ChatGPT – A Systematic Review of Published Research Papers

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ChatGPT was released on November 30, 2022 by OpenAI. After its launch, it started to be used by many users for different fields of interest. Several scientific articles have even been published in which ChatGPT appears as an author because text generated by him was used. The impact it had on technology is enormous and that is why many materials have been published on how to use it in different fields as well as in different usage scenarios.In this material, we carry out an analysis of the materials that were published in three months after the appearance of ChatGPT (December 2022, January 2023 and February 2023). For this synthesis, the materials indexed by Google Scholar, Scopus and Web of Science were analyzed. Within the analyzed materials, scenarios of using ChatGPT and how to interact with it are identified. We also present the way of involvement or use of ChatGPT in education, science and research and in the final part of the material we present some suggestions for future research that can be carried out with the help of ChatGPT.
Keywords: ChatGPT, OpenAI, Papers, Research, Review

1 Introduction

Launched recently, ChatGPT ended up having a lot of users in a very short time, and that's because we're living in a time when artificial intelligence is born and ended up being used in a beneficial way for users. Its purpose is to understand and generate human-like text in response to natural language input, and it can perform tasks such as language translation, text completion, and question answering. Its capabilities are achieved by training on large data sets so that it can learn patterns and relationships in language without explicit supervision. Certain researchers argue that this stage is as important for the appearance of electric current, or the appearance of the mobile phone or any other magnificent appearance in history.

It is very important to adapt in any field and be able to use new technologies as well as this new artificial intelligence technology in our fields of interest.

After the appearance of ChatGPT, many articles appeared in which its use is presented for solving problems in different fields. In this article we present materials that have appeared on the use of ChatGPT in areas such as education, health, Internet of Things, Finance and Investments as well as in the academic writing part. For some articles ChatGPT even appears as the author, although this is not accepted by some researchers, and should normally be given as the reference for that article. Also in this material we perform an analysis of Web of Science indexed publications and Scopus indexed publications through which we want to present the high degree of publication of materials that use ChatGPT.

2 Number of the ChatGPT related publications
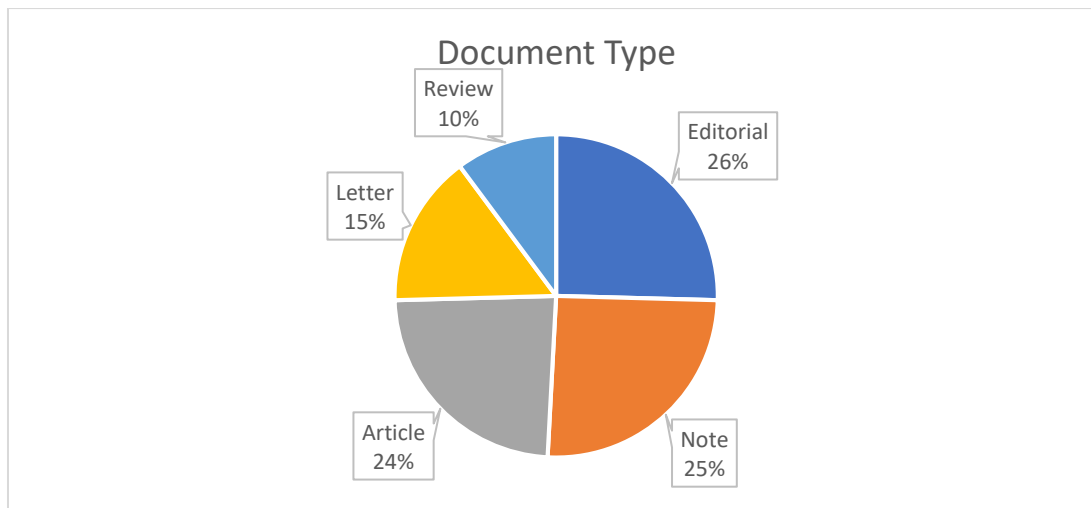
2.1 Publications on Scopus

A search of the term ChatGPT among Scopus materials found 59 materials published in the period 2022 – 2023 (February). Of these, 2 materials were published in 2022 (December) and 57 materials were published in 2023 (January and February). 145 unique authors were identified for these materials. Only 8 authors have their names on several materials: Graham F and Stokel-Walker C. on 3 materials and with two materials each: Stiglic

