

AI can't actually compute. It can do math by regurgitating answers to questions that it has already seen answered (or something close enough to what it has already seen answered), and it can do that fairly well for many problems, especially simpler ones. It is responding with patterns that it recognizes. And while recognizing patterns helps figure out what method to use to solve a problem, math is not actually solved by vague pattern recognition; there are concrete, specific answers to math problems. LLMs are not extracting numbers from a prompt, converting them to numbers, and performing pre-programmed calculations to get a correct result. They are “guessing” based on a vast analysis of data.

Calculations and computations are done via algorithms, but an LLM does not use an algorithm. There isn't actually a connection to the numerical data being processed. The output of an LLM is only based on the likelihood of the next token. The number “5” is a token, not a number – what comes after it is a result of the massive data analysis already done by the neural network. It can't be perfect, because there are many possible options for the next token. Sometimes it's correct! But “sometimes” doesn't work to replace a calculator, which will give the same answer based on the same input every time.

I first realized that LLMs weren't good at math when I was trying to use it to help with matrix problems – it only had to do fairly simple equations with small numbers (like adding or multiplying matrices that consisted only of single digit numbers), but it was getting some very obvious things wrong, simply because of the amount of numerical data it needed to keep track of for a single problem. I was very surprised at the time – and glad I had a pretty decent understanding of what was going on in the course, so I could catch the mistake. Even having a model that has been trained in-depth on mathematical concepts doesn't understand the concept, only what word comes next in the sentence explaining the concept.