

The future impacts of LLM (and other AI systems) on scientific research

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1 What is the current state of the public philosophical discourse on AI systems ?

These lines are a follow-up to the reflections expressed by the French philosopher and popularizer Thibaut Giraud (@MonsieurPhi). Public philosophical discourse on AI in France is dominated by voices that are fundamentally hostile against LLM like ChatGPT and other generative AIs.

Such views are not necessarily problematic *per se* (we can indeed have good reasons to be wary of some aspects of AI systems). The problem is that this hostility is frequently based on questionable metaphysical assumptions about the nature of the mind and simplistic conceptions of how AI systems (in particular *generative* AIs like LLM) actually work.

Focusing on LLMs, we can make a short list of these (more or *less*) problematic claims (some of them already mentioned by Thibaut Giraud) here :

1. We cannot assess whether LLM "think" and "are intelligent", because it depends on our philosophical definition of these notions.
2. LLMs cannot possess the same "intelligence" as humans because their material composition and functional principles are fundamentally different.
3. In particular, none of the tasks currently used to assess objectively the cognitive abilities of LLMs can actually prove.
4. LLMs cannot "think" because their fundamental nature is to perform "probabilistic calculus" and their task is to "predict words".
5. LLMs cannot "generalize" because they proceed by induction from a given, limited dataset (on which they have been trained).
6. Even if LLMs score higher than humans on certain "cognitive" tasks, it does only imply that they well "simulate" or "mimic" thinking - without *really* doing so.
7. The question of whether LLM are "intelligent" is not important. What matters is only to determine how they impact our own cognitive abilities and socio-economic systems organizations.

(1) is a definitional issue that can be settled easily : once we agree on a correct definition of “intelligence”, we can fix objective criteria to assess whether a system satisfies this definition.

(2) is an (interesting) empirical issue that can in principle be settled through controlled observation (it does not mean that it is an *easy* issue).

(3) assumes that “being intelligent” is an non-verifiable property, therefore it should be meaningless to ask whether AI systems *or* humans are “intelligent” in this sense.

(4) implicitly considers that it is impossible to “think” simply by performing “mathematical calculus”. This claim is associated to an hostility toward the computationalist theory of mind according to which our individual mental states are updated through logical operations. If we put this last point aside, we can at least remark (like Thibaut Giraud does) that it would be strange to consider that the neurones that constitute our brain are fundamentally unable to produce “thinking” (at an emergent level) simply because their basic job is to receive and emit simple chemical signals. This does apply to the mathematical neurones constituting deep neural networks (DNN) like those involved in LLMs : their basic job is to perform mathematical computations of numerical inputs, but it does not mean that they are collectively unable to produce complexe cognitive faculties at the emergent level.

(5) is a more difficult point to discuss, however we can already recall that LLMs do not simply “pick” facts or ideas in a gigantic database. DNN are *trained* on datasets, and their ability to generalize can be assessed through their “out-of-sample” predictive power, i.e. their ability to make accurate predictions about elements that did *not* belong to their training dataset. Concerning LLM, as their task is to predict words (and not simply to classify elements for instance), assessing their ability to generalize is an empirical issue whose challenge is to design appropriate benchmarks (especially when it concerns generalizing in scientific domains).

(6) is a fallacy that is well known in philosophy. What is the difference between “possessing X” and “simulating the possession of X” ? If this difference is observable, then we should clearly determine what this difference *consists in* - which is not the case for the intelligence of LLMs. If it is not observable, then it is of no interest.

(7) is without a doubt a major issue, but it does clearly not deserve to be used as a practical tool to avoid all the other, above-mentionned questions. In addition, even if we can make non-tested conjectures, this question is once again an empirical issue that can be settled through controlled observation. The stakes are really important, for instance for teachers. Are LLMs like ChatGPT a threat for *important* cognitive faculties of students ? In this case, we should create conditions for LLM-free teaching, at least for bachelor students. If not, then LLM are simply new tools that eliminate useless faculties (for instance the faculty to verify manually that there is no missing “dot” in a CSV causing the document to malfunction.)

2 AI for hypothesis generation and data analysis

3 AI as a tool for basic scientific tasks