G., Pallant J.L., Aljanabi M., Gosak L., Huh S and Khan A.R., Figure 1.
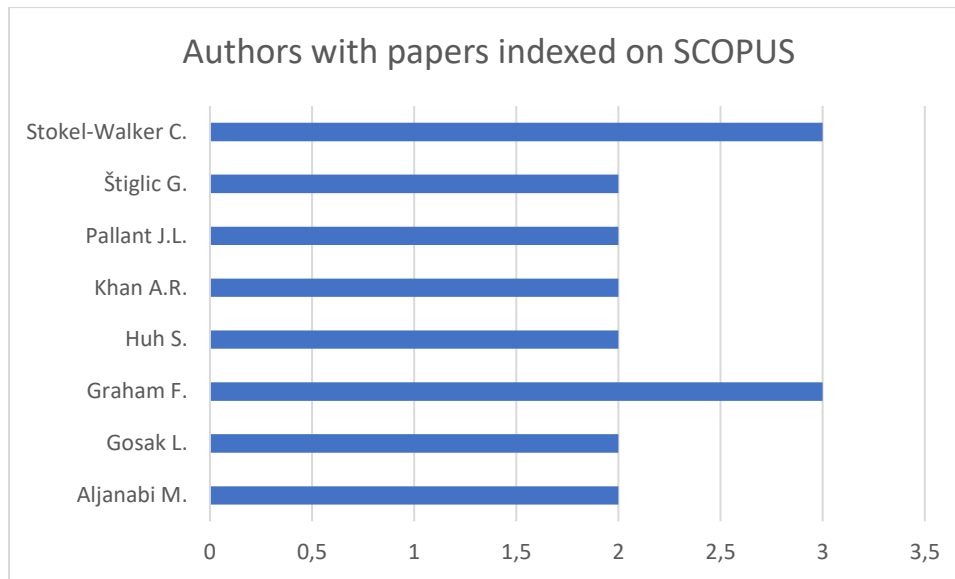
Fig. 1. Authors on Scopus

The documents identified on SCOPUS are from different categories. After the analysis, it was observed that only 14 materials are published in the form of articles, most of them being Editorials or Notes, Figure 2.

Fig. 2. Document type on SCOPUS

Applying the country filter, we get that most of the materials were published in the United States of America, Figure 3.
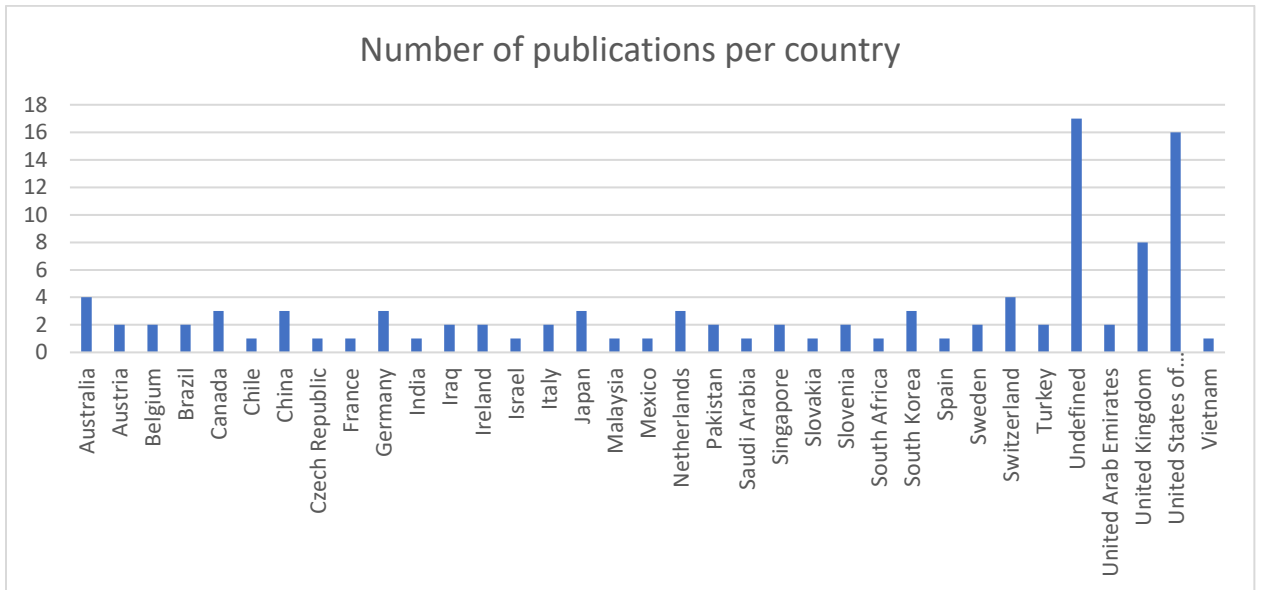
Fig. 3. Number of publications per country

These numbers will surely increase in the coming period as many authors will try this tool and publish their results.

2.3 Publications on Web of Science
On the Web of Science on February 28, 21 materials with the keyword ChatGPT were identified. Among the 21 materials, one is in German, the remaining 20 materials are in English. Most of the materials identified are of the Editorial Material type, with only 2 published articles, Figure 4.
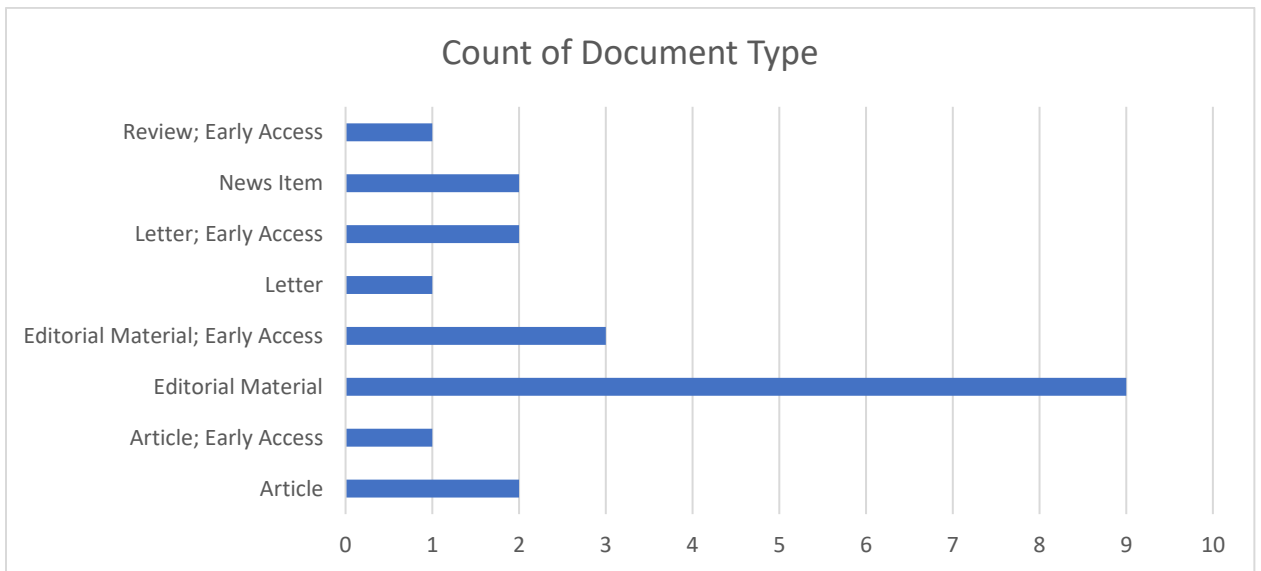
Fig. 4. Count of Document Type on Web of Science

Table 1 shows the number of citations of these materials. The table shows only papers that have citations. It should be noted that the articles were published in December 2022 and January and February 2023 respectively, and for this reason they have such a small number of citations. Only citations with WoS are considered for this analysis.

Table 1. Number of citations per paper

Paper	Publisher	Publisher City	Early Access Date	Number of citations
(Yeo-Teh & Tang, 2023) [1]	TAYLOR & FRANCIS INC	PHILADELPHIA	2023	1
(Else, 2023) [2]	NATURE PORTFOLIO	BERLIN	JAN 2023	1
(Stokel-Walker, 2023) [3]	NATURE PORTFOLIO	BERLIN	JAN 2023	3
(O'Connor, 2022) [4]	ELSEVIER SCI LTD	OXFORD	DEC 2022	2

Figure 5 shows the degree of use of materials on Web of Science. This indicator shows the number of reading these papers on the Web of Science platform and the accessing number of them.
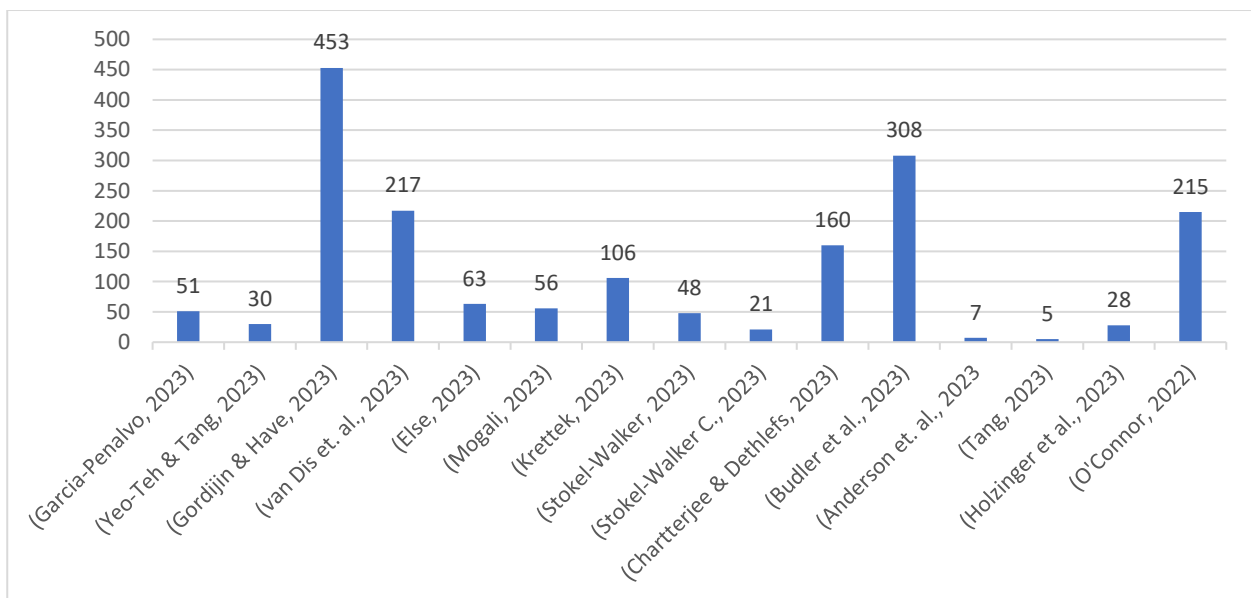
Fig. 5. Paper usage count. Sources [1] - [17]

2.1 Publications on Google Scholar
Through a search for ChatGPT on Google Scholar, 5700 materials were identified in total. For the period 2022-2023, 1450 materials were identified and only for the year 2023, 1290 materials were identified. As many types of documents are indexed on Google Scholar it is to be expected that most of these are not articles and other materials published in another form. For this reason, we will not perform analysis on them, but only present the analyzes performed for the materials indexed on Web of Science and Scopus.

3 Domains and areas of using ChatGPT
ChatGPT is used in many areas and the obtained results are presented in papers that approach different domains. In this chapter, we present the most used domains for ChatGPT.

3.1 ChatGPT and Education environment
ChatGPT has influenced the educational field, and some papers that are published in the first three months after the launch of ChatGPT try to answer to the next question: How could ChatGPT influence the educational environment?

In [18] the authors present the way this artificial intelligence model works together with the advantages and disadvantages of its use. It also provides answers on how ChatGPT should be used to help both students and teachers in order to optimize the learning process. According to [18], ChatGPT could help the learning process due to the tutoring it can offer to students and its ability to adapt information corresponding to the level of questions received from the user, the translation of educational materials can also help foreign students, the interactive mode of this model is another strong point because this is one of the best learning methods for a student. The author also states that studies have demonstrated that this model can automate the scoring of grade essays with a correlation of 0.86 and it was able to identify key features of well-written essays. On the other hand, some of the disadvantages of this model were also identified even by ChatGPT itself: lack of human interaction, limited understanding, confidentiality, limited creativity. ChatGPT can represent an extraordinary tool for learning, used as a method for deepening information, but it could not replace education in academic environments. It must be taken into account that due to its serious limitations, it has sometimes happened to generate erroneous answers, even making references to non-existent articles. It also led some teachers to rethink the way of evaluating students.

In [19] the author presents the need for responsible and ethical use of artificial intelligence, respectively the ChatGPT model in the educational environment. It states that the implementation of the ChatGPT model in educational environments plays a significant role in terms of optimizing educational experiences, but emphasizes that the technology must be used responsibly and ethically. According to him, the ChatGPT model should be used to complement the information the students have, but not to replace the need to learn. It is necessary to ensure that students will continue to develop their ability to think critically and find solutions to problems, as well as taking measures to reduce any existing prejudices and forms of discrimination. Regarding responsible use, the author states that many teachers are considering rethinking the way students are evaluated to avoid as much as possible the use of artificial intelligence by students in this process. Because of the speed with which this model was launched and used by an extremely large number of users, educational environments have not yet had the opportunity to alter their policies. It is mentioned that ChatGPT does not intend to replace qualified instructors. According to the principles of responsibility, it should supplement the information in the class and provide support to the students in applying and testing the learned concepts. Among the objectives of education is the cultivation of interpersonal relationships, and both the student-student relationship and the student-teacher relationship play an important role even in the learning process. It is important that the students are presented with the working mode of the ChatGPT in order to know both the opportunities that it can offer and also the limitations that the model can have.

In [20] the authors used ChatGPT to generate responses for specific disciplines. The answers were regenerated 5 times and then they checked the percentage of plagiarism using Turnitin. According to the analysis, the percentages of plagiarism were between 0% and 50%, which is why the rethinking of the students' evaluation method and the assignment of homeworks was considered. They highlight the fact that students could take advantage of the existence of this model to stop making efforts in the learning process and even to try to pass the assignments using this model. They also support the fact that used in the previously specified way, students could become dependent on artificial intelligence, and their development could be stagnated both on a personal, educational and professional level. In terms of opportunities, students could use ChatGPT to organize their ideas and create a template that they can later use to implement the assignments.

In [21] the authors present the opportunities that ChatGPT brings to all types of users for learning(elementary school students, high school students, university students, groups and remote learners) and for teaching as: personalized learning, lesson planning, language learnings, research and writing, professional development, assessment and evaluation. But they are also made aware of the possible problems that could result from the use of this model. Among these are: the difficulty to distinguish between the text generated by the model and that generated by a student, as ChatGPT has the ability to generate text that cannot be identified by plagiarism software, lack of understanding and expertise, copyright issues. As presented, ChatGPT can be a great tool if it is used properly, respecting its purpose of complementing the information for the deepening of the concepts and a better understanding.

In [22] the author describes how ChatGPT can complete the tests and exams offered to students without being able to detect whether the text was written by a human or by artificial intelligence. Currently, there is an application designed precisely for detecting the use of artificial intelligence in completing certain tasks, but this is only at the beginning and the level of accuracy is not yet concrete. Some educational institutions are trying to rethink the way tests, exams and evaluations should be held. They argue that evaluations should avoid the use of the computer, be written on paper, based on skills, real-time and oral. In contrast, other educational institutions encourage teachers to discuss with students about this tool and its limitations, as well as how to avoid plagiarism in order to respect the ethics of the universities.

In [23] the authors present the impact that ChatGPT had on education, as well as the way to detect text generated by artificial intelligence. According to their study, students are predisposed to use artificial intelligence to meet deadlines for various assignments, which is why the idea of exams being held in physical format without access to computers has returned. The "AICheatCheck" web application was launched to help teachers distinguish between the self-generated test and the one generated by artificial intelligence.

3.2 ChatGPT and Medical Domain
ChatGPT also had an influence on the field of e-health, especially on medical writings, and further on we will analyze some articles written based on this exposure.

In [24] the author has analyzed numerous publications about the implications of ChatGPT in the medical field, including both the professional, the educational-medical and the research dedicated to e-health. In this analysis, he highlights the benefits that ChatGPT seems to bring to e-health, among which we mention: improving medical writing, improving the research process (researchers could invest more time in the practical part of research), predicting diseases, the availability to explain to users what certain medical concepts represent in their understanding, and based on them ChatGPT seems to be an effective tool for researchers. On the other hand, the risks, concerns and limitations of this model must also be taken into account. Some of these are represented by: lack of ethics, originality and transparency, plagiarism, and inaccurate answers can also have serious consequences. The lack of data confidentiality is another important risk, as well as the fact that the source from which the model was prepared is not updated. In terms of medical education, if used responsibly, ChatGPT could help enormously in understanding the rigorous concepts specific to this field. In the antithesis, it is considered to change the evaluations that the students support in order to avoid plagiarism as much as possible and the many negative effects it could have on education.

In [25] the authors highlight the process that takes place in order to issue medical guidelines. Issuing a guideline is a long-term process that involves the selection of as many reliable and accurate research sources as possible. In this process, it is important that the issuer maintains the course of the purely

scientific guide, without directing the medical research towards personal opinions regarding the researched field. Also, updating them is difficult, according to the authors, there is a possibility that the information might not be up-to-date between the start of the updating process and the actual publication or the inappropriate selection of data could affect the veracity of the guideline. Having said that, ChatGPT seems to represent a promising tool for the medical future. It could optimize the process of issuing guidelines taking into account the speed with which it can access the databases, which would help doctors to focus more on the application of practices. Due to the conversational capacity with which this model was implemented, ChatGPT can help patients by explaining the implications of diseases, how they can be treated or how they could detect certain diseases. However, it is necessary to mention that ChatGPT should not be seen as a substitute for medical assistance, but as a supplement to it.

In [26] the authors present how ChatGPT could be involved in the healthcare field in order to help clinical professionals both in detecting diseases or treatments that need to be followed, as well as allow them to focus on the tasks that involve human decision-making. According to them, ChatGPT can excel in drug discovery by identifying and classifying chemical formulas. It can also provide cancer treatment based on magnetic resonance or predict ageing related diseases. However, the model must be used responsibly, since the accuracy of the data is not completely known and the detection of certain diseases or treatments must also be done according to interrelation characteristics. As an example, ChatGPT is unable to diagnose patients with mental illnesses because it lacks emotional behavior.

In [27] the authors wanted to check if ChatGPT could be used in medicine that deals with the antimicrobial part. In this approach, they asked a series of questions to the model in order to be able to conclude whether ChatGPT could identify all the scenarios. According to them, the model was able to identify certain scenarios along with the possible treatment, but there were also exceptions in which ChatGPT provided feedback that could have endangered the patient's health. Thus, the integration of ChatGPT in antimicrobial medicine should be done with great caution, and it could not replace the consulting infection doctor.

In [28] the authors begin the article with a brief presentation of ChatGPT as well as highlighting the possible advantages and disadvantages of its use in everyday life. Along the way, they tested the veracity of the answers that ChatGPT offered to questions such as: What are the applications of NPL, What will be the impact on health services and What is the internet of orthopedic things and its classification. The answers received from ChatGPT to the above-mentioned questions were compared with existing answers in the literature. According to them, used with caution, ChatGPT could have a positive impact on the medical industry, and another huge advantage is represented by the fact that it could be used as a virtual assistant to help potential patients when no other way of help is available.

3.3 ChatGPT Used for Writing

Writing is another area where ChatGPT has proven its effectiveness. Below are presented a series of articles that highlight this aspect.

In [29] the authors started from the premise that the use of LLM languages (Large Language Models), such as ChatGPT, in academic writing can raise a number of problems related to the resulting content. It was highlighted that there are a number of important challenges regarding: knowing the real contribution of a human author to the creation of a certain content, and the possibility that human authors do not verify the veracity and correctness of the content generated by LLM and take it as such. Based on these findings, the authors of the article recommended three safeguards regarding the transparency and credibility of content, consistent with the rules governing the use of content-generating AI tools: information (confirmation by the human author that he used LLM for content generation),

accreditation (the exact contribution of LLMs to the resulting content), verification (the content generated by LLMs must be verified by human authors).

In [30] the authors carried out a study by which they tried to verify if the use of ChatGPT allows the creation of publishable content, comparable in quality to the peer-reviewed content conceived by human authors and published in journals. Thus, the authors investigated the differences between content conceived by human authors and content generated by ChatGPT. Based on the premise that ChatGPT can produce a concise introductory section if given well-defined requirements, introductory sections from 327 published articles were compared to introductory sections produced via ChatGPT. A methodological approach was used divided into two main sections: Data Description (exploring ChatGPT's ability to generate publishable content requires the use of two types of data, human-authored text and ChatGPT-generated text) and Analytical Methods (two methods were used analytics for text data, i.e. supervised text mining and unsupervised text mining). Using text classification algorithms with high predictive accuracy it was concluded that text generated by ChatGPT differs significantly from that conceived by human authors.

In [31], the authors investigated whether it is possible to train a machine learning model capable to disting between a small text written by a human user and a similar text generated by ChatGPT. Their study was based on short reviews posted online. Thus, a methodology consisting of two modules was used. In the first module, a machine-learning model trained to distinguish between human-created text fragments and text samples generated by ChatGPT was included, and in the second module, an AI framework that allows the interpretation of the results provided by the machine-learning model. XAI (Explainable Artificial Intelligence) was used to highlight the differences between the manner of writing a text specific to a human operator and ChatGPT respectively. For this purpose, two experiments were carried out, the first one

used text generated by ChatGPT through custom queries, and the second had as a reference point text obtained by reformulating reviews conceived by human users. It was concluded that it was more difficult for the machine learning model to distinguish between human-conceived and ChatGPT-generated reviews when the text obtained from the reformulation of human user-conceived reviews was used.

In [32], the authors deal with the topic of using ChatGPT in scientific writing, emphasizing the utility of this tool for text generation on a very wide variety of topics. Thus, research articles can be written and data and information can be synthesized. ChatGPT can suggest the researcher appropriate titles for the paper he wants to develop, help him to draft it, and also proves useful in the process of editing and summarizing the paper. Artificial Intelligence does not allow the generation of new ideas, but it can assist the researcher in organizing, synthesizing and developing their own. However, the authors state that, even if it represents an important moment in terms of the current stage of development of the information society, the automatically generated text cannot yet represent a substitute that replaces the specifically human capacity for thought and creation. It is concluded that, considering all these aspects, it is necessary to reach a consensus regarding the ways to regulate the use of chatbots in the field of scientific writing.

In [33] the authors started from a very important premise, namely that scientific information can only be shared through a language, the emergence of language tools based on Artificial Intelligence representing a real revolution in the field of scientific communication. ChatGPT is just one in a wide range of language tools, with others still in development or to be released in the near future. Although ChatGPT has proven a multitude of utilities, the quality of the text structure it creates can be misleading, as readers may be convinced that it is of human origin and may pass over errors in the text without further checking their veracity.

Additionally, ChatGPT can make connections that don't make any sense which can be very confusing for readers. The authors of the article pointed out that AI language bots are unable to understand new information by not being able to perform in-depth analysis, which can prove to be a limitation for the scientific character of a paper. Consequently, the authors offered a series of recommendations that can allow the realization of a scientific paper to fully benefit from all the advantages of using Artificial Intelligence.

3.4 Using ChatGPT for Finance and Investments

In the following, we will analyze some articles regarding the impact that ChatGPT has on the financial and investments field.

In [34] the authors implemented a study methodology to test market efficiency using a sample of AI-themed crypto-assets, for which they calculated an AI crypto index. The CoinGecko portal was used as the data source and 10 AI-themed samples were selected for the July – December period. According to the results obtained by them, the launch of the ChatGPT model led to an increase in returns for most AI based tokens and AI cryptocurrency index. In contrast, during this period the Bitcoin currency experienced a decrease in value.

In [35] the authors aimed to test the capacity of the ChatGPT model in the financial field. This testing was carried out in several stages in order to be able to cover areas such as measure the financial literacy or advice utilization. In parallel with ChatGPT, other standardized tools were used to be able to conclude as precisely as possible the expected results compared to the real ones. According to them, ChatGPT had accurate results in the measurement of financial literacy, but the results were not good at all for tests involving calculations and these being said it is not recommended to use ChatGPT for the financial field.

In [36] the authors present the potential of using ChatGPT to optimize communication between people with financial knowledge and those without financial knowledge, thus the possibility of translating financial models into terms that are easy to understand for any category of public. Thus they analyzed the answers received from the ChatGPT model for financial terms such as: earnings to price, alpha, beta, and illiquidity for which the answers were acceptable and easy to understand. They also asked the model for an easy-to-understand explanation for any category of people for a complicated financial model. According to them, the limitations of the ChatGPT model must be taken into account in this field, as some of the answers generated were inadequate or erroneous.

4. Conclusions and Suggestions for Future Research

According to what has been presented up to this moment, it can be seen that the launch of the ChatGPT model represents the opening to a new world, the one in which humans together with artificial intelligence could improve as many aspects of life as possible. We have already analyzed several areas of general interest in which ChatGPT could help improve them, but there are certainly many more areas for which this model could have an impact.

In the future ChatGPT could definitely improve or even replace the consulting field. To support this hypothesis, we can only think of the ability of this model to simulate a conversation with a human and the large volume of data on which this model was prepared. For example, ChatGPT could offer support to a user who wants to make a professional conversion but is not sure what this conversion would entail. At this moment, ChatGPT will definitely respond with a series of steps that should be followed to achieve that goal and with a series of examples. Having this context, there is the possibility that users should first call ChatGPT and possibly later call a specialized consultant. However, it must be taken into account that we cannot rely 100% on the information received from ChatGPT, not yet knowing the level of correctness of the data used to generate the answers, but we could certainly

have a starting point on which to continue the research and a better understanding.

Another field on which ChatGPT could have an influence could be represented by e-commerce. Of course, a customized integration would be needed for the respective business, but ChatGPT could be able to offer support to the clients of e-commerce platforms, reducing the companies' costs regarding trainings or personnel. On the other hand, this aspect could have a negative impact on people, by the simple fact that there could be the possibility of their total or partial replacement.

There should be a way for ChatGPT to be presented to as many people as possible together with the multiple advantages it offers and examples of how its use could be leading to higher productivity. But also for the integration of ChatGPT in the currently existing domains, it is necessary to issue a more detailed analysis on the possible impediments generated by this model.

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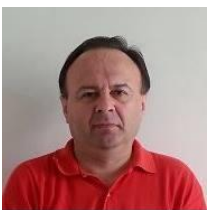
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