

Awad distinguishes between different “types” of AI. What classification scheme does the paper use and why do these types matter for scientific research?

The paper uses a classification scheme of how AI encompasses a constellation of paradigms, and each one is defined by different approaches to learning, inference, and knowledge representation. The types are descriptive AI, predictive AI, generative AI, optimization AI, prescriptive AI, privacy-aware AI, causal AI, and explainable AI. These types matter for scientific research since they support a broad range of scientific objectives, from classification and simulation to exploration and explanation.

Does Awad make a clear distinction between AI as a tool and AI as a scientific collaborator? If so, what are the differences and what are some examples given to support the differences? Do these examples suggest a real shift in how science is conducted, or mostly an extension of existing methods?

Awad does a good job making a clear distinction between AI as a tool and AI as a scientific collaborator through the examples given for each type of AI in scientific research. One example of AI as a scientific collaborator is in section 1.4 of optimization AI, where it talks about a branch of AI called reinforcement learning. It enables an AI model to learn through interaction with its environment, receiving feedback in the form of rewards to gradually discover the best strategy for achieving a goal. Reinforcement learning has been used to automate experimental design and control protocols.

Normally a human would do such tasks, therefore making this AI a scientific collaborator. Another example of AI as a scientific collaborator is in section 1.7 of meta-scientific AI, where it talks about how this class of AI systems are designed to support or enhance the scientific process itself. They can generate hypotheses, design experiments, analyze data, and connect insights across different scientific fields. It doesn't just act as an advanced tool, but gets involved in the discovery process as an active collaborator. An example of AI as a tool is in section 1.2 of descriptive AI, where it talks about natural language processing. It allows computers to read and analyze large volumes of text, such as academic papers, technical documents, policy reports, and social media posts. These examples are mostly an extension of existing methods since they just do and improve what humans have been doing before the prevalence of AI.

What are some limitations or risks of using AI in science? How do these relate to issues such as interpretability, bias, reproducibility, or theory formation?

When using AI in science, sometimes AI models function like “black boxes”, where results are produced without a clear derivation as to where the conclusion came from. This makes it hard to explain or justify the outputs, leading to issues in interpretability, theory formation, and reproducibility. On the other hand, when it comes to reproducibility, AI models have the chance to hallucinate and fabricate information, and they have an authoritative voice in their claims, making their assumptions sound correct, when it is based on false evidence. This will in turn make reproducibility weak, creating trust issues in science. Unintentionally, NLP reflects biases, which include racial and gender stereotypes. This will skew the creation of hypotheses by AI and marginalize minority entities/communities through the evidence of science.

According to Awad's arguments, is AI more likely to accelerate scientific discovery or to reshape the scientific method itself? Do you agree or disagree?

Awad claims that AI is more likely to reshape the scientific method itself. I disagree with this statement since according to Awad's evidence, at most AI is able to replace humans at doing entire jobs by themselves. They can even run environments and experiments without the need to actually create them in real life. All this does is make scientific discoveries faster and cheaper to achieve, but it doesn't mean that the AI or humans are doing anything new. However, it does add an extra step to constructing a final scientific proof, which involves proofreading and revising for any false information that the AI might have included due to its hallucinations and removing any biases that the AI could have picked up on from the data. The need for liberal arts becomes more necessary to science than we even realize.