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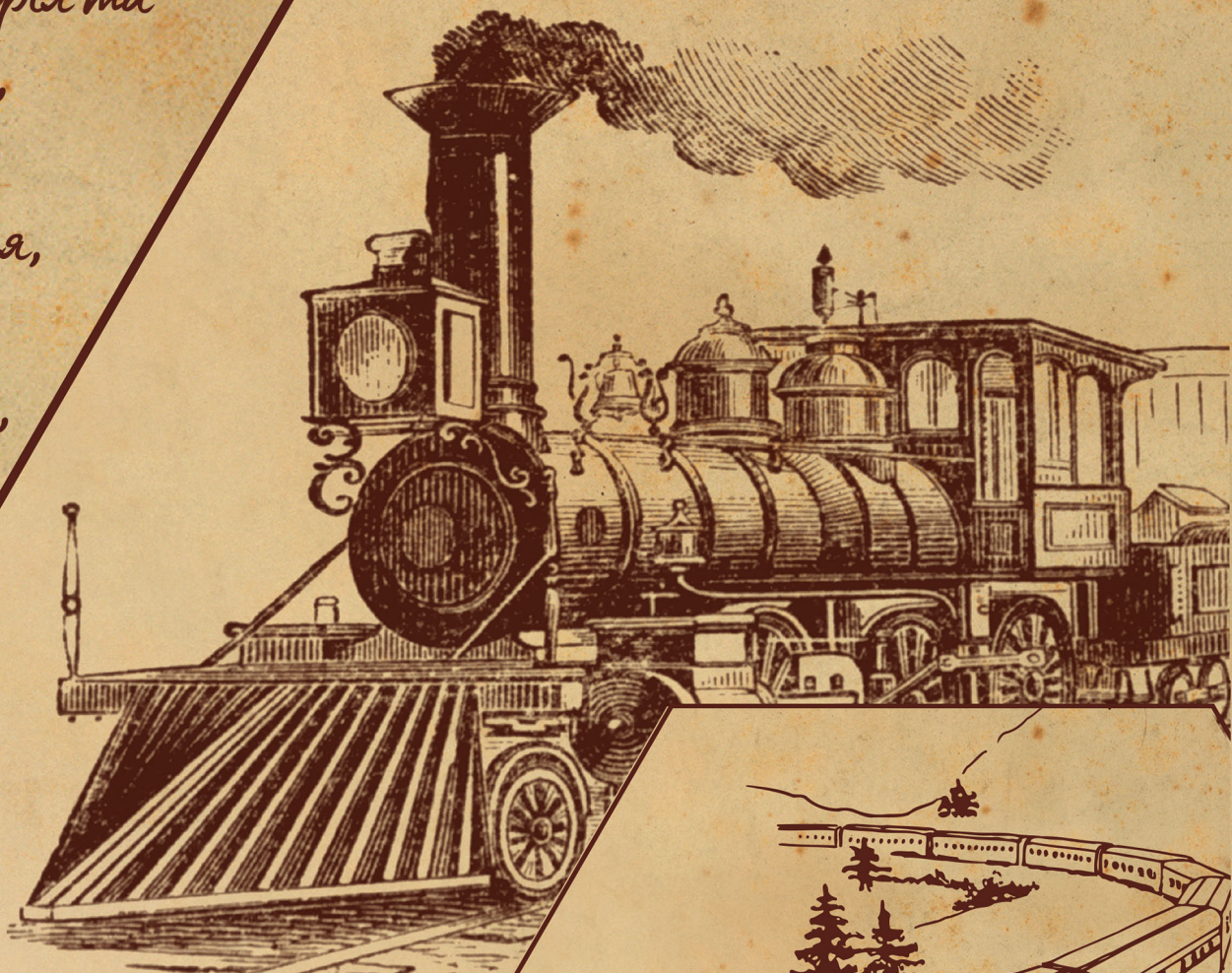


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## APPLICATION OF ARTIFICIAL INTELLIGENCE TECHNOLOGY IN GEOGRAPHIC AND LAND MANAGEMENT EDUCATION

**Abstract.** The article is devoted to studying and highlighting the opportunities and challenges of using artificial intelligence (AI) technology in the field of geography and land management education. The authors examine current trends in



the use of AI to optimize educational processes, increase the availability of educational resources, and improve students' ability to understand and analyze geographic and land management issues.

