

APPLICATION OF AI IN CRISIS MANAGEMENT

Arkadiusz BANASIK^{1*}, Piotr PIKIEWICZ²

¹ Silesian University of Technology, RMS2; arkadiusz.banasik@polsl.pl, ORCID: 0000-0002-4267-2783

² Silesian University of Technology, RMS2; ppikiewicz@polsl.pl, ORCID: 0000-0002-1348-9381

* Correspondence author

Purpose: Artificial intelligence (AI) can be applied in various areas of crisis management. It can provide numerous benefits concerning speed, effectiveness and precision of actions. AI accelerates the process of massive amounts of data processing, such as sensor data, satellite images, social data streams and much more. This enables to make quick analysis of a situation and make quick decisions in order to monitor various sources of information in real-time and detect early signals of a crisis. Advanced algorithms can identify patterns and anomalies enabling a quick response. AI can be used to model various crisis scenarios based on available historical and current data. This way it is possible to predict the probable effects of a given crisis and prepare for various situations. AI can analyze social media data to monitor community sentiments, identify potential threats and manage crisis communication. Automatic sentiment analysis systems can help understand society's response to a crisis. Advanced AI systems can be used to predict human behavior in various crisis scenarios. This allows to understand better how people may react and what their needs are in a given time. AI can help detect and combat cyber attacks, which constitute a serious threat, especially when it is necessary to maintain critical infrastructures. Integrating AI into crisis management requires caution because decisions made by AI systems should be consistent with ethical standards and they must consider the human supervision and assessment of the crisis situation.

Design/methodology/approach: The paper analyzes the AI methods applied during crises. The results of interviews conducted with students, teachers and authors' personal experiences are provided.

Findings: AI is a new way of solving problems, especially during crises. The new technologies determine the way and the speed of problems solving.

Originality/value: Originality based on the interviews and post-crisis (COVID) points of view are the value.

Keywords crises, AI, Chat GPT.

Category of the paper: Research paper, Viewpoint.

1. Introduction

In today's dynamic educational environment, where teachers, students, and educational institutions have to cope with various challenges, the application of artificial intelligence (AI) is becoming a significant research and implementation area (Banasik, Kempa 2023; Usidus 2023a, 2023b, 2023c, 2023d; Lindebaum, Fleming, 2023). In particular, the development of AI technology is offering new perspectives in the field management crisis in education. It enables faster reactions to sudden situations and more effective coordination of activities. This paper focuses on the analysis of specific applications of artificial intelligence in the context of management crisis in education. It also examines how modern technologies can support educational systems in coping with the challenges that educational surrounding variability provides (Fazgalić, 2022; Grioux, 2021).

ChatGPT is an advanced technology of artificial intelligence that may have many applications in various fields (Van Dis et al., 2023). Here, there are presented a few examples:

- Customer service: ChatGPT may serve as an automatic assistant answering customer questions and solving problems.
- Content generation and copywriting: ChatGPT is a powerful content generation tool that can create articles, blogs, posts on social media and much more.
- Translations and multilingualism: ChatGPT can help translate foreign languages and deliver information in many languages.
- Education and virtual tutors: ChatGPT can help do homework and prepare to examinations. For example, ChatGPT can be used to generate various tests or translate didactic materials in foreign languages. Additionally, ChatGPT can help students understand complex concepts by summarizing scientific papers or other texts.
- Entertainment and storytelling: ChatGPT can create scenarios and dialogues in the film and theatre industry generating creative and original ideas.
- Analytics and text-based data analysis: ChatGPT can be used to test data and analyze trends providing valuable information for companies and researchers.

The article contains an introduction, related works, ChatGPT analysis, discussion, and conclusions.

2. Related works

Intelligence is perceived as a feature of an individual who interacts with the external environment or deals with a problem or a situation. Intelligence is related to the ability to succeed, which implies the existence of goals. It emphasizes on learning (Ratten, Jones, 2023;

Burger et al., 2023; Korzynski et al., 2023), adaptation, and experience. Many definition of intelligence have been defined by Legg and Hutter (Legg et al., 2007), including some taken from the AI domain.

Intelligence can be perceived as the ability to use sense perception in order to understand even potentially unknown situations and confront them with the existing knowledge.

