Contribution ID: **44** Type: **not specified**

Can AI Perform Enumerative Geometry?

Tuesday, 15 October 2024 16:00 (15 minutes)

What happens when we let artificial intelligence tackle mathematical problems? This work explores how Transformer neural networks—initially designed for language processing—can learn and perform tasks in computational Algebraic Geometry. As a result, we introduce a neural network model that approximates psi-class intersection numbers on the moduli space of curves. Through our analysis, we discover that the network is independently learning Virasoro constraints among the intersections, meaning that the network is not only computing but revealing the hidden structures that generate them. We also explore the network's internal reasoning and find that it can assist in forming new mathematical conjectures. By interpreting its Causal "thought process" and abductive knowledge discovery, we investigate how it encodes information about the asymptotic behaviour of the intersection of psi-classes, offering insights that could guide human intuition. Our findings advocate an exciting possibility: AI could become collaborators in research-level Mathematics, providing data-driven hints and evidence for relationships that mathematicians suspect but haven't yet proven.

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Session Classification: Poster Session