The research highlights various aspects of AI implementation in geography and land management education, including the use of intelligent systems for geodata analysis, creation of virtual environments for practical learning of geographic and land management concepts and development of innovative teaching methods. The study also draws attention to the challenges and prospects of introducing AI in geographic and land management education, taking into account the ethical and social aspects of this process.

The obtained research results open wide opportunities for further improvement and development of strategies for the implementation of artificial intelligence technologies in the field of geographic and land management education. These data will be a valuable source of information for discussions among experts and stakeholders regarding the optimal ways of applying innovative solutions in this area. Given the growing importance of digital technologies in the educational process, these results can serve as a guideline for the development of programs aimed at improving the quality of education and training qualified specialists in the field of geography and land management.

**Keywords:** artificial intelligence, geographic and land management education, ChatGPT, chatbot.

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### **ЗАСТОСУВАННЯ ТЕХНОЛОГІЇ ШТУЧНОГО ІНТЕЛЕКТУ В ГЕОГРАФІЧНІЙ ТА ЗЕМЛЕВПОРЯДНІЙ ОСВІТІ**

**Анотація.** Стаття присвячена вивченню і висвітленню можливостей та викликів застосування технології штучного інтелекту (скорочено – ШІ) в галузі географічної та землевпорядної освіти. Автори розглядають сучасні тенденції використання ШІ для оптимізації навчальних процесів, підвищення доступності освітніх ресурсів та покращення здатностей здобувачів у розумінні та аналізі географічних та землевпорядних питань.

Наукове дослідження висвітлює різноманітні аспекти впровадження ШІ у географічну та землевпорядну освіту, включаючи використання інтелектуальних систем для аналізу геоданих, створення віртуальних середовищ для практичного вивчення географічних та землевпорядних концепцій та розвитку інноваційних методів викладання. Дослідження також звертає увагу на виклики та перспективи впровадження ШІ у географічну та землевпорядну освіту, враховуючи етичні та соціальні аспекти цього процесу.

Отримані результати дослідження відкривають широкі можливості для подальшого вдосконалення та розвитку стратегій впровадження технологій штучного інтелекту в галузі географічної та землевпорядної освіти. Ці дані стануть цінним джерелом інформації для обговорень серед експертів і зацікавлених сторін щодо оптимальних шляхів застосування інноваційних рішень у цій сфері. Враховуючи зростаючу важливість цифрових технологій в освітньому процесі, ці результати можуть служити орієнтиром для розробки програм, спрямованих на підвищення якості навчання та підготовку кваліфікованих фахівців у галузі географії та землевпорядкування.

**Ключові слова:** штучний інтелект, географічна та землевпорядна освіта, ChatGPT, чат-бот.

**Relevance of the research.** Artificial intelligence is the most significant feature of knowledge, technology and communications revolution. The rapid development of digital technologies in the field of artificial intelligence development opens up many new opportunities for all participants in the educational process, makes adjustments to models, style and teaching methods, *"has the potential to*



*solve many problems in education, introduces innovative methods of teaching, learning and acceleration progress on the way to the Sustainable Development Goals*” [1]. At the same time, in connection with the spread of AI resources, many questions arise that concern educators: these are questions of academic integrity, ethics, authorship, transparency of education, achievements assessment of higher education students, recognition of the teaching staff achievements of higher education institutions (abbreviated as HEI ), their status, etc. In this regard, UNESCO is developing a new artificial intelligence roadmap to *“ensure the integration of new technologies and AI in education on our terms”* [2]. In 2019-2021, three forums were held in Beijing (China). In 2022, UNESCO published recommendations on the implementation of artificial intelligence in education [3]. The Cabinet of Ministers of Ukraine approved the concept of artificial intelligence development until 2030. All this confirms the relevance of our research topic.

**Purpose of the research.** Is to draw the attention of educators to the possibilities and advantages of using artificial intelligence programs as a useful tool and resource in geographic and land management education, as well as to determine certain features of AI usage that should be taken into account by all participants in the educational process.

