AI Limitations in Growth of Scientific Knowledge

Steven Meyer
Jan. 28, 2025
(Submitted to 2025 EPSA)
smeyer@tdl.com

Abstract

This paper compares the claim of large language model (LLM) machine learning that artificial intelligence will soon surpass and make obsolete scientists versus reality. First the paper analyses the complex language used to justify a session on opacity in machine learning. It then analyzes the claims for the generative AI model revolution. Contrary to popular culture, examples where humans defeat supposed world champion game computer programs are then discussed. The paper concludes with explanation of why Lighthill's recommendations to the UK granting agency back in 1973 still apply and how London application computer program development has benefited from those recommendations.

1. Introduction

During 2025 it is being claimed that Artificial Intelligence (AI) is able to provide foundational models for science that will replace human scientists. AI machine learning (ML) will surpass human problem solving in this view. This paper provides novel ways of analyzing what AI really is to show that it is nothing more than word context computer application programs generating natural language like text to provide researchers the answers machine learning program have been trained to provide. Pattern is similar to a bright student figuring out what a teacher wants to hear. Large language models (LLMs) are being touted as replacements for scientific research. Because of this linguistic meta property of AI, it is difficult to make concrete the claims of AI and to analyze those claims objectively.

This paper has two parts. First the abstract used to justify a session on ML at the recent 2024 PSA conference is analyzed. Second, the actual success of AI in competing against human reasoning when game playing competition happens is discussed. Foundational model of AI machine learning is justified by claiming the human brain artifact and the digital computer artifact are the same when digital computers are programmed using neural net algorithms. It is claimed that by applying large amounts of resources to building larger and larger foundational LLMs, ML will surpass human intelligence especially in the area of scientific study. The implicit claim is that the activity of science and the very idea of human intelligence itself is next word or image prediction programs using ML neural network training algorithms.

The papers conclusion is that the recommendations on UK funding of AI research provided by James Lighthill (Lighthill[1973]) still apply. That so called AI is really just application programming. Such programs can provide valuable assistance to scientific research. One important example is protein molecule folding programs that assist in discovery of new chemical compounds (Wikipedia[2025]).

2. PSA Session Abstract on ML Opacity

Here is an abstract describing a PSA session from the printed programme (PSA[2024]). Erwin Schrodinger's paper responding to the EPR thought experiment in the quantum physics area offers similar complex linguistic arguments suitable for studying LLMs (Schrodinger[1935]).

PSA symposium session abstract titled "Machine Learning in Science Beyond Opacity (PSA[2024]):

> Many philosophical and technical debates on machine learning (ML) have adopted an 'internalist' perspective, focusing primarily on understanding the internal characteristics of algorithmic systems. Examples include debates on epistemic opacity, explainability, and trustworthiness of ML systems. This symposium explores a new perspective on ML--one that takes 'externalist' approach, where we recognize the value of redirecting efforts toward the scientific merits of ML in context. In this vein, we discuss the relations between ML systems and the scientific contexts in which they are used, and how these relations shed light on the reliability of ML tools beyond problems of internal opacity. In particular, we explore four themes. First, we explore the relation between ML models' and the domain knowledge of the scientific context in which they are implemented; second, it is shown that forms of transparency relying on an internalist approach to ML present a deficient epistemology for algorithms; third, we diagnose how epistemic misalignments in data acquisition and processing practices can potentially impact the validity and generalizability of ML algorithms in (medical) audionics; finally examples of psychiatric practice are put forward where the contention is that ML and data are too limited for adequate modeling and prediction.

Here are the presentation titles. The authors have all published similar papers. Ratti, E., Facchini, A. and and Termine, A, "Theory-ladeness, Machine Learning, and Phenomenological Models." Duran J. "Against epistemic transparency in algorithmic science." Rameau, A. "Epistemic Misalignments in Machine Learning Models Relying on Voice." Romeijn, J. and H. van Loo, "Think descriptions in data-driven psychiatry."

3. Predictions of Foundational AI Models Replacing Scientists

Contrast this with Nvidia Corp. President's predictions for LLM based AI provided more and more resources are given to neural network training. Answers during earning call questions session Nov. 21, 2024 (Nvidia[2024]):

> And that's expected as we're in the beginnings of this generative AI revolution as we all know. And we're at the beginning of a new generation of foundation models that are able to do reasoning and able to do long thinking. And of course, one of the really exciting areas is physical AI, AI that now understands the structure of the physical world. And so, Blackwell demand is very strong.

Another answer.

