Engineers' Perspectives on the Use of Generative Artificial Intelligence Tools in the Workplace

Jose Joskowicz
University of the Republic
Faculty of Engineering
Montevideo, Uruguay
josej@fing.edu.uy

Daniel Slomovitz
University of the Republic
Faculty of Engineering
Montevideo, Uruguay
dslomo@gmail.com

Abstract— **The integration of Artificial Intelligence (AI) into the workplace requires commitment not only from the leadership of managers but, equally important, from the engineers responsible for its implementation. This paper presents a survey on perceptions concerning the utilization of AI tools in engineering environments. It was focused on engineers and students in the areas of electricity, electronics and computing. The questionnaire covered demographic information, Artificial Intelligence knowledge level, preferred tools, primary applications, perceived impact, and attitudes toward labor substitution. With the endorsement of the IEEE Uruguay Section and IEEE Region 9, the survey was distributed via email to a diverse group of potential participants, in more than 20 countries, including all IEEE members in Region 9.**

Keywords—Artificial Intelligence, AI tools, generative, future impact, IEEE member.

I. INTRODUCTION

The latest advances in generative Artificial Intelligence (AI) have produced a great social impact and are having a strong impact on work activity in various industries and sectors. Companies are introducing these technologies at all levels, from the management decisions to the production areas and the innovation centers. Some researchers have been performed on how the new AI techniques can help in prototyping and in the innovation process [1][2]. Other explores how top management can encourage and facilitate artificial intelligence-enabled business models innovation [3] and the impact of the adoption of AI techniques in industrial production systems and some specific industries, such as manufacturing [4]. However, it is still not clear the degree of adoption that these technologies are having in various work environments. Many people believe that AI will replace, at least in part, some work activities. The incorporation of AI into the workplace requires not only the conviction of top management, but also and fundamentally, of the engineers and technicians who must apply it in their daily work.

Some surveys and studies have been performed with regard to the impact of AI in the workplace. The Organization for Economic, Cooperation and Development (OECD) has recently published the results of a survey performed with workers and employers in finance and manufacturing industries [5]. The survey reveals that workers in these industries tend to be very positive about the impact of AI on their work. Around 80 % of AI users said that AI had improved their performance at work, compared to 8 % who said that AI had worsened it. Nevertheless, some workers express some concerns about the impact of AI on job stability and wages. In a general survey regarding how Americans think about artificial intelligence [6], nearly half (46 %) of the responders are very or somewhat excited about AI that could perform repetitive workplace tasks, compared with 26 % who would be very or somewhat concerned about that. In a study conducted in twelves Western European countries, it is shown that 67 % of European public organizations have adopted one or more AI use cases [7].

These available reports and surveys were performed in some industry or public sectors, or to the general public. Nevertheless, none of them studied the impact of AI specifically in the field of engineering. This motivated our survey, focused on knowing the level of knowledge, use and perspectives of engineers and students, mainly associated to IEEE, in relation to AI tools in their work. The degree of knowledge, the used tools, the predominant uses, the impact and the perceived perspectives regarding labor replacement are investigated and described in the following sections. These results may be taken into account for managers on any industry whose workers are electrical or computing engineers.

II. STUDY METHODOLOGY

This survey was carried out on engineers and students with an electrical, electronic and computer profile, with the aim of collecting data on their experience and perceptions about the use of AI tools at work. The survey was designed to obtain demographic information, level of knowledge in AI, tools used, main uses, perceived impact and attitudes towards labor substitution. The survey questionnaire was sent by email to a large group of potential participants. A total of 375 responses were obtained.

The questions asked were the following:

1. Select the country where you work or study.
2. Select your main area of activity.
3. Select your age range.
4. Select your level of knowledge regarding Generative Artificial Intelligence (AI) tools.

5. Have you used any artificial intelligence application in your work in the last 6 months?

   If the answer is "No", continue with question 6.
   If the answer is "Yes", continue with question 7.

6. If the answer is no, can you tell us why?

   Continue with question 12.

7. What AI applications have you used? (Select all that apply).

8. What specific tasks or activities have you performed with the help of AI applications? (Select all that apply).

9. Briefly describe the main specific use that you have made with the help of AI applications (*open question*).

10. How has the use of AI applications impacted your work?

11. Do you think that current AI applications, or in the near future, will put your work at risk?

12. What is your perception of the future impact of AI applications in your profession?

13. What is your perception about the future impact of AI applications in other professions (other than your own)?

The survey was available between the dates May 4ᵗʰ 2023 and July 7ᵗʰ 2023.