Artificial intelligence focuses mainly on the data analysis. According to (Jagadish et al., 2014), data sciences are based on data management and analysis. On one hand, data management covers acquisition, content extraction, integration and data representation. On the other hand, data analysis refers to the analysis and interpretation based on people. The stage of data management is devoted to data perception. Data analysis aims at providing the user the content that may be interpreted and then the decisions can be made. The sub-stage analysis concentrates on detection of patterns and correlations (for statistical purposes) in order to ensure the decision level appropriate for the interpretation based on people (Benaben et al., 2019; Hu et al., 2023).

Real-time Big Data applications are related to the industry, e.g., financial and stock markets, intelligent transport, warning systems etc. These applications are crucial because they help improve the quality of life, limit risk and rescue people (Mohamed, Al-Jaroodi, 2014). Due to the real time requirements, many challenges focus on collecting, transmitting, processing and visualizing huge amounts of data.

Metamodel of teamwork, which has been defined for the needs of crisis management, was described in (Lauras et al., 2015). It consists of two layers: a **primary layer**, which explains concepts and relationships in every teamwork situation and a **specific layer**, which contains concepts derived from basic ideas and which more precisely describe notions of a given field. The core is of agnostic nature; however, the layer is dedicated to the domain of management crisis.

3. ChatGPT analysis

Artificial Intelligence (AI) is a continually developing science field that has been shaping our digital reality for several decades. Since early theoretical considerations to contemporary apps based on deep learning, AI's history reveals some extraordinary journeys during which researchers and innovators have been conquering new lands in the field of intelligent devices.

In the beginning of Artificial Intelligence, from the 1940s to the 1960s, researchers experimented with innovative concepts and methods that aimed at creating machines that were able to think and make decisions similarly to humans. The modern era of Artificial Intelligence is a dynamic period in which researchers exploit advanced methods and technologies to create intelligent systems capable of solving complex problems. Among essential Artificial

Intelligence methods, which play an important role in various fields, used to analyze data or recognize patterns, it is possible to distinguish the following:

- Deep Learning – it is one of the modern most revolutionary artificial intelligence methods. It is based on neural multi-layer networks that automatically learn the representation data through information processing. That approach significantly has improved tasks performance such as image recognition, language analysis and predictions.
- Reinforcement Learning – it is a method in which the system agent makes decisions in an environment and his actions are rated by means of reward and punishment. Algorithms of reinforcement learning can use improvement strategies to maximize long-term benefits. This approach is applied, among others, in computer games, robotics and process optimization.
- Natural Language Processing (NLP) – Natural Language Processing is an area of AI that covers the human language understanding, interpreting and generating. Advanced NLP algorithms provide texts analysis, languages translations, image descriptions creation and interactions with users in a way which is close to the interpersonal communication.
- Deep Neural Networks (DNN) - Neural Networks of Deep learning is considered as a powerful tool in Artificial Intelligence. DNNs consist of many neuron layers that model complicated data dependencies. They are used in various fields, from images processing to financial trends forecasting.

3.1. ChatGPT – functioning rules

GPT algorithm or Generative Pre-trained Transformer is called a family of Artificial Intelligence models based on Transformer architecture. A key aspect of GPT is the pre-training, i.e., preliminary learning model on big data collection, which allows to acquire general linguistic skills. Here is a description of the GPT algorithm:

- Transformer Architecture: GPT is based on Transformer architecture, which focuses on attention mechanisms. This allows to analyze the sentence context effectively and to understand the dependence between various words in the text.
- Pre-training: This model is called the pre-training with the usage of the linguistic big data collection. In the case of GPT, the pre-training covers the prediction of the next words in a sentence. This enables the model to understand the text grammar, context and meaning.
- Fine-tuning: After initial learning, the model can be adjusted (fine-tuning) to specific tasks. That may concern different fields, such as machine translation, text generation, questions answers.

- Autoregression: GPT generates a text autoregressively, which means that every next word is generated based on the previous one. That allows for the creation of smooth and consistent texts.
- Main Multiplication (Multi-Head Attention): The main multiplication mechanism allows the model to focus on various aspects of the text, which increases the model's ability to analyze the context.
- Number of Layers: GPT usually consists of many layers of transformers. The bigger number of layers, the more advanced understanding of data dependencies.