> And so, on the one hand, the first thing that's happening is $1 trillion worth of computing systems and data centers around the world is now being modernized for machine learning. On the other hand, secondarily, I guess, is that on top of these systems are going to be -- we're going to be creating a new type of capability called AI. And when we say generative AI, we're essentially saying that these data centers are really AI factories. They're generating something.

and another.

And these applications have long context lengths because they want to understand. They want to be able to inference within understanding the context of what they're being asked to do. And so, the context length is growing larger and larger. On the other hand, the models are getting larger.

4. In Reality Humans are Beating Machines - PRs not withstanding

Press release claims that the deep mind GO game playing program can defeat human GO champions shows the problem. An amateur GO player wrote a program to analyze a particular GO configuration. The results were then exploited to defeat Google's deep mind GO supposed world champion GO program (Waters[2023]). The deep mind program had not been trained on the particular part of the GO game configuration space. Professional GO players recognize the pattern and know to avoid it. There are many such patterns in the GO game space.

It is not exactly acknowledged in popular culture, but the reality is that computer chess programs no longer attempt to compute with human grand master chess position analysis instead they use data base lookup of an opponents previous games so that chess experts are effectively playing against themselves. This is possible because every game played by the best grand masters is recorded into computer data bases (Kasparov[2019]). Meyer[2019] analyzes this situation in more detail. The 2023 chess cheating scandal is about the data base problem (Schribner[2022]).

5. How should Computer Artifacts be Utilized by Society

As predicted by Cambridge Lucasian professor of applied mathematics James Lighthill in 1973, development of "smart" computer application programs is a valuable endeavor. It should be organized and funded by whatever application or scientific area is being studied.

Interestingly, The Lighthill Report has 50 years later spurred complex computer application program progress in Britain. This is shown by a recent article in Wired Magazine on the 'hottest' London start ups. The company PhysicsX is developing a modeling application to improve formula one racing car engine modeling (Wired[2024]). Another company is using microphone records to analyze heart function (Medeiros[2024]).

6. References

Kasparov[2017] Kasparov, G. *Deep Thinking: Where Machine Intelligence Ends and Human Creativity Begins.* Public Affairs, 2017.

Lighthill[1973] Lighthill, J. "Artificial Intelligence: A General Survey" in *Artificial Intelligence: a paper symposium.* UK Science Research Council, 1973. URL Jan 2025: https://rodsmith.nz/wp-content/uploads/Lighthill_1973_Report.pdf

Meyer[2019] Meyer, S. A Popperian Falsification of AI - Lighthill's Argument Defended, *arXiv:1704.08111v3 [cs.AI],*, 2019. URL Jan 2025: https://arxiv.org/abs/1704.08111

Nvidia[2024] Huang, J. President, Nvidia (NVDA) Q3 2025 Earnings call Transcript. Semiwiki discussion, Page 15, Nov. 20, 2024. URL Jan 2025: https://semiwiki.com/forum/index.php?threads/ nvidia-nvda-q3-2025-earnings-call-transcript.21528/

PSA[2024] Philosophy of Science Assoc. 29th PSA Program, Nov. 14-17 2024 New Orleans, Session "Machine Learning in Science Beyond Opacity," p. 90.

Schribner[2022] Schribner, H. Chess grandmaster files $100M defamation lawsuit over cheating allegations. Axios news story Oct. 25, 2022, URL Jan 2025:

https://www.axios.com/2022/10/20/ hans-niemann-lawsuit-magnus-carlsen-chess-cheating-scandal

Schrodinger[1935] Schrodinger, E. The Present State of Quantum Mechanics. Dublin Institute translation, *Die Naturwisenshaftern 1935, vol 23, Issue 48,* 1935.

Waters[2023] Waters, R. Man beats machine at Go in human victory over AI. Ars Technica new story, Feb. 19, 2023 7:51AM, URL Jan 2025: https://arstechnica.com/information-technology/ 2023/02/man-beats-machine-at-go-in-human-victory-over-ai/

Wikipedia[2025] Wikipedia list of protein structure prediction software. Jan 2025 URL: https://en.wikipedia.org/wiki/List_of_protein_structure_prediction_software

Wired[2024] Wired Magazine, This code Breaker is Using AI to Decode the Heart's Secret Rhythms, Wired Magazine, Aug 15, 2024 5:09AM, Search Wired magazine for: ai-doctor-roeland-decorte-future-industries.

Wired[2024b] The Hottest Startups in London in 2024, Wired Magazine, Oct. 14, 2024, 2:08AM, Search Wired magazine for: the-hottest-startups-in-london-in-2024.