III. RESULTS

The detailed results of each question are presented in Annex 1. A total of 375 responses were received from 20 different countries in the Americas. 52 % of the responses correspond to professionals who work as engineers or engineering technicians, 36 % to professionals whose main area of activity is teaching or academia, and the remaining 12 % to students.

A. General knowledge level and degree of use of AI tools

Only 21 % of respondents state that they have a high degree of experience in AI tools. 44 % have a medium degree of knowledge, and the remaining 35 % have low or no knowledge. There is not a clear relationship between the degree of knowledge and age. The lowest degree of knowledge is found among those under 30 years old and those over 60 years old: 40% of those under 30 years and 41 % of those over 60 years have little or no knowledge.

69 % have used an AI tool in the last six months. In this case, 77 % of those under 50 years old have used some AI tool, compared to 57 % of those over 50 years old. Of the 31 % who have not used AI tools, a third indicates that they do not know AI tools.

B. Most used tools and specific uses

The survey asked to detail the use of several generative AI tools, which are described below.

Text generation tools:

ChatGPT: Chatbot Generative Pre-trained Transformer (GPT) is a prototype dialogue-based AI automaton (chatbot), developed by the OpenAI company [8].

AutoGPT: It is an open-source experimental application that uses the capabilities of the GPT-4 language model [10]. GPT-4 is the most advanced text generation model from the OpenAI company [9].

BERT: Bidirectional Encoder Representations from Transformers (BERT) is a technique based on neural networks for the pretraining of natural language processing, developed by Google[11].

Copy.ai: It is a software that uses AI to generate texts, targeted to business and marketing applications [12].

Image generation tools:

Dall-E: An AI system that can create realistic images and art from a natural language description, developed by the company OpeanAI [13].

Stable Diffusion: An AI model capable of generating photorealistic images based on any text input [14].

Midjourney: An AI program with which its users can create images from textual descriptions [15], from the Discord platform [16]. Midjourney is an independent research laboratory.

StyleGAN2: An AI model for the generation of face images [17].

Video generation tools:

Synthesia: An application that allows to create videos of an avatar speaking, based on textual descriptions [18].

Audio generation tools:

Vall-E: A tool capable of simulating voices from a text and a short voice sample, developed by Microsoft [19].

Presentations generation tools:

SlidesAI: Designed to create professional slides for presentations from any text [20].

82 % of the responders use text generation tools, 33 % image generation tools and 10 % presentation, video and audio generation tools. ChatGPT turns out to be the most used application, by a wide margin: 89 % of those who use AI tools, have used ChatGPT in the last six months. The applications that follow in popularity of use, according to the survey, are Dall-E with 21 % and Midjourney with 16 %.

Specific activities carried out with the help of AI applications have a more even distribution. The main ones are text generation (61 %), general information search (57 %), text revision (42 %), data analysis (38 %) and software code creation (37 %).

Question 9, regarding specific uses, allowed for free text answers. Many of the responses can be included within the general classifications presented in question 8. However, some responses are remarkable: Several respondents mentioned that they use the tools to generate or improve reports and presentations, and to generate summary of different kind of texts. Some answers mention the use of AI applications that are not of the generative type, like digital twins, classification problems, health index assessment in electrical equipment to

predict failures in substations and power plants, image recognition, facial recognition, audio processing, among others.

C. Impact on work and future perspectives

79 % of respondents indicate that the impact of using AI applications has been positive or very positive in their work. Only 0.4 % have indicated that the impact of the use of these applications has been negative. It is noteworthy that none of the respondents answered "very negative". There are no significant differences in this response according to the age group.

15 % believe that this type of application puts or will put their own work at risk in the near future. This percentage grows to 25 % in students.

76 % have an optimistic or very optimistic perception about the impact of AI in their profession. This overall percentage rises to 83 % in the case of students and drops to 71 % in the case of engineering professionals. 57 % have an optimistic vision for the future of other professions. In contrast, there are 7 % of respondents who have a pessimistic or very pessimistic view about the future impact of AI in the engineering profession and 17 % in other professions.