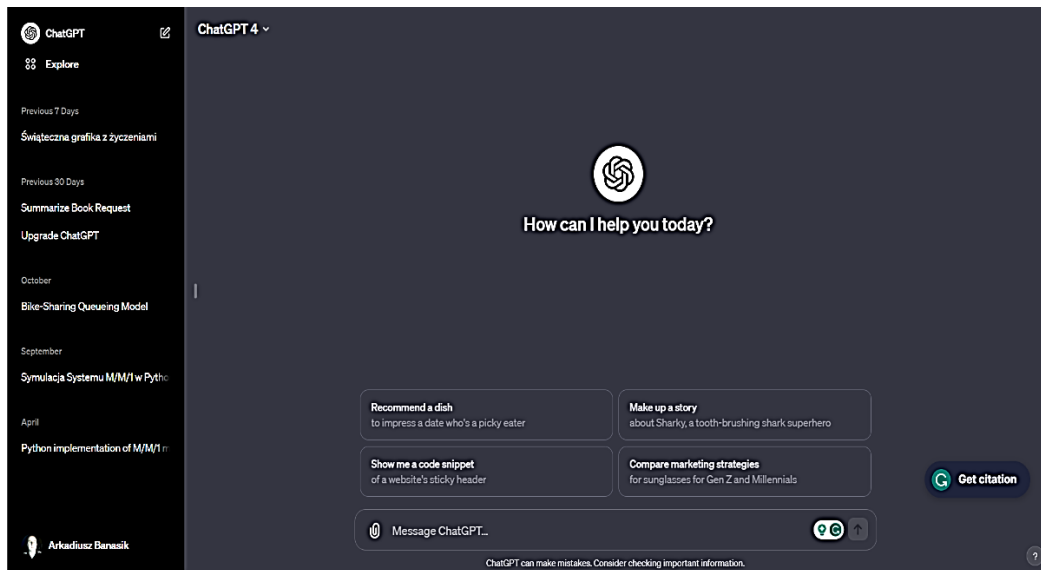


Figure 1. ChatGPT main window.

Source: <https://chat.openai.com/>, 29/10/2023.

In the case of ChatGPT, to generate answers based on the previous text, the sequential context is used. This model operates on a big collection of textual data. It allows the model to understand the language structure, grammar and semantic contexts.

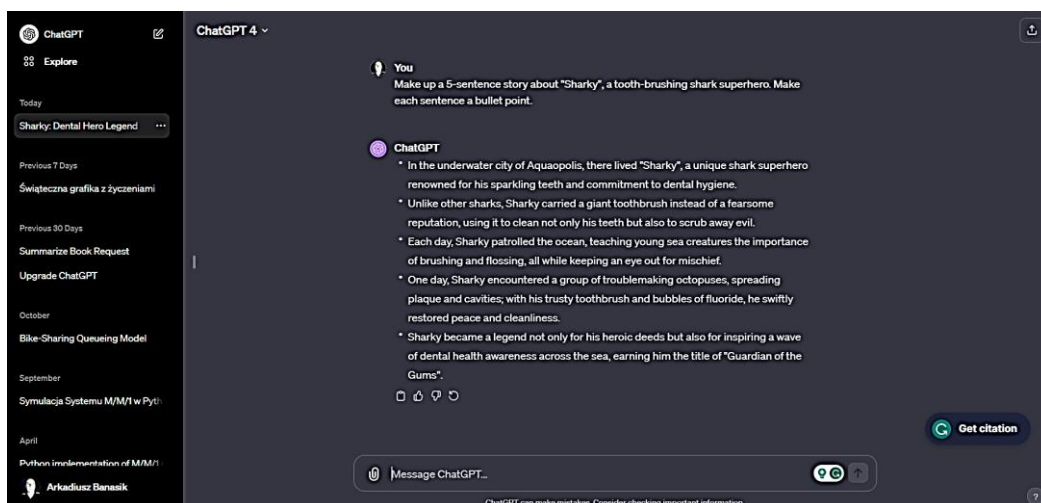


Figure 2. ChatGPT sample question.