**Outline of the main material.** One of the first to draw attention to the problem of artificial intelligence was Alan Turing, who in his work *“Computing Technology and Intelligence”* (1950) formulated a provocative question at the time: *“Can machines think?”* [4]. Since then, many programs and systems have been developed, endowed with intellectual processes characteristic of humans, or those that even surpass human capabilities. The electronic encyclopedia *“Britannica”* (<https://www.britannica.com>) distinguishes the following among such processes: the ability to reason, find meaning, generalize or learn from past experience [5].

Nowadays, AI programs can interpret language, play games, identify patterns, plan, develop models, warn about risks, and more. Importantly, built-in intelligence is constantly *“learning”* how to do this, processing huge amounts of data, looking for patterns to model in its own decision-making. A significant number of programs (Siri, Alexa, Google search and translators, conversational bots, email spam filters, etc.) have long been and are actively used by ordinary people. Services for constructing tests, crosswords and puzzles, creating presentations are successfully mastered by educators. As the technologies embodied in applications become more sophisticated, some routine tasks (recognition, translation, computation) are gradually removed from the tasks that *“require intelligence”* in the definition of AI [6].

On June 1, 2023 **ChatGPT** (*eng. Generative Pretrained Transformer*) for iOS operating systems started working in Ukraine. The chatbot is already available on the App Store and runs on iOS 16.1 or higher. It was created by the American company OpenAI. Soon chatbots will begin to be widely used in the educational process by both teachers of higher education institutions and students of higher education, which requires an appropriate response.



The analysis of publications devoted to artificial intelligence in education allowed to generalize the advantages of AI for use in geographic and land management education:

1. Amazing possibilities in terms of simplicity, accuracy and speed of obtaining answers to the given question (task) [7]. So, for example, ChartGPT prints answers faster than you can read them.

2. Assistance in planning and modeling, as well as providing algorithms for task performance. 3. Creativity (in particular, generating ideas about the optimal use of teaching methods and techniques when studying a certain topic), creating fundamentally new, in different styles, images and texts, which will stimulate the teacher to creative work and innovation.

4. The ability to process large sets of geographic and cartographic data, identify dependencies and make predictions based on this data.

5. Creation of visual materials, such as worksheets, animated educational videos, graphs, interactive maps, presentations and other high-quality and modern didactic materials that bring learning to a higher quality level and add interactivity to it. For geographic and land management education, which operate with images of countries and regions, land cadastral information, a large volume of statistical and factual data, visual content is absolutely necessary. 3D relief models, climatic, demographic and other trends help higher education students to see and understand geographic and land management processes.

6. Combining AI with virtual and augmented reality technologies. This allows to create an immersive environment for studying geo-disciplines and creating realistic scenarios.

7. Automated verification of applicants' works and quick feedback. Such digital services from AI free up time that teachers can redirect to performing other tasks.

8. Ensuring inclusiveness and equality of education for all categories of applicants, improving access to education for vulnerable groups.

9. Providing learning in the form of a game.

10. Creating a competitive environment, etc.

The emergence of new tools can inspire teachers to rethink the content of the educational materials offered to students, in particular, to reduce the share of tasks of a descriptive nature and increase the share of tasks of a higher cognitive level, tasks with elements of creativity. AI will help and improve field research, for which a large number of mobile applications have been created to identify plants, animals, minerals, etc.

A big advantage of programs with built-in artificial intelligence for students is the provision of personalized learning. AI improves the ability to acquire, retain and recall knowledge when needed, which promotes academic achievement, works to free learners from a one-way learning method [7].

ChartGPT provides step-by-step algorithms for obtaining tasks. For example, on requests "How to build a profile using a topographic map?" (Figure 1), "How





to conduct a local history study of your street?” and “Local lake research plan?” the chatbot provided good recommendations and advice.

