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