Source: <https://chat.openai.com/>, 29/10/2023.

In practice the Markov chains are implemented as weights (parameters) inside the model. They are customizable during the training based on the relationship among words in sequences. Therefore, ChatGPT, a linguistic model based on GPT, can "remember" previous text parts and use them to generate consistent and contextually related answers.

Let's consider an example of using Markov chains for words prediction in sentences, for example, let's assume that there is a limited set of words: {w1, w2, w3}, representing three possible words in a given context, we want to predict the next word in a sentence based on the previous two words.

Example transitions matrix:

$$P = \begin{bmatrix} 0.3 & 0.5 & 0.2 \\ 0.2 & 0.4 & 0.4 \\ 0.1 & 0.6 & 0.3 \end{bmatrix}$$

Rows represent previous words, and columns represent possible following words.

$P[i,j]$ means the probability that the next word will be a j-th word, provided the previous two words are i-th and (i-1) these words.

Exemplary initial state may look like:

Initial state = [0.4 0.3 0.3]

If there is a sentence starting with "w1 w2 w3", it is possible to predict the next word by multiplying the initial state by the matrix transitions:

Predicted next word = Initial State \times P

The probability schedule for the following words in the context of the previous words will be got. By means of this simple method of using Markov chains it is possible to predict the sequence words in sentences.

It's worth noting that although this model is able to consider the context, it does not possess the access to specific sources of information and generated answers are based on statistics and patterns observed in the training set.

GPT has become one of the most advanced language models, capable of generating high-quality text, replying to questions, translating and performing many other linguistic tasks.

3.2. ChatGPT – specificity of crisis applications

ChatGPT is the advanced artificial intelligence technology with many applications advisable for students and teachers during education crisis. ChatGPT is a type of the algorithm of natural language processing. It is able to learn how to understand the context and generate new statements contextually. Thanks to this algorithm it is possible to reply to questions, talk, explain and develop new texts.

ChatGPT may constitute help with school assignments and exams preparations. For example, the ChatGPT can be used to generate course tests sets or to translate teaching materials into other languages. Moreover, ChatGPT can also help students understand complex concepts by summarizing scientific or other texts.

For teachers, ChatGPT can constitute a tool to create interactive lessons and curricula. For example, teachers may use ChatGPT to prepare lesson scenarios or generate personalized emails to students. ChatGPT may also help teachers understand students' problems through the analysis of answers and suggestions referring to the methods of explaining the thought issues or teaching materials.

In crisis situations, such as the COVID-19 pandemic, ChatGPT can ensure constant availability of information and support for students and teachers. ChatGPT may help deliver information on topics during the remote teaching and learning, provide teaching materials, and answer students' questions. Additionally, ChatGPT can help create personalized teaching programs and deliver information on physical and mental health problems. ChatGPT may also help analyze students' answers and suggestions concerning problem explanations or teaching materials.

However, it should be remembered that ChatGPT, like any other artificial intelligence technology, has its drawbacks and limitations. In particular, ChatGPT can generate inaccurate or unimportant answers if not appropriately trained or supervised. Additionally, ChatGPT can reflect prejudices present in the training data. It can lead to bias and inaccuracies in responses.

3.3. ChatGPT – pros and cons

ChatGPT, like any other artificial intelligence technology, has advantages and disadvantages. Here there are a few key points that should be taken into account.

Advantages of ChatGPT:

- **Natural language interaction:** Using the ChatGPT makes natural language interaction possible. It allows the users to communicate with devices in a more humane way. That can make interactions more intuitive and users friendly.
- **Versatility:** ChatGPT can be applied for wide scope of tasks, such as questions reply, text generation, recommendations delivery, brainstorming and many others.
- **24/7 Availability:** Once implemented, ChatGPT can provide help and information availability 24 hours a day.
- **Scalability:** ChatGPT can run many conversations simultaneously. So, it is scalable for companies and platforms whose demand the involvement of many users simultaneously.
- **Smaller work load:** ChatGPT can help reduce agents' involvement by automatizing some tasks and interactions. This way they are allowed to be focused on more complex or specialized tasks.