The chatbot deals well with the tasks of creating virtual tours of countries and regions, offering the user to supplement the generated text with photos and videos. Other tasks that can safely be entrusted to the program include the following: classifying the geographical objects of the research, brainstorming (for questions such as “what can it affect?”), comparing territories according to certain characteristics, determining factors affecting development and geography of various types of economic activity, give an assessment of the situation (geoecological, geopolitical, demographic, economic, etc.) that existed in the country and region, for example, until 2022.

Let’s note some websites (programs) with built-in AI that are *useful for teaching geo- disciplines* (Figure 2).

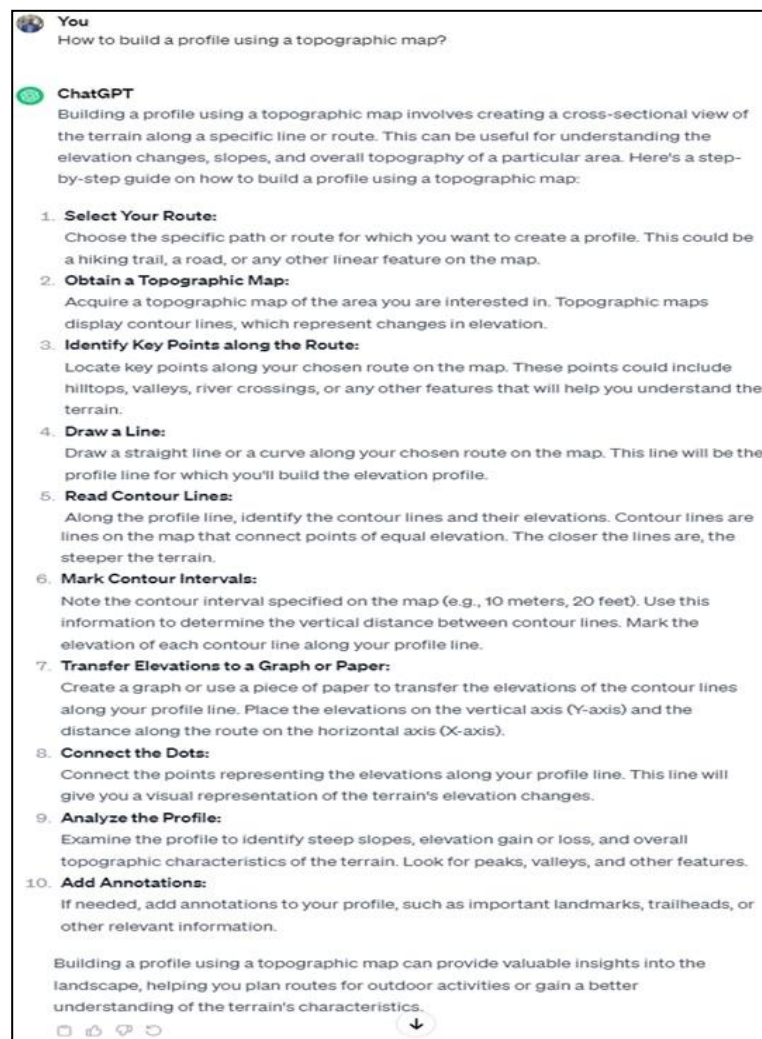


Fig. 1. ChatGPT answer to the question “How to build a profile using a topographic map?”

