Possibilities of using ChatGPT in teaching the subject Methods of Information Processing

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Abstract: The article draws attention to the issue of texts generated with the help of artificial intelligence (AI). The paper deals with examples of the processing of some selected tasks from the subject Methods of information processing taught at the Faculty of Economics of the University of South Bohemia solved with the help of AI. The generated answers are critically assessed and compared with the procedures used in teaching.

Keywords: AI, ChatGPT, large language model, teaching
JEL Classification: C63, C88, I21

1 Introduction

The subject Methods of Information Processing is taught at the University of South Bohemia in České Budějovice.

This subject is offered for study programs Economics and management, Management of Regional Development and Tourism in the block of compulsory subjects and for study programs Analysis in Economic and Financial Practice and Finance and Accounting in the block of compulsory elective subjects. In the last academic year, 130 students completed this subject, of which 12 students chose it from other compulsory elective subjects. This academic year, 131 students are enrolled in the course, of which 25 students have chosen it.

The course Methods of Information Processing is focused on the practical use of information technologies with an emphasis on scientific work. It consists of three parts, characterized as searching, management and presentation of information. The student will complete partial homework assignments. An e-learning environment is exploited throughout the course. The course is intended primarily for students who are preparing to create a qualification thesis.

One of the credit requirements is the solution of several practical tasks related to the discussed topic. Topics include the following: numeral systems, terminology (information, data, knowledge, results), citation rules and citation errors, ethics in science, thesis, resume, business cards, web design, advertising and advertising slogan, accompanying text for presentation, abstract , annotation, keywords, video, audio and image editing, some tasks are based on the use of online tools, e.g., creation of comics, timelines, structured biographies, business cards, talking heads, etc.

With the onset of the development of artificial intelligence, there is a need to revise assigned tasks and existing methods of solving these problems. Many assigned tasks, which until now have been solved by students, will now be possible to solve by machine, when the student only interprets the task, and the robot offers him a solution. This problem applies mainly to tasks oriented to word processing, but not exclusively. We will introduce the ChatGPT tool, with the help of which students are able to solve many tasks on their own without much effort.

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2 ChatGPT

ChatGPT is one of the very popular AI tools used by users all over the world. There are many ways to use ChatGPT, a brief overview is shown in Figure 1. ChatGPT is based on a language model called Predictive Transformer (PT), which was originally developed by Google, for natural language processing (NLP).

The PT language model underwent extensive evolution during 2018-2023, which was directly related to the progressively larger training dataset. Each new version of the language model brought a dramatic change, especially in the number and depth of neural layers, which was directly related to the number of parameters of the PT model for learning. A comparison of the PT models can be found in Table 1.

Table 1 Overview of PT models and their parameters used in ChatGPT

Model name	Year	Architecture	Dataset size [GB of text]	Parameter Count [million]
GPT-1	2018	12-level	4.5	117
GPT-2	2019	As GPT-1, normalization	40	1500
GPT-3	2020	As GPT-2, Human feedback model	570	175 000
ChatGPT-3.5	2022	Enhanced GPT-2	N/A	175 000
ChatGPT-4	2023	Text Prediction + Learning from Human Feedback	N/A	100 000 000

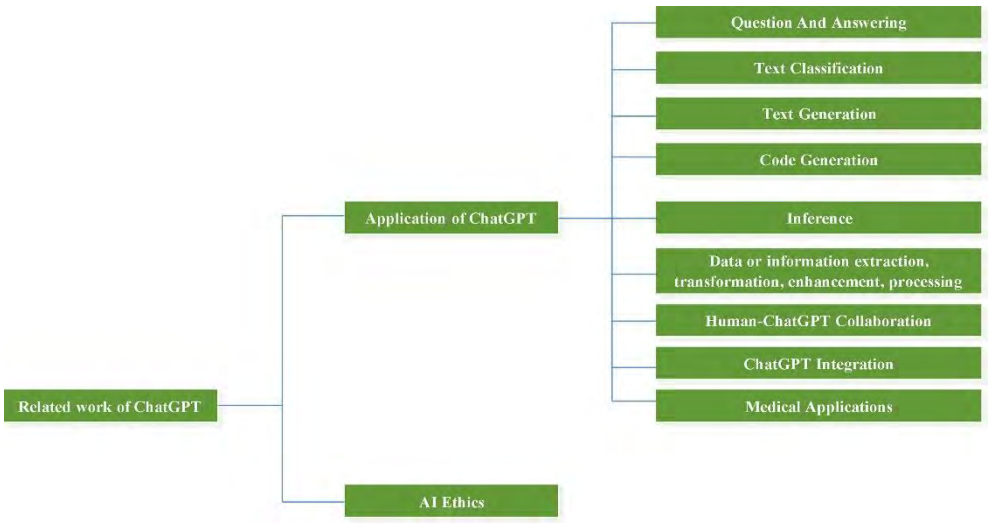
Source: Partha, 2023

3 How does ChatGPT work internally?

At present, it is not possible to find relevant detailed information about the inner workings of ChatGPT. What is certain is that ChatGPT works with tokens, which are individual natural language words converted into a binary representation (e.g., using the word2vec tool). The input sequence of tokens is gradually transformed recursively into new text. This is the reason why ChatGPT is currently unable to handle the context resulting from the previous queries.