Disadvantages of ChatGPT:

- **Lack of understanding:** ChatGPT frequently lacks fundamental understanding of contexts and nuances. It generates responses based on patterns that were taught while training. It sometimes may lead to inaccuracies or unimportant answers.

- **Bias and inaccuracies:** If data was not appropriately supervised and monitored, ChatGPT responses might reflect prejudices present in the training data. It may also generate inaccurate or false information.
- **Ethical concerns:** There exist ethical concerns referring to artificial intelligence used to generate content connected with creating potentially harmful, misleading, or inappropriate matters.
- **Dependence on training data:** ChatGPT replies are based on training data. If training data contained mistakes or restrictions, they might be reflected in results.
- **Lack of creativity and common sense:** When ChatGPT can generate text, it lacks natural creativity and common sense. It may struggle with tasks demanding true creativity or a deep understanding of the world.
- **Security threats:** If ChatGPT was not correctly secured, it might be used for malicious purposes, such as generating convincing but false content on fraud or disinformation campaign purposes.
- **Loss of interpersonal interactions:** Relying on interactions with artificial intelligence may limit fundamental interpersonal interactions, which may provide social and psychological consequences.

3.4. Alternatives for ChatGPT

Artificial intelligence is highly popular in the application of various tools. This has caused the creation of many alternatives for ChatGPT. Here there are the most popular of them :

- **Microsoft Bing:** Bing is the search engine that uses advanced artificial intelligence algorithms to generate personalized search results. Bing may help search for information, answer to questions and deliver recommendations. Bing can generate texts in a specified style or format, such as stories, poems, articles, code programming, etc.
- **Jasper:** Jasper is the platform chatbot that uses artificial intelligence to generate answers to questions and conversations with users. Jasper may be used variously, for example, customer service, leads generation, information delivery, etc.
- **Google Bard:** Google Bard is the tool to generate poems in various styles and formats. Google Bard may be used for numerous goals, such as creating poems, songs, stories, etc.
- **YouChat:** YouChat is the platform of chatbot. It uses artificial intelligence to generate answers to questions and conversations with users. YouChat may be used for customer service, leads generation, information delivery, etc.
- **Chatsonic:** Chatsonic is the chatbot platform that uses artificial intelligence to generate answers to questions and conversations with users. Chatsonic may be used for various applications such as customer service, leads generation, information delivery, etc.

- **Character AI:** Character AI is the artificial intelligence platform that uses a learning machine algorithm to generate personalized recommendations and content. Character AI can be used for various goals, such as creating customized training programs and recommendations regarding health and fitness and many others.
- **Chinchilla AI:** Chinchilla AI is the artificial intelligence platform that uses machine learning algorithms to generate personalized recommendations and content. Chinchilla AI can be used for various goals, such as creating customized training programs and recommendations regarding health and fitness and many others.

4. Discussion

AI can increase efficiency and save time through automating routine tasks. It enables the employees to focus on more complex and strategic aspects of work by optimizing production processes, transport planning and energy consumption management to minimize the negative influence on the natural environmental. Improvement of medical diagnoses, development of more effective medications, drugs and therapies, acceleration of scientific research in the field of molecular biology, increase road safety, reduction of road accidents, optimization of road traffic through the development of autonomous cars, are the areas where the use of AI in monitoring systems, data analysis, technology of image recognition, increase safety in public spaces, airports or CCTV systems. This is just happening in many places worldwide.

Common usage of AI causes threats such as: privacy violations, identity theft or illegal use of personal data. AI automation can lead to the loss of workplaces in some sectors, which can generate social tensions. Algorithms based on historical data can reproduce existing prejudice and discrimination. These can lead to unequal treatment of social groups and machines overload. It may lead to the loss of skills and experienced human staff in some areas. The lack of uniform standards and regulations may lead to abuse and irresponsible AI technology applications.

AI can be used for machine translations, but in this, as in any other case, you should be careful and carefully analyze the proposals presented by AI. Queries and commands should be formulated very precisely - otherwise we may get quite strange answers. For example, AI can translate: "social tension" as "social voltage", "it is based on" as "it lean against", "it is devoted to" as "it is crucified" or "foreign languages" as „languages of aliens".

That is why implementing AI technology requires a sustainable approach that considers benefits and potential threats. It has to be ensured that the development in this field will serve society as a whole.