IV. ANALYSIS OF THE RESULTS

The results indicate that, even in a group with technical training in engineering, the degree of general knowledge of AI tools is low in all age groups. Only 21 % of respondents have a high degree of experience in AI tools. The knowledge level is not equally distributed among the professions: 34 % of Professors or Academics reported a high degree of knowledge regarding AI tools, compared to 26 % for Computer Engineers, 13 % for Electrical Engineers and 7 % for students. Even so, the degree of use of these new techniques is high: almost 70 % of the group surveyed have used some AI tool, recently. Notably, the younger respondents exhibited even greater adoption, with an 85 % of those under 30 years old actively using AI technologies. Similarly, academics (students and professors) reports 79 % of adoption, compared to 59 % in the case of professionals. It is remarkable that students are the segment with lower knowledge in the technology (7 %), but with higher adoption of the available AI tools (87 %). Only 10 % of the total respondents stated that they did not know AI tools.

The most frequent use of AI techniques Is associated with the generation and analysis of texts. The most used application among those surveyed, by a large margin, is ChatGPT. It is interesting to note that the most common uses are the generation of texts and the general search for information. Software code creation ranks fifth in utilization.

Overall, the utilization of AI applications at work yielded predominantly positive outcomes. Particularly noteworthy is the significantly higher positive impact observed among younger respondents, with an 86% of those aged under 40 expressing favorable views. Furthermore, within the academic community (Professors and Students), 81% of respondents believed that the impact of AI on their work was positive or very positive. Even though 15 % of those surveyed believe that their job could be replaced by some form of AI, in general, an optimistic view of the future impact of AI applications is perceived. It is noteworthy that the impact of AI is perceived as more positive in engineering-related professions, compared to other professions. Also, optimism decrease as age increase (from 81 % for those with less than 30 years, to 67 % for those with more than 60 years old). It is worth mentioning that Students are the segment most apprehensive about the threat AI poses to their future jobs, with 25 % expressing such concerns. However, they paradoxically are the most optimistic group regarding AI's impact on their future profession, with an 83 % expressing positive expectations.

V. CONCLUSIONS

In the present work, the level of general knowledge and the degree of use of Artificial Intelligence tools among professionals and students of electrical and computer engineering have been analyzed, as well as the most used tools and their specific applications in the workplace. In addition, the impact that these tools generate at work and the future perspectives for their adoption have been examined. This information is useful and should be taking into account in any management decision.

The information was obtained by conducting a survey, to which 375 professionals or students responded, directly related to the areas of electrical engineering or computing, residing in 20 countries in the Americas.

From the analysis of the collected data, the following conclusions have been obtained:

The results of the survey reveal that the level of general knowledge about Artificial Intelligence is low. However, there is a great adoption in the use of AI tools in the workplace. Among the most used tools are those related to the generation and correction of texts, where ChatGPT stands out as the most used by a wide margin. Complementarily, many other AI tools are used, mainly for general information search, text generation and review, data analysis, software code creation, among other functions.

The adoption of AI tools seems to have had a significant impact on the work of the professionals and students surveyed. A very positive perception has been evidenced regarding the impact of the use of AI in the work of professionals.

In general, the future perspectives regarding AI at the workplace is positive, both in the profession of the respondents, and in other professions. The vast majority of those surveyed are not afraid of being replaced at work by AI techniques. However, a not insignificant number of professionals believe that this will be likely or very likely in the future.

In conclusion, the report shows that the level of knowledge about Artificial Intelligence is low, but its use is wide. Text generation tools are the most used in the workplace. The impact at work has been perceived as positive. Future perspectives are mostly optimistic, both in the engineering professions and in other professions.
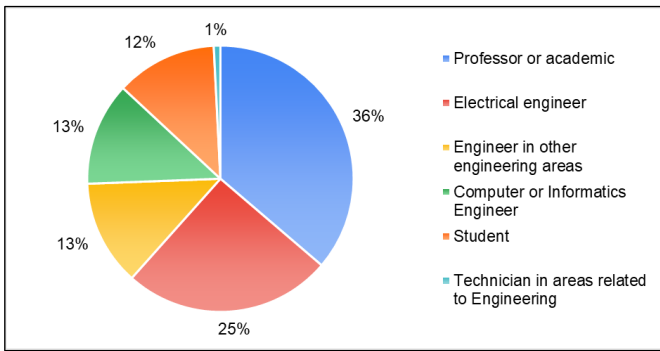
VI. ACNOLEDGMENTS
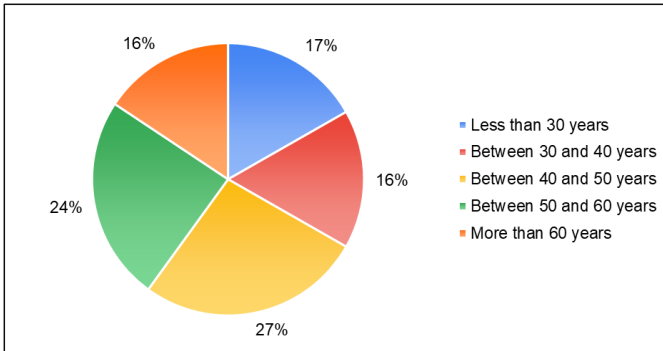
ANNEX 1: DETAILED RESPONSES