ChatGPT itself is probably internally composed of multiple PT models. All PT models are likely to have the same architecture, however they differ in their internal parameter settings, which is related to the optimization for the specific application area (AA) shown in Fig.1.

Figure 1 The possible application areas of ChatGPT. Currently the model can generate textual answers from 9 different areas



Source: Yiheng et al., 2023

ChatGPT first imports the type of query asked (e.g., a numerical example, a history question, a request to generate a poem, etc.) and the PT for the specific AA is responsible for generating the answer.

The generation of the response itself, as already mentioned, is done recursively. This way of internal structuring is very efficient as it allows ChatGPT to scale well in terms of adding more AAs. It is also possible that this way of

decomposition is multilevel, i.e., for math questions there are several different PTs, each tailored to a specific sub-area of a given AA.

Thus, thanks to this structure, to add another AA, it is sufficient to train another architecturally identical PT model based on the new set, which is already optimized for that AA. To use the new PT model, it is also necessary to modify the determination of the type of the query asked, which then causes the query to be passed to the newly created PT model.

4 Examples of solved tasks

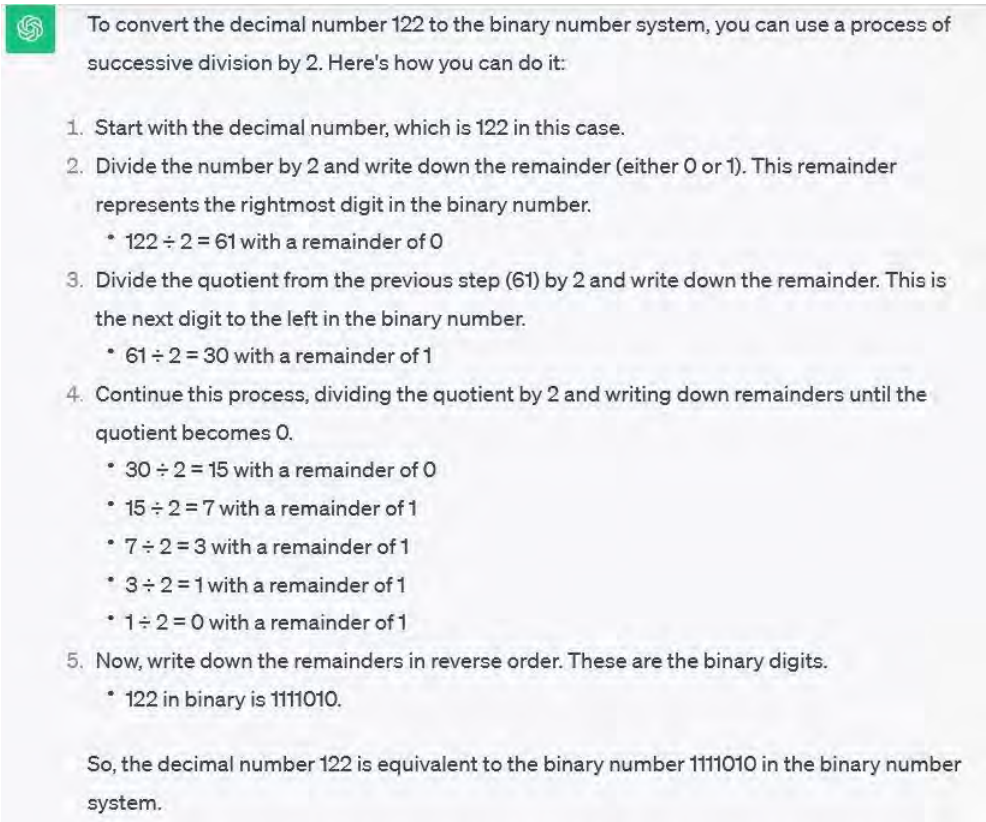
Now we will present some selected tasks for which the students have to work out solutions. We will try to get the correct solution from the ChatGPT system, preferably in such a form that we don't have to do any additional activities and have a direct result.

