-produced" by a lawyer and a chatbot like ChatGpt; it will be necessary to determine who is responsible for such an error. The stakes are high because the objective of professional civil liability is to protect individuals by reducing the risk of damages and compensating victims. Thus, the lawyer personally assumes the mission entrusted to him. The substitution of the lawyer, even partial, by an artificial intelligence is a violation of this professional obligation. And he will not even be able to take action against the Open AI company that created the ChatGPT service.

In 2023, the European legal regime for liability for artificial intelligence, the AI Act, is still not ready. With specific security standards, certifications, and audits, the current regimes for civil, contractual, and extra-contractual liability are applicable. Contractual Civil Liability Defined: The terms of use published by the company OpenAI prohibit the passing off of ChatGPT's computer responses as responses provided by a human. (Aubert, 2023)

C - Ownership of the Content of AI-Generated Texts

For users of chatbots, whatever they may be, the main consequence lies in the impossibility of prohibiting the copying of their AI-generated content by a third party on the basis of copyright. Therefore, the

victim will not be able to bring an action for copyright infringement. They would therefore not be able to prohibit the use of similar or identical content and obtain damages. What if the robot provided the user with text identical or similar to an existing work? This scenario becomes all the more likely since AI ingests knowledge from third parties. In some cases, its responses could be plagiarized. Who should be held responsible?

Until now, the user will be responsible for dissemination and exploitation. The carefully considered warnings and general conditions of the companies that produce these generative languages cheerfully remind us of this. The user uses the tool and its content at their own risk. It is therefore up to them to ensure that they do not infringe the rights of third parties. These include intellectual property rights (copyright and trademark). They also concern press law, defamation, disparagement, and invasion of privacy. (Rouge, 2023)

4- Conclusion

The extraordinary evolution of technological advances in the field of generative AI is outpacing the regulations regarding the ethical code with which the scientific community is required to adhere. To date, it has not been possible to assign specific legal status to chatbots and humanoids programmed by generative AI. Liability is still attributed to users/owners. However, once legal status is granted to these chatbots and humanoids, it will be possible to attribute responsibility for their harmful actions and impose appropriate sanctions. These sanctions can range from reprogramming the robot responsible for the harmful act to the complete deletion of the program. The choice of methods for compensation for damages under civil liability law will fall under the jurisdiction of each state.

In this research, we used the ChatGpt chatbot to demonstrate its effectiveness while confirming the reliability of its information, and we referenced its use in accordance with the recommendations of the "Université de Moncton" in Canada. We recommend the official integration of generative AI tools at the level of Algerian universities in accordance with universities in developed countries. Also, it is necessary to support any legal study concerning ethics and professional conduct in the field of AI and generative AI in order to resolve the very complex problem of the responsibility that will have to be attributed to conversational robots or humanoids.

References

- Aubert, J.-F. (2023, 05 30). *ChatGPT et responsabilité civile professionnelle*. Consulté le 07 28, 2024, sur Village de la justice: <https://www.village-justice.com/articles/chatgpt-responsabilite-civile-professionnelle-reserve,46188.html>
- ChatGpt, O. (2023). *Les dernières découvertes de nouveaux antibiotiques*. Consulté le 7 12, 2024, sur sur chatgpt (version 4),: logiciel: <https://openai.com>
- ChatGpt4, O. A. (2023). *Esper Bionics' Latest Prosthetic*. Consulté le 04 13, 2025, sur ChatGpt (version4), Logiciel: <https://chatgpt.com/c/67fd1c43-8734-8012-a7ce-9ed44df6d0cf>
- Cousi, C. (2023). *ChatGPT pour la recherche scientifique*. Consulté le 11 06, 2023, sur Methode Recherche: <https://methode-recherche.com/chatgpt-test-pour-recherche-scientifique/>
- Defer, A. (2023, 10 17). *Près d'un tiers des chercheurs utilisent l'IA générative dans leurs travaux*. Consulté le 07 24, 2024, sur L'Usine Digitale : [https://www.usine-](https://www.usine-digitale.fr/article/pres-d-un-tiers-des-chercheurs-utilisent-l-ia-gener)
- [digitale.fr/article/pres-d-un-tiers-des-chercheurs-utilisent-l-ia-gener](https://www.usine-digitale.fr/article/pres-d-un-tiers-des-chercheurs-utilisent-l-ia-gener)
- Flandrin, P. (2023, 06 22). *Académie des sciences : comprendre ChatGPT pour en faire bon usage*. Consulté le 11 12, 2023, sur L'Humanité: <https://www.humanite.fr/culture-et-savoir/chatgpt/academie-des-sciences-comprendre-chatgpt-pour-en-faire-bon-usage>
- Frackiewicz, M. (2023, 03 05). *L'IA et l'évolution de la technologie d'imagerie par satellite*. Consulté le 11 13, 2023, sur TS2 SPACE: <file:///C:/Documents%20and%20Settings/Crash/Bureau/semi%20I%20A%20-%20belmadi/extraction%20photo%20satellite/L'IA%20et%20l'C3%A9volution%20de%20la%20technologie%20d'imagerie%20par%20satellite.htm>
- Jacquin, J.-B. (2024, 01 02). *Antibiotique; Une nouvelle classe de molécules déniché par l'intelligence artificielle*. Consulté le 07 22, 2024, sur Le Monde: https://www.lemonde.fr/sciences/article/2024/01/02/antibiotiques-une-nouvelle-classe-de-molecules-denichee-par-l-intelligence-artificielle_6208735_1650684.html
- Kawthar, O. B. (2024). *Extraction de réseaux routiers à partir d'images issues- Th-se de Doctorat*. Sidi Belabess- University-UDL-SBA-Algeria.
- Le Havre, U. (2023, 05 12). *Liberté de la recherche et intégrité scientifique*. Consulté le 07 23, 2024, sur Univ- Le Havre: <https://www.univ-lehavre.fr/fr/universite/nos-atouts-nos-engagements/liberte-de-la-recherche-et-integrite-scientifique/>
- Logeon, S. (2020, 03 04). *Un nouvel antibiotique trouvé grâce à l'intelligence artificielle*. Consulté le 06