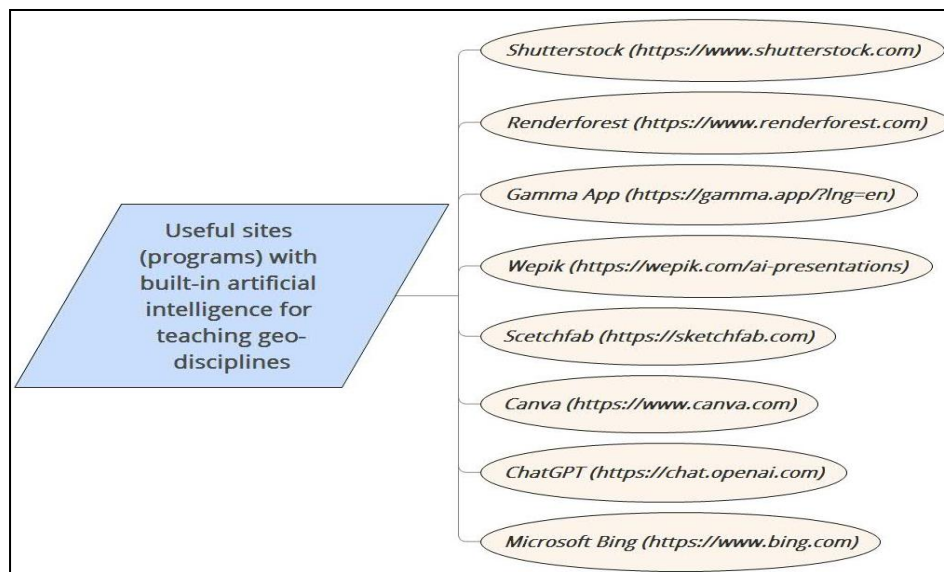


Fig. 2. Useful sites (programs) with built-in artificial intelligence for teaching geo-disciplines

The **Shutterstock** program (<https://www.shutterstock.com>) contains stock photos, drawings, videos, including those made with the help of AI. Such photos will elevate any presentation. The program generates exclusive photos according to the description.

The **Renderforest** program (<https://www.renderforest.com>) will help the teacher to create animated educational videos, graphics, build sites in a personal browser, etc.

If you need to quickly make a presentation, you can use the services of the **Gamma App** website (<https://gamma.app/?lng=en>). To create a presentation in this service, you need to enter a request, and the more detailed it is, the better the output will be. The neural network generates a presentation in 8 slides and adds videos, images, lists and tables on the requested topic. After creating a presentation, if you don't like the design and content, you can edit it and add slides.

A similar but better design tool than Gamma App is **Wepik**, especially its presentation generator (**AI Presentation Maker**: <https://wepik.com/ai-presentations>). In less than a minute, it develops a presentation made in a certain style (professional, creative, ordinary, etc.), with high-quality photos and ready-made text. Moreover, the tool is free, and the presentations generated by it can be downloaded or opened using the link.

Excellent 3-D models and simulations, including geographic models, are available for free at **Scetchfab** (<https://sketchfab.com>). At the request of the user, the program will select several models, among which you can choose the best ones for educational content and demonstration. It can be a model of a volcano, a theodolite,



a model of a river valley, minerals, etc. All these models can be rotated, viewed, including in 3-D glasses.

Artificial intelligence is constantly expanding its functions in the *Canva* service (a cross- platform service for graphic design, <https://www.canva.com>), which now, according to the user's description, generates photos in various options and styles, quickly translates English-language presentations or documents downloaded in *\*pdf* format to the site (downloading is done by simply dragging and dropping the document).

The above-mentioned *ChatGPT* (<https://chat.openai.com>) will help create a glossary for a certain topic, suggest the best (in its opinion) methods for teaching the selected educational material, find literature and links to video materials, and offer ideas for projects and research for students of higher educational institutions.

A similar resource, not inferior to *ChatGPT* in terms of intelligence, is *Microsoft Bing* (<https://www.bing.com>). It has a very convenient search tool (by voice, image or text), chat (in which you can communicate with AI), an unlimited number of videos, photos, maps, which are quickly filtered by the selected criterion.

Despite the advantages, the use of AI has certain disadvantages. A serious concern is the risk that learners will rely too much on AI-generated material and fail to acquire critical thinking skills. In this regard, it is important for applicants to know how to ask questions of an AI program in order to get relevant and meaningful answers [8], and critically evaluate these answers.

Our testing of *ChartGPT* has shown that it gives inaccurate or incorrect answers to some questions related to geography and land management. The simple demographic task offered to the chatbot to determine the growth rate of the country's population was incorrectly solved (instead of the growth rate, *ChartGPT* calculated the population growth rate). The answer it generated regarding the assessment of the country's geographical position was also incorrect: after the correct two points, the chatbot began to describe the country's climate and natural resources, which it was not asked about. When asked about changes in the geography of the global chemical industry, we received a meaningful, but not entirely accurate answer, which indicates that the chatbot (so far) does not see the difference between changes in the geography of the industry and the factors that cause these changes.

