DEAKIN UNIVERSITY | DEAKIN APPLIED ARTIFICIAL INTELLIGENCE INITIATIVE

“What If”: Scientific Reasoning with LLMs

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Background and problem statement

Many physical theories are based on axioms or assumptions that are expressed in mathematical language, and then the entire body of the theory is constructed by a cascade of mathematical treatments that are based on the fundamental assumptions. This results in a mathematical formalism which defines a particular theory. Theories clash when the underlying assumptions are different, and/or when the conclusions contradict with each other. Recent advances in LLMs have made them superior in mathematical derivations, which means that one can construct an entire mathematical framework by appropriately prompting an LLM.

Aim

The aim of this project is to challenge the LLM’s fundamental knowledge through asking “what if” questions at the level of theoretical foundation: what if the assumption “A leads to B” is relaxed, or countered by an alternative assumption such as “A and C”? The project will use various LLMs to establish cascades of mathematical derivations, alongside python code to implement the theories.

Objectives

- Pushing the limits of the most advanced LLMs, and assessing which LLMs are more geared towards free exploration of creative ideas.
- Learning new mathematical physics by challenging or completing current theory.

Expected outcomes

- Publication of the outcome in a physics journal.

How will this opportunity benefit you?

Skill development in the following areas:

- Programming
- Machine learning
- Mathematics
- Physics

Other details

- Located on-campus at Burwood
- 14 weeks in duration (Unpaid)
- Undertaken as 3 days per week for a total of ~320 hours
- To be commenced within the 12-week trimester period