12, 2024, sur Le Temps: <https://www.letemps.ch/sciences/un-nouvel-antibiotique-trouve-grace-lintelligence-artificielle>

Makboul, H. (2024, 07 01). Integration of Generative Artificial Intelligence in scientific reserche at Algerian Universities. *Security of Strategic Affairs* , p. p. 15.

Ménissier, T. (2023, 02 17). Les nouveaux vecteurs de la crédibilité scientifique à l'interface entre mondes sociaux, Les quatre éthiques de l'intelligence artificielle. *Revue d'anthropologie des connaissances . O. e. journals, Éd.*

Nicholas, G. (2022, 07 20). *Cette prothèse de main alimentée par IA est également élégante.* Consulté le 11 11, 2023, sur r ZD NET::

<https://www.zdnet.fr/actualites/cette-prothese-de-main-alimentee-par-l-ia-est-egalement-elegante-39944932.htm>

Ofis. (2024, 02 09). *Systèmes d'intelligence artificielle générative: quelques points de vigilance.* Consulté le 12 06, 2024, sur Office Français sur l'intégrité scientifique: www.ofis-france.fr

Ould Babaali, K. (2022, 12). A new approach for road extraction using data augmentation . . *Indonesian Journal of Electrical Engineering and Computer Science* , 28 (03), p. 1493.

Rebecca, F. (2017, 09 11). (2017, 11 09). *La citoyenneté controversée, attribuée à l'humanoïde Sophia par l'Arabie Saoudite.* Consulté le 07 27, 2024, sur Village de la justice:.

Consulté le 07 27, 2024, sur <https://www.village-justice.com/articles/citoyennete-controversee-attribuee-humanoide-sophia-par-arabie-saoudite,26391.html>

Redbond, C. (2023, 10 12). *IA générative c. IA prédictive : le match.* Consulté le 07 27, 2024, sur blueprism: :

<https://www.blueprism.com/fr/resources/blog/generative-ai-vs-predictive-ai/>

Rouge, H. d. (2023, 01 16). *La propriété des contenus ChatGPT : enjeux et implications.* . Consulté le 07 12, 2024,

sur TLMR: [https://tlmr-avocats.com/la-proprieete-des-contenus-chatgpt/#:~:text=En%20effet%2C%20pour%20les%20utilisateurs,contrefa%C3%A7on%20de%](https://tlmr-avocats.com/la-proprieete-des-contenus-chatgpt/#:~:text=En%20effet%2C%20pour%20les%20utilisateurs,contrefa%C3%A7on%20de%20)

[chatgpt/#:~:text=En%20effet%2C%20pour%20les%20utilisateurs,contrefa%C3%A7on%20de%](https://tlmr-avocats.com/la-proprieete-des-contenus-chatgpt/#:~:text=En%20effet%2C%20pour%20les%20utilisateurs,contrefa%C3%A7on%20de%20)

Sagesse. (2017, 01). *Amélioration de la gouvernance dans le système de l'Enseignement Supérieur en Tunisie: vers une autonomie des universités et de nouveaux mécanismes d'assurance qualité.* Consulté le 07 23, 2024, sur Sagesse: https://www.uni-med.net/wp-content/uploads/2019/07/SAGESSE_Plan-de-diffusion-du-projet.pdf

Vergès, E. (. (s.d.). Ethique et déontologie de la recherche scientifique, Un système normatif communautaire. *Presses de l'Université Toulouse Capitole* , 131-132.