A chatbot is able to maintain a dialogue and teach students to formulate questions, but it cannot replace communication between students and teachers and between students.

Assessing the challenges associated with the spread of programs with built-in AI, one cannot fail to mention the difficulties in evaluating learning outcomes. *How to make sure you're checking a higher education applicant's response to an open-ended question, not a ready-made chatbot response?* We asked *ChartGPT* such a question and received the following answer (pay attention to its conclusion):



Checking that you are getting a real response from a student and not from a chatbot can be a tricky task due to the nature of the interaction. However, here are some tips:

**1. Ask for specific details:** Ask the student to expand the answer by providing specific details or examples. This can help you determine if the student really understands the topic and can provide insightful feedback.

**2. Ask for arguments or evidence:** Ask the student about the arguments that support his answer. This may require him to further develop opinions and point to specific facts.

**3. Check the general logic:** Evaluate the logic of the answer. If it seems dissonant or contains inaccuracies, this may indicate that it is not an automatic response.

**4. Change the wording of the questions:** Repeat the question, phrasing it differently. This can help to identify inconsistencies in responses.

**5. Analyze the response for context:** Consider the specific context of the question and check whether the answer fits that context. Automated responses may be drawn from general databases and may not always take into account the context of your question [8].

**6. Use speech recognition tests:** You can include tests for speech recognition for the first time. For example, ask the student to answer your question in the form of an audio or video recording.

Even so, it can sometimes be difficult to tell whether a person or a chatbot is responding, especially if the response is very general.

It must be mentioned that the chatbot's answer (unlike the answer of the student) is always correctly structured, has a somewhat monotonous presentation style, lacks slang, emotions and creativity.

To help educators, a free resource **GPT Zero** (<https://gptzero.me>) has also recently appeared, which checks writing for the presence of text created by artificial intelligence and humans (Figure 3).

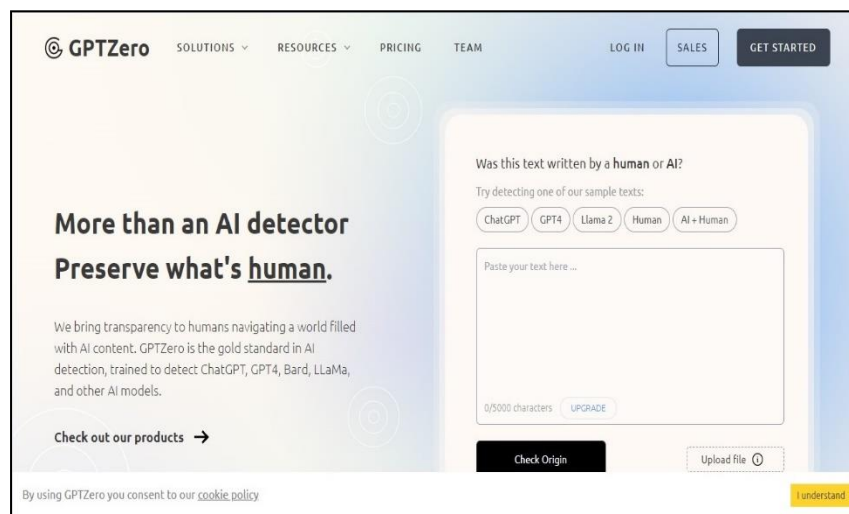


Fig. 3. GPT Zero's free resource for checking written text for artificial intelligence and human-generated text



The service defines one of three options:

- 1) the work is unique (written by a person);
- 2) work is a combination of human work and artificial intelligence;
- 3) completely generated by artificial intelligence.

**Conclusion.** Finally, being in the trend of modern technological changes means being aware of new technology features and being able to use them rationally. Given the rapid development of artificial intelligence programs, teachers should be at the forefront of AI users, constantly test various programs and find options for their rational use in education and science. Today, it is clear that programs with built-in artificial intelligence can take over routine work, save teachers' time and provide many ideas for improving learning productivity in geographic and land management education. However, responses generated by AI must be monitored. The results of testing programs with built-in AI for the educational components of the geofield disciplines (as well as other disciplines) should be the subject of continuous discussion and exchange of experience.

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