4.1 Conversion between number systems

One of the initial tasks concerns the conversion between number systems. Students have to write the procedure how they solved the example. Let's try typing this example into the ChatGPT prompt: Convert the number $(122)_{10}$ to binary numeral system.

The following Figure 2 represents the output that the system offered us.

Figure 2 The example of using ChatGPT for finding solution of conversion between numeral systems task



To convert the decimal number 122 to the binary number system, you can use a process of successive division by 2. Here's how you can do it:

1. Start with the decimal number, which is 122 in this case.
2. Divide the number by 2 and write down the remainder (either 0 or 1). This remainder represents the rightmost digit in the binary number.
   - 122 ÷ 2 = 61 with a remainder of 0
3. Divide the quotient from the previous step (61) by 2 and write down the remainder. This is the next digit to the left in the binary number.
   - 61 ÷ 2 = 30 with a remainder of 1
4. Continue this process, dividing the quotient by 2 and writing down remainders until the quotient becomes 0.
   - 30 ÷ 2 = 15 with a remainder of 0
   - 15 ÷ 2 = 7 with a remainder of 1
   - 7 ÷ 2 = 3 with a remainder of 1
   - 3 ÷ 2 = 1 with a remainder of 1
   - 1 ÷ 2 = 0 with a remainder of 1
5. Now, write down the remainders in reverse order. These are the binary digits.
   - 122 in binary is 1111010.

So, the decimal number 122 is equivalent to the binary number 1111010 in the binary number system.

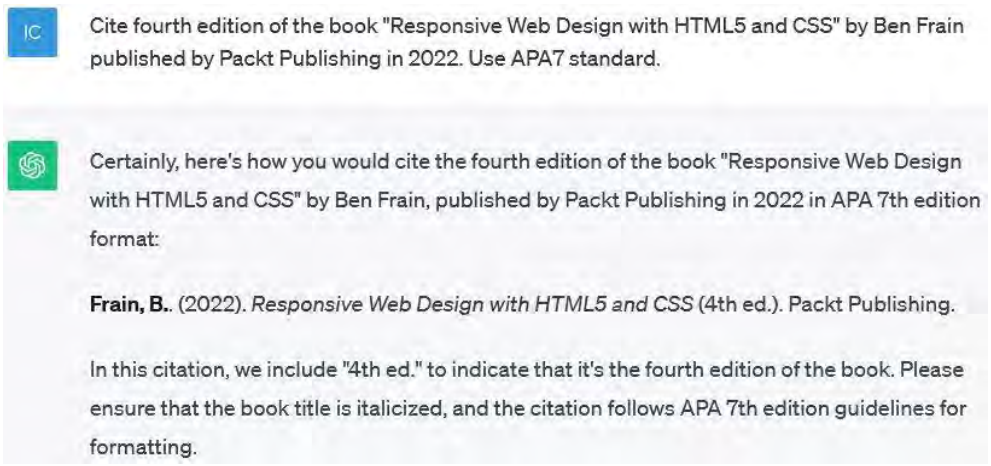
Source: Own processing in OpenAI, 2023

From the obtained output, it is evident that the student has a complete solution presented. This solution corresponds to a procedure that the student would have to work out on his own. Here, the student already has everything ready and does not need to make any further efforts.

4.2 Correct citation of the specified book in the required standard

Let's look at another example that the students are solving. In this example, students must correctly cite the specified book to the required standard. This places a requirement on the student to check the order and formatting of the individual items of the citation. Again, we put the task into the ChatGPT system and got the answer (see Fig. 3). It is also evident here that the system processed the entire task for us. However, if we compare the obtained solution with the correct result, we find that there is a small error in the double dot after the author's name. The other items are already fine, including the required formatting (American Psychological Association, 2020).

Figure 3 The example of using ChatGPT for finding solution of citation in correct standard task



