AI and Society

An Open Educational Resource

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About this OER

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This OER provides a structural framework, content, and teaching ideas for a lesson on the basics of AI, its areas of application (particularly AI in education), and the problems AI can cause.

This OER pursues the following learning objectives:
- The students can roughly explain what AI is.
- The students understand the difference between AI programs and normal programs.
- The students can name possible areas of application for AI.
- The students can identify biased AI through examples.
- The students can express their opinions on AI in education.

The proposed content is suitable for middle school students. No prior knowledge about AI is required.

Introduction

This section introduces the topic and concepts and motivates engagement with the subject.

Artificial Intelligence (AI) is a program that interprets input data, learns from it, and uses what it has learned to achieve specific goals [5, S.8]. However, AI should not be confused with regular programs. Normal programs are given the rules and structure for solving a task [2]. AI programs, on the other hand, are given the structure of learning and develop their own rules for solving a task based on data [2]. It is said that AI "learns" from the data, or that it is "trained" on the data. Another distinction between AI and normal programs is whether a program passes the Turing test. This test is passed if a person interacting with a machine cannot recognize that it is a machine [2]. If this happens, the program is called "intelligent."

Artificial intelligence is developing rapidly and is already being used in various everyday applications. As we will see later, AI is also used in situations that can influence our lives. To promote the responsible use of AI, it is necessary to reflect on the potential problems of AI and its effects on society.

Teaching Idea: Ask students if they have heard of AI before and if they can describe in their own words what it is. Turn this into an idea-sharing session.

Teaching Practice: Use ChatGPT or a similar tool (e.g., Microsoft BingAI) in class and ask the AI what it is.

Use Cases of AI

Dieser Abschnitt gibt einen Überblick über mögliche Anwendungsfälle von KI. Optional kann hier der Fokus auf KI für ein bestimmtes Einsatzgebiet, z.B. Bildung, gelegt werden.

A) AI in Education

For quite some time, but especially since the hype around ChatGPT, AI has arrived in education [1]. AI can be used to support both students and teachers.

Support for Students:

- AI tutoring in the form of chatbots [30]
- Learning content tailored to personal preferences, prior knowledge, or learning styles (personalized or adaptive learning) [12]
- Analysis of one's own learning behavior for self-assessment [31]

- Use for homework (e.g., ChatGPT for essays in German, DeepL for foreign language instruction) [11]

Support for Teachers:
- Grading assignments [32]
- Formulating assignments [33]
- Analyzing learning behaviors to intervene early in case of problems [34]

Teaching Idea: Ask students to think about where, in their daily school routine, they already use AI or would like to be supported by AI. This can again begin with silent brainstorming or a group brainstorming session in small groups.

B) Other Areas of Application

Artificial intelligence is becoming increasingly relevant in our daily lives. It is already being used in the following areas:

Everyday Organization and Household
- Voice assistant systems like Siri, Alexa, etc. [35]
- Search engines [4]
- Smart refrigerators [5]

Transportation and Passenger Transport
- Self-driving cars and buses (with varying levels of "autonomy") [9]
- Development of self-driving ships, drones, and other delivery robots [8]

Security and Justice
- Access control [13]
- Video surveillance with AI facial recognition [14]
- Recommendations for judges [15]

Production
- Smart factories (material, quality) [16]
- AI as a product designer [17]

Medicine and Care
- Development of new medicines and vaccines [18]
- Diagnosis based on images (e.g., MRI, X-rays, microscopic images of tissues, early detection of skin cancer) [19] [20]
- "Emotional" robots interacting with dementia patients [21]

Art and Music
- ChatGPT writes texts and poems [22]
- New songs/images in the style of famous artists [23]
- Music suggestions for Spotify and similar services [24]

Video Games
- Generation of game worlds [25]
- Behavior of opponents and NPCs [26]

Agriculture
- Irrigation machines [27]

Job Applications
- Pre-filtering of applications by suitable candidates [28]
- Creation of personality profiles based on videos of applicants [29]

Teaching Idea: Ask students to think about where AI is being used. Ideas can first be written on cards (to include contributions from introverted students) and then sorted and discussed on the board based on their categories.

AI is Biased

This section first describes an experiment that can be conducted to explore AI biases. Then, other examples of biased AI are examined.

A) Experiment: What Does a Teacher Look Like?

Experiments have shown that people associate certain professions with specific genders [10]. In this experiment, we aim to determine how AI perceives certain professions.

For our experiment, an AI will be given job titles in English (in English, job titles are mostly gender-neutral, thus reducing gender-related bias in the results, e.g., lawyer, doctor, scientist, police officer, engineer). The AI will then return an image that it associates with the given profession.
For this experiment, it is recommended to register at OpenAI (https://openai.com/) and use the AI tool DALL-E. DALL-E is a type of "Generative AI" that can create images [6]. The use of DALL-E is currently free for a certain number of prompts. Alternatively, Google Image Search can also be used.

Teaching Idea: Allow students to suggest professions and observe the results. Predefine the number of professions you want to test. You can set the experiment goal (e.g., observing whether AI exhibits biases and which ones) after the initial observations to create an element of surprise.