1. Select the country where you work or study.
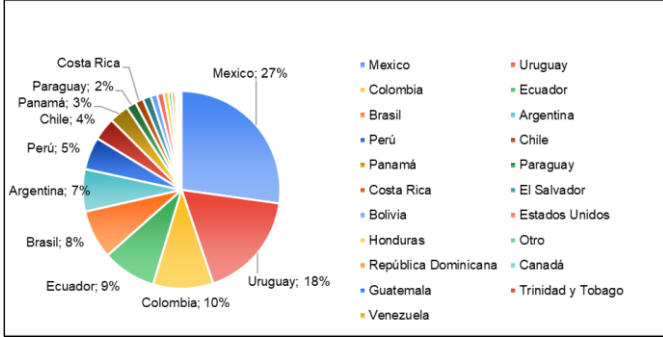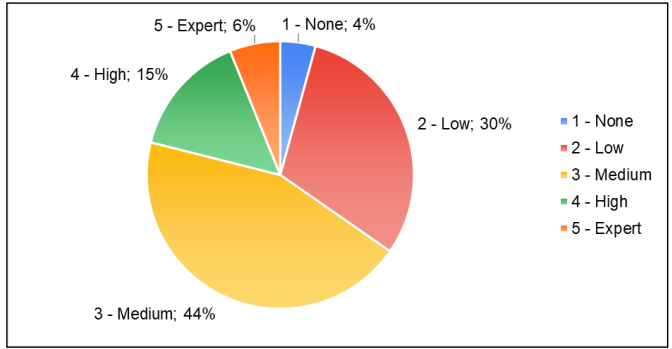

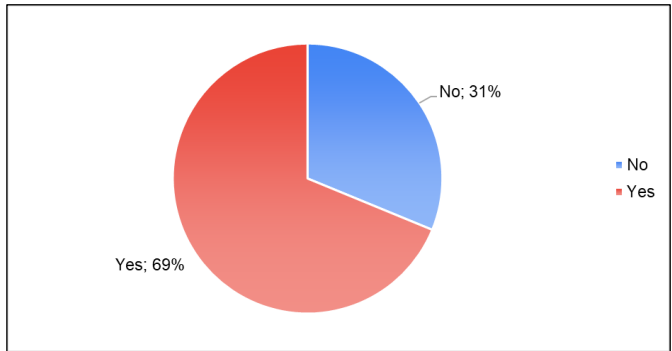2. Select your main area of activity.
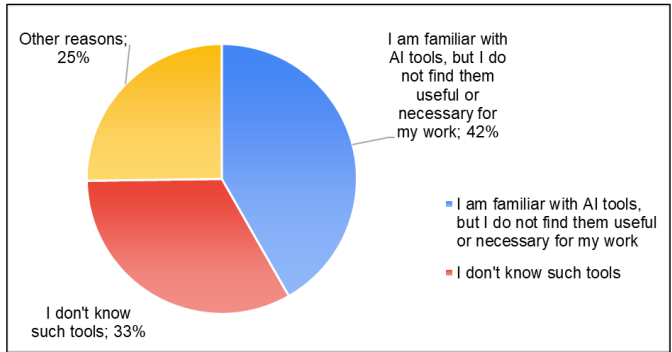

3. Select your age range.

4. Select your level of knowledge regarding Generative Artificial Intelligence (AI) tools.
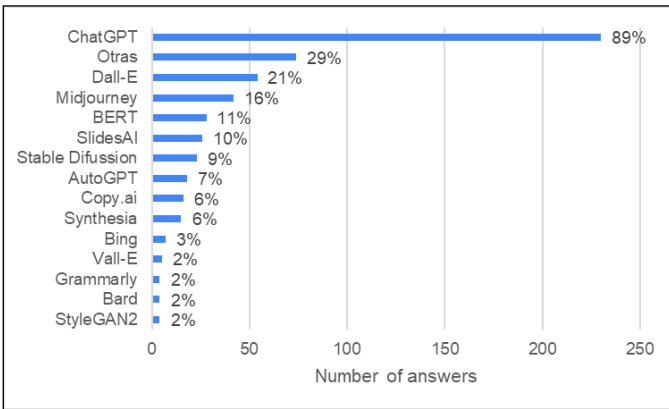