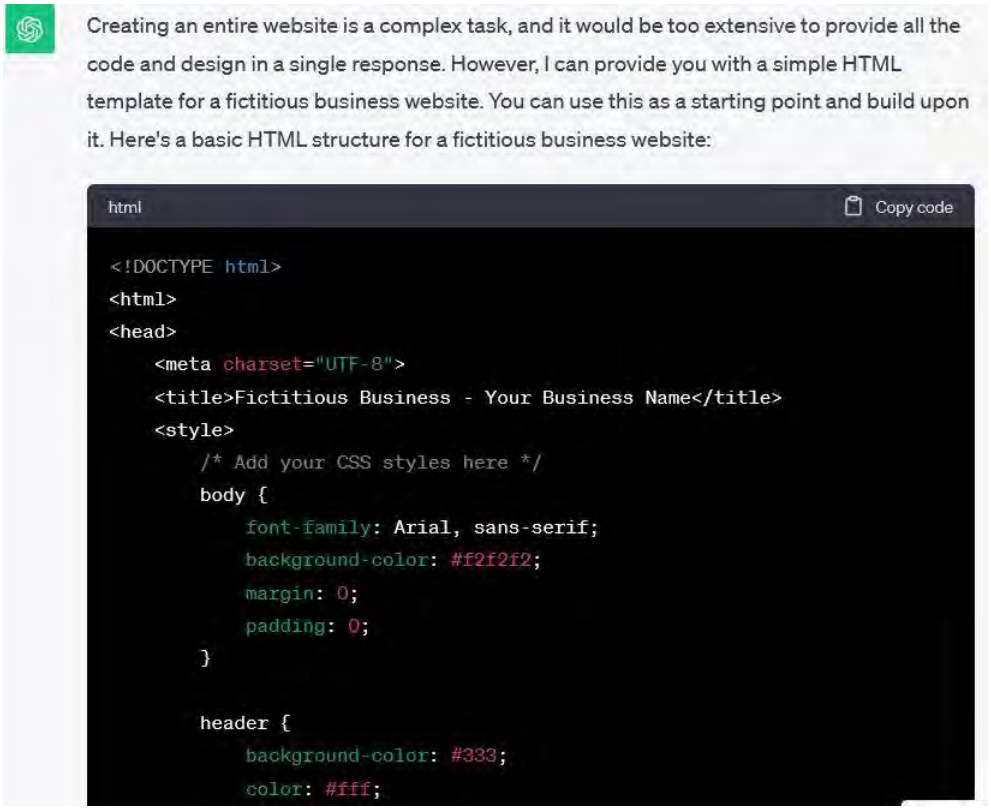
Source: Own processing in OpenAI, 2023

4.3 Creating a website for a fictitious business

The next student task is more complex and has several parts. Students must present a business plan for their company and prepare a presentation for it in the form of a website. Also, when solving this task, students using the ChatGPT system will get a lot of material for developing the final solution.

From the system we can get the basic structure of the website (Fig. 4). The given page is just a base, which contains only the most necessary. The page does not contain any recommended metadata (author, description, etc.) or the page is not responsive (Mozilla Foundation, 2023), but as a default state it is fully functional, although in terms of style and the chosen format it is rather below average, as can be seen from Fig. 5 on the left.

Figure 4 The basic structure of the website obtained from the ChatGPT system

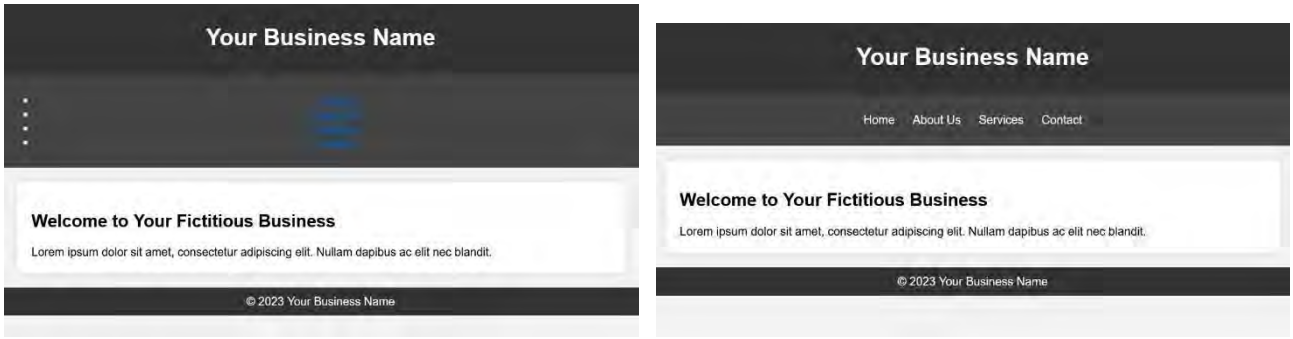


Source: Own processing in OpenAI, 2023

If we are not satisfied with the result, we can move on and try to get a better solution. We will ask ChatGPT in the command line to change the colors in the menu to other ones that will be more readable. The system will reply that of course it will. To make a change, we have just to modify the *nav* element where the colors are set. We can make any

further adjustments in this way according to our own choice of colors. A view of the changed colors for navigation can be seen in Figure 5 on the right.