5. Conclusions

Nowadays AI is applied in many fields. It is not possible to predict what direction the artificial intelligence development will be heading and what benefits and threats it will bring. What ethical challenges can arise from using AI in management of crisis situations, especially when collecting and analyzing personal data? How to ensure the appropriate data security to avoid abuse and privacy violations while using advanced technology during crisis? Discussion in these areas may help define the best practices and technology development paths for AI in order to make it the best solution in a crisis situation.

References

1. Banasik, A., Kempa, W. (2023) Wyzwania współczesnej nauki i edukacji wobec wzrostu ilości informacji i metod jej przetwarzania. In: D. Morańska, P. Oleśniewicz (eds.), *Edukacja jutra. Nowe poszukiwania badawcze*. Sosnowiec: Oficyna Wydawnicza "Humanitas", ISBN 978-83-66165-97-7.
2. Benaben, F., Lauras, M., Fertier, A., Salatgé, N. (2019). *Integrating Model-Driven Engineering as the Next Challenge for Artificial Intelligence – Application to Risk and Crisis Management*. 2019 Winter Simulation Conference (WSC). National Harbor, MD, USA, pp. 1549-1563, doi: 10.1109/WSC40007.2019.9004828.
3. Burger, B., Kanbach, D.K., Kraus, S., Breier, M., Corvello, V. (2023). On the use of AI-based tools like ChatGPT to support management research. *European Journal of Innovation Management*, 26(7), pp. 233-241.
4. Fazlagić, J. (ed.) (2022). *Sztuczna inteligencja (AI) jako megatrend kształtujący edukację. Jak przygotowywać się na szanse i wyzwania społeczno-gospodarcze związane ze sztuczną inteligencją?* Warszawa: Instytut Badań Edukacyjnych.
5. Hu, X., Tian, Y., Nagato, K., Nakao, M., Liu, A. (2023). *Opportunities and challenges of ChatGPT for design knowledge management*. arXiv preprint arXiv:2304.02796.
6. Jagadish, H.V., Gehrke, J., Labrinidis, A., Papakonstantinou, Y., Patel, J.M., Ramakrishnan, R., Shahabi, C. (2014). Big data and its technical challenges. *Communications of the ACM*, 57(7), pp. 86-94.
7. Korzynski, P., Mazurek, G., Altmann, A., Ejdys, J., Kazlauskaite, R., Paliszkievicz, J., ..., Ziemia, E. (2023). Generative artificial intelligence as a new context for management theories: analysis of ChatGPT. *Central European Management Journal*.
8. Lauras, M., Truptil, S., Bénaben, F. (2015). Towards a better management of complex emergencies through crisis management meta- modelling. *Disasters*, 39(4), pp. 687-714.

9. Legg, S., Hutter, M. (2007). A collection of definitions of intelligence. *Frontiers in Artificial Intelligence and applications*, 157, 17.
10. Lindebaum, D., Fleming, P. (2023). ChatGPT undermines human reflexivity, scientific responsibility and responsible management research. *British Journal of Management*.
11. Mohamed, N., Al-Jaroodi, J. (2014, July). *Real-time big data analytics: Applications and challenges*. International conference on high performance computing & simulation (HPCS), pp. 305-310. IEEE.
12. Ratten, V., Jones, P. (2023). Generative artificial intelligence (ChatGPT): Implications for management educators. *The International Journal of Management Education*, 21(3), 100857.
13. Usidus, M. (2023a). Jest wszędzie, jest wszystkim i wszystko jest nią. *Młody Technik*, no. 1, 3.
14. Usidus, M. (2023b). Ludzki mózg i ogrom informacji. *Młody Technik*, no. 1, pp. 24-29.
15. Usidus, M. (2023c). Świat danych. *Młody Technik*, no. 1, pp.42-46.
16. Usidus, M. (2023d). Maszyna do robienia wszystkiego, *Młody Technik*, no. 3, pp. 24-30.
17. Van Dis, E.A.M., Bollen, J., Van Rooj, R., Zuidema, Z., Bockting, C.L. (2023). ChatGPT: five priorities for research. *Nature*, Vol. 614, 9 February 2023, pp. 224-226.