Review of: "Limitations of and Lessons from the Learning of Large Language Models"

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Potential competing interests: No potential competing interests to declare.

This is an interesting article. Its central thesis is that large language models (LLMs) are not as expressive as reasoning expressible in classical logic. My comments are as follows:

- “Classical logic” needs to be defined. It is clear that classical logic is opposed to intuitionistic logic by admitting inferences such as not-not-A to A ("the excluded middle" or “tertium non datur”), but it is less clear whether higher-order logics (quantification over properties, properties of properties, etc.) are included as well as first-order logic (quantification over individuals). I assume that higher-order logics are included because propositions correspond to types, and richer types correspond to higher order logics.
- The distinction between classical logic and the supposed weaker intuitionistic logic needs to explain the meaning of the “double negation” translation, where a deduction-preserving substitution is made from classical logic to intuitionistic logic, which also applies to some very rich typed theories of the lambda calculus.
- Likewise, the fact that Gentzen's LJ and LK first-order logic sequent calculus (classical and intuitionistic) can write proofs without detours by removing formulas of arbitrary complexity (called “cut elimination”) indicates that just because something is complex does not mean that there is not a simpler proof (or computation).
- It is not clear that the thesis is that LLMs can reproduce intuitionistic logic. If it is, then that should be made clear and an argument given, although it is very unlikely to be true. Both intuitionistic logic and classical logic have infinitely many symbols, and the use of higher types can increase the expressiveness of those logics. LLMs are therefore likely to be much weaker in expressive power than any logic.
- The sentence regarding “bricks” is unclear in English.
- A reference to Griffin TG. (1989), A formulae-as-type notion of control, might be useful, as the idea of passing state information is a global property.