Teaching Idea: If using DALL-E, encourage students to end the experiment with creative ideas by entering terms that students come up with themselves. This allows the students to learn something new about the situation created in DALL-E.

During the experiment, it should become apparent that the Google results are biased [36] (screenshots appear on the next page). For example, more male-presenting individuals, more white people, fewer people with visible disabilities, etc., appear. These biases in the results are caused by the AI program used for the image search. They arise because the AI program has been trained on image data and has associated specific genders and skin colors with certain professions.

This could happen because some professions have traditionally been more female- or male-dominated, or because certain groups of people have been historically prevented from entering specific professions. This discrimination should not be learned by an AI, as it could reinforce biases by creating the impression, for example, that women lawyers are an unusual choice.

The fact that certain professions have traditionally been filled by specific genders leads to discriminatory AI today, which is referred to as the "Garbage in, Garbage out" principle [38]. To better understand this principle, a simple metaphor can be used: imagine artificial intelligence as a blender. What goes in determines what comes out. If you put old, wrinkled bananas in, you get a subpar banana shake ("Garbage in, Garbage out"). This means AI learns from the data it is given.
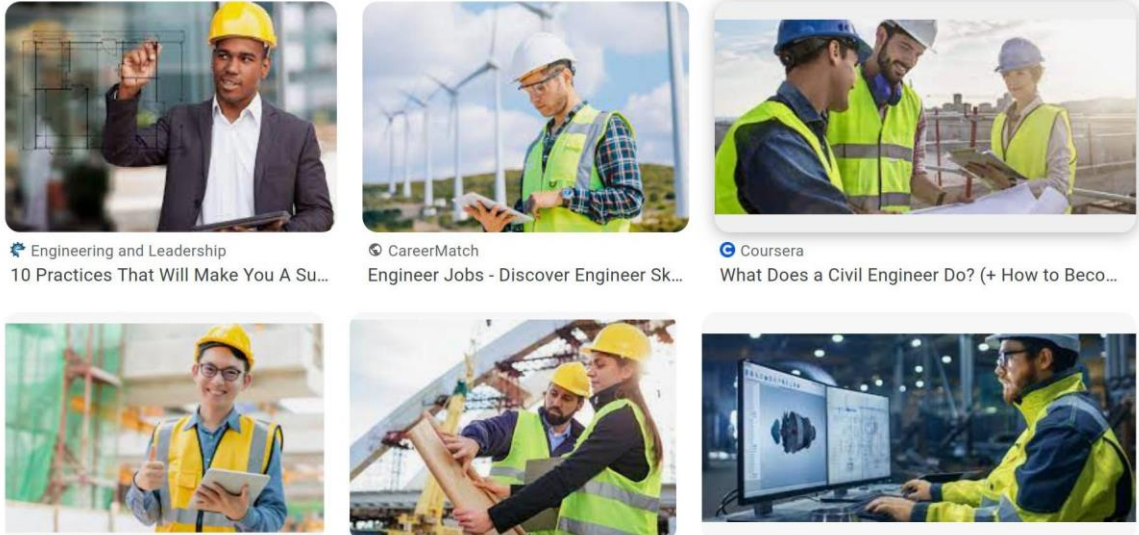
If the data used contains biases, such as the assumption that most computer scientists were male in the past, the AI could incorrectly assume that men are inherently better suited for IT jobs, even if this does not reflect reality. Therefore, it is essential to monitor the data given to AI for learning and to regularly check the behavior of the AI.

Developers of Google Image Search and generative AI systems are working to address biases in their AIs. However, different experiment results continue to emerge.

Fiona Fischer, Monika Resner and Linda Fernsel, research group Informatics and Society HTW Berlin, August 2023

B) Other Cases of Biased AI

Additional examples of biased AI in everyday life include:

- Job Applications for a New Position [7]: In the workplace, AI systems are already being used to screen and evaluate job applications. However, these systems can display potential biases based on the data they were trained on. Historical biases in training data can lead to specific demographic groups being disadvantaged. For instance, applicants might be less favored by the system due to their gender, age, ethnicity, or other characteristics.

- Applying for a Loan at a Bank [37]: AIs could make unfair decisions based on their training data, discriminating against certain population groups, such as those with traditionally lower incomes or specific ethnic backgrounds. This might result in such individuals being denied a loan or having to pay higher interest rates.

- In Police or Judicial Work [3]: Artificial intelligence is used in law enforcement, for example, to predict crimes or support decision-making in legal proceedings. AI systems trained on biased data might demonstrate prejudice against specific population groups. This could lead to certain groups being disproportionately targeted or disadvantaged in court decisions.

Teaching Idea: Since artificial intelligence is increasingly used in education, the biases of AI programs in this field should also be considered. Ask students to imagine AI monitoring and grading their homework. Then, ask them how they would feel about it. Discuss whether AI could cause issues for some students. Helpful keywords for this task are provided in [7, S.17f]: language barriers, gender, income, and family background. Also, consider potential advantages.

Summary & Conclusion

AI encompasses many different intelligent programs that are increasingly being used in various areas of our lives. Like any new technology, AI also brings some risks. It often reproduces the biases it has learned. Therefore, it is important to question and critically assess the results and actions of AI.

Teaching Idea: Ask students to write down in three sentences what they are taking away from this lesson.

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