5. Have you used any artificial intelligence application in your work in the last 6 months?
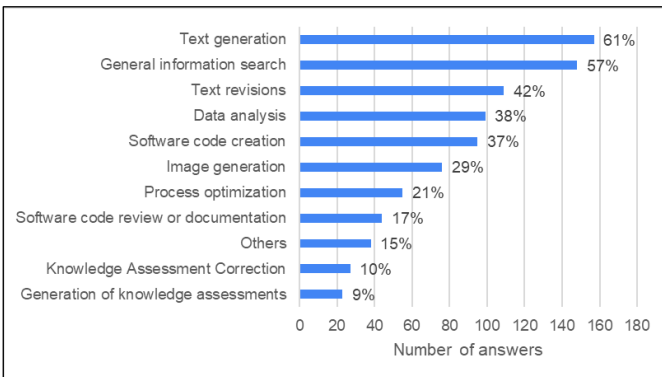

6. If the answer is no, can you tell us why?

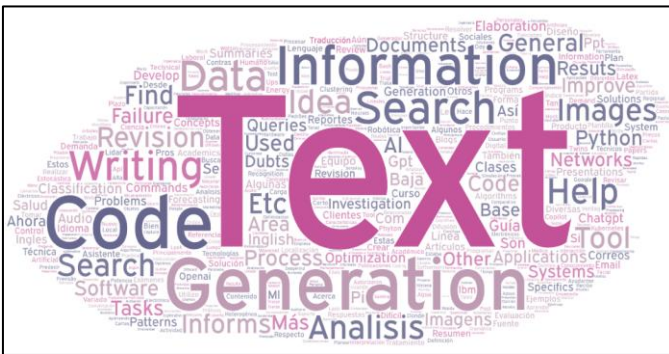7. What AI applications have you used? (Select all that apply).

8. What specific tasks or activities have you performed with the help of AI applications? (Select all that apply).
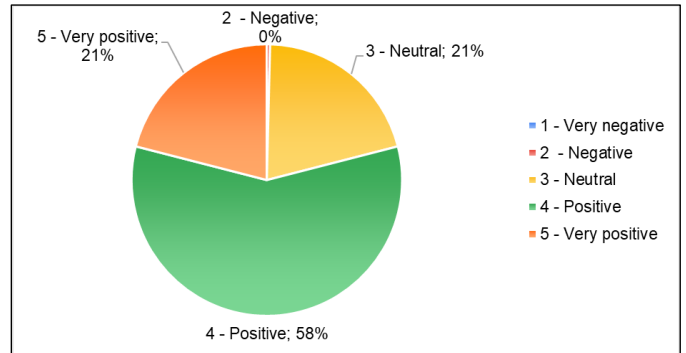

9. Briefly describe the main specific use that you have made with the help of AI applications (open question).
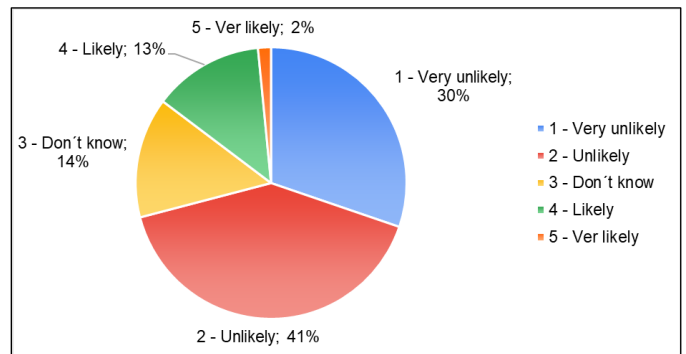
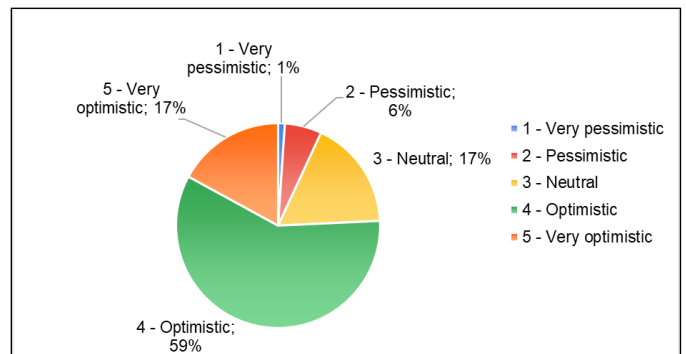The most mentioned terms are plotted in the following word cloud.