Figure 5 The appearance of the page that was obtained from the ChatGPT system (left); with changed colors in navigation (right)

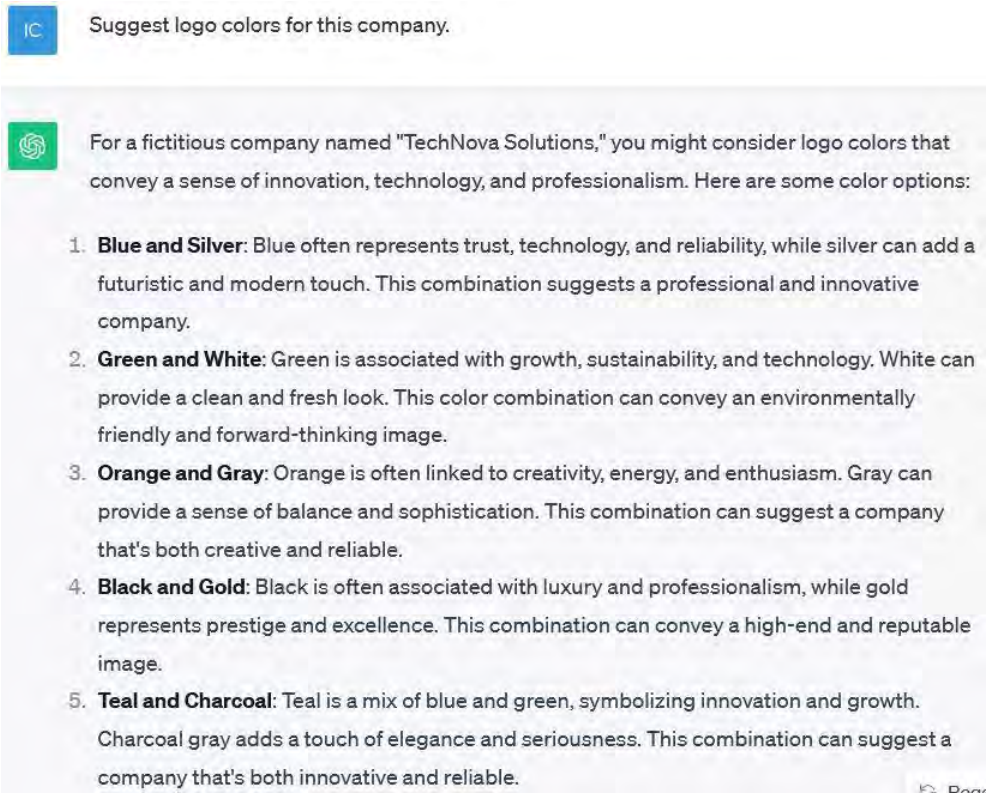


Source: Own processing in OpenAI, 2023

The fictitious company should be named, for which we will again use the ChatGPT system. We will ask him to suggest a name for our company. Received response from the system: "Certainly, here's a fictitious company name: *Technova Solutions*. This name suggests a forward-thinking technology company that provides innovative solutions to its clients. You can use this name as a starting point for your fictitious business or modify it to suit your needs." (OpenAI, 2023).

We also have to design a logo, so we will let the system design the color options for the appearance of our company logo. A sample of the submitted proposals, including their rationale and characteristics, is shown in Fig. 6.

Figure 6 The color design for company logo



Source: Own processing in OpenAI, 2023

Based on the submitted color proposals, we chose the color combination of blue and silver. We received the corrected source code of the website when we passed the request to ChatGPT. You can see its final appearance in Fig. 7.

The final step in this task is creating a business plan. This time, after the query, the system did not give us the final answers, but provided us with a list of key components that must not be missing in our business plan. For each point, the system provided brief information on what should be included here. For a better overview, we present the individual mentioned key components: 1. Executive Summary, 2. Business Description, 3. Market Research, 4. Product and Services,

5. Marketing and Sales, 6. Financial Plan, 7. Management and Operations, 8. Legal Structure, 9. SWOT Analysis, 10. Funding and Financing. 11. Contact Information, 12. Appendices.

Figure 7 The color design for company logo

Source: Own processing in OpenAI, 2023

5 Conclusions

One fact emerges from the above. If the tasks are given in a way to calculate something or find something out, the resulting solution can be easily obtained from the system and the students do not have to do any of their own initiative or creative activity.

If the task is more complex and consists of other sub-parts and is not focused only on obtaining a text result, the system will not present the result in the overall view. The student thus gets a helper and a mentor from the system, but not a tool for obtaining the entire result. The student will have to perform additional activities and make additional efforts to create their final solution. The development in the field of Large Language Model development not only brings us educators the benefit of using this system, but also presents us with new challenges in choosing appropriate teaching methods and how to continue preparing and educating students for their future life.

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