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Byte Quest

Department of
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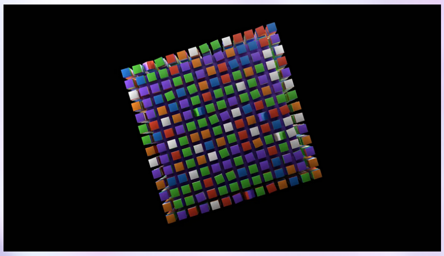
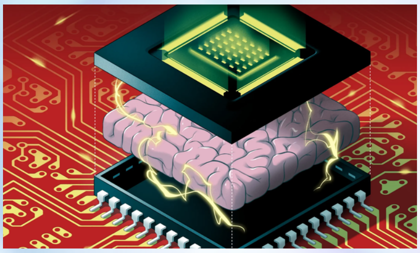
AFTER A QUANTUM CLOBBERING, ONE APPROACH SURVIVES UNSCATHED



AI REVEALS NEW POSSIBILITIES IN MATRIX MULTIPLICATION



NEW CHIP EXPANDS THE POSSIBILITIES FOR AI

NEW ENTANGLEMENT RESULTS HINT AT BETTER QUANTUM CODES

Department Vision

To be a center for academic excellence in the field of Computer Science and Engineering education to enable graduates to be ethical and competent professionals.

Department Mission

To enable students to develop logic and problem solving approach that will help build their careers in the innovative field of computing and provide creative solutions for the benefit of society.

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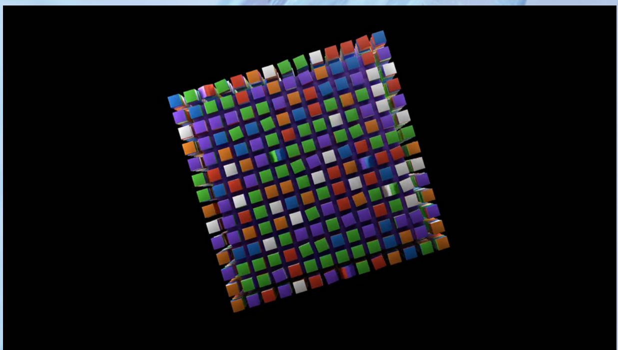
AFTER A QUANTUM CLOBBERING, ONE APPROACH SURVIVES UNSCATHED

The quest to find applications showcasing the "quantum advantage" of quantum computers met a significant obstacle when Ewin Tang devised a classical computing solution, debunking several potential quantum algorithms for data analysis. However, one algorithm, a quantum variant of topological data analysis (TDA), remained seemingly impervious to classical emulation. Recent research attempts aimed at finding classical alternatives for TDA were unsuccessful, suggesting a potential inherent link between TDA and quantum mechanics via supersymmetry, an unexpected connection that sets TDA apart from other algorithms.

While TDA exhibits resilience against classical computing, the conditions necessary for a clear quantum advantage, defined by exponential speedup compared to classical techniques, seem stringent, particularly requiring an immense number of high-dimensional holes in data. Such conditions might be rare in practical scenarios, raising doubts about TDA's widespread applicability. Despite limitations, researchers remain intrigued by the potential quantum implications of TDA, viewing it as a gateway to uncover more quantum problems suited for quantum computation. The ongoing exploration of this connection between topology and quantum mechanics fuels optimism, although there's a lingering possibility that an innovative classical approach could eventually challenge TDA's unique quantum advantage.

AI REVEALS NEW POSSIBILITIES IN MATRIX MULTIPLICATION



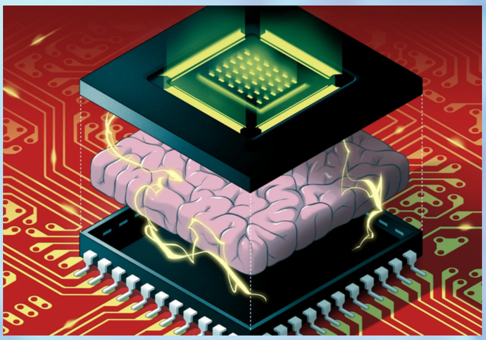
Researchers have long pursued efficient ways to multiply matrices, and recent breakthroughs with AI, like DeepMind's AlphaTensor, have uncovered new strategies. This AI, trained through neural networks, swiftly rediscovered known algorithms and found thousands of novel, efficient multiplication methods for various matrix sizes.

Despite the excitement, experts remain cautious about immediate applications, highlighting limitations in AlphaTensor's ability to explain its choices and the constraints of specific algorithms. Traditional computer searches have complemented AI-driven discoveries, further refining the multiplication process.

In essence, while these advancements showcase the potential of AI in mathematical problem-solving, they also emphasize the need for careful consideration beyond speed when applying these algorithms practically. The integration of AI like AlphaTensor opens new possibilities for solving complex computational problems but requires continued research and exploration.

NEW CHIP EXPANDS THE POSSIBILITIES FOR AI

The growing size of artificial intelligence algorithms poses challenges in terms of hardware limitations and energy inefficiency. To address this, neuromorphic computing, inspired by the brain's energy-efficient design, introduces NeuRRAM—a new chip utilizing resistive RAM (RRAM) and analog memory to boost energy efficiency and computational power for AI tasks. This chip, capable of executing complex AI algorithms with increased efficiency, merges memory and computation, demonstrating significant potential for smaller devices like smartwatches and phones to handle sophisticated AI applications.



The NeuRRAM chip's analog memory cells, storing a continuous range of values, allow it to store more information in a smaller space compared to traditional digital memory. It showcases remarkable energy efficiency—up to 1,000 times more than conventional digital computers—while performing tasks like image and speech recognition at par with digital systems. This advancement in neuromorphic computing integrates memory and computation, resembling how our brains process information, and shows promise for future energy-efficient computing.

However, challenges remain, such as ensuring precision in analog RRAM chips due to inherent variability. Despite these hurdles, NeuRRAM's success paves the way for scalable energy-efficient AI computing, potentially revolutionizing the field by addressing computational power and energy consumption concerns in large-scale AI applications. Researchers anticipate further developments, potentially mimicking the brain's neural communication signals for even greater energy efficiency

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NEW ENTANGLEMENT RESULTS HINT AT BETTER QUANTUM CODES

Three scientists were awarded the Nobel Prize in Physics for proving the concept of quantum entanglement, where entangled particles' states are connected regardless of distance. This phenomenon, called "nonlocality," has crucial implications for uncrackable code creation via quantum key distribution. While entangling more than two particles isn't new, a lab in China made a significant breakthrough by demonstrating nonlocal entanglement among three particles, a crucial step for quantum cryptography.

In this experiment, lasers entangled three photons placed meters apart and simultaneously measured their properties, confirming three-way quantum nonlocality. Though some loopholes remain, separating the particles ruled out proximity as an explanation. The experiment adhered to a stricter definition of nonlocality, useful in cryptographic scenarios. This achievement paves the way for longer-distance quantum experiments and robust quantum key distribution, promising enhanced security for communication.
The technology has broader implications beyond cryptography, potentially advancing quantum networks like a quantum internet. Despite current challenges, these experiments showcase quantum mechanics' capabilities, opening doors to unforeseen technological possibilities, especially in quantum communication and computing.

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