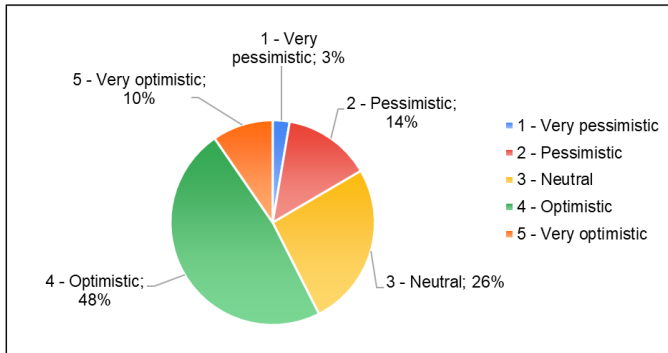10. How has the use of AI applications impacted your work?

11. Do you think that current AI applications, or in the near future, will put your work at risk?

12. What is your perception of the future impact of AI applications in your profession?

13.   What is your perception about the future impact of AI applications in other professions (other than your own)?

REFERENCES

[1] V. Bilgram and F. Laarmann, "Accelerating Innovation With Generative AI: AI-Augmented Digital Prototyping and Innovation Methods," in IEEE Engineering Management Review, vol. 51, no. 2, pp. 18-25, 1 Secondquarter,june 2023, doi: 10.1109/EMR.2023.3272799.

[2] A. Brem, F. Giones and M. Werle, "The AI Digital Revolution in Innovation: A Conceptual Framework of Artificial Intelligence Technologies for the Management of Innovation," in IEEE Transactions on Engineering Management, vol. 70, no. 2, pp. 770-776, Feb. 2023, doi: 10.1109/TEM.2021.3109983.

[3] P. Jorzik, A. Yigit, D. K. Kanbach, S. Kraus and M. Dabić, "Artificial Intelligence-Enabled Business Model Innovation: Competencies and Roles of Top Management," in IEEE Transactions on Engineering Management, doi: 10.1109/TEM.2023.3275643.

[4] M. O. Akinsolu, "Applied Artificial Intelligence in Manufacturing and Industrial Production Systems: PEST Considerations for Engineering Managers," in IEEE Engineering Management Review, vol. 51, no. 1, pp. 52-62, 1 Firstquarter,march 2023, doi: 10.1109/EMR.2022.3209891.

[5] "The impact of AI on the workplace: Main findings from the OECD AI surveys of employers and workers", https://dx.doi.org/10.1787/ea0a0fe1-en. Accesed in July 2023.

[6] "How Americans think about artificial intelligence", Pew Research Center, March 17, 2022, https://www.pewresearch.org/internet/2022/03/17/how-americans-think-about-artificial-intelligence/ . Accesed in July 2023.

[7] "Inteligencia Artificial en el Sector Público. Perspectivas europeas para 2020 y años siguientes", 2020 https://info.microsoft.com/rs/157-GQE-382/images/ES-CNTNT-eBook-SRGCM3981-v2.pdf

[8] https://chat.openai.com/. Accesed in July 2023.

[9] https://github.com/Significant-Gravitas/Auto-GPT. Accesed in July 2023.

[10] https://openai.com/product/gpt-4. Accesed in July 2023.

[11] https://cloud.google.com/ai-platform/training/docs/algorithms/bert-start?hl=en. Accesed in July 2023.

[12] https://www.copy.ai/. Accesed in July 2023.

[13] https://openai.com/product/dall-e-2. Accesed in July 2023.

[14] https://stablediffusionweb.com/. Accesed in July 2023.

[15] https://www.midjourney.com/ . Accesed in July 2023.

[16] https://discord.com/. Accesed in July 2023.

[17] https://github.com/NVlabs/stylegan2. Accesed in July 2023.

[18] https://www.synthesia.io/. Accesed in July 2023.

[19] https://vall-e.io/. Accesed in July 2023.

[20] https://www.slidesai.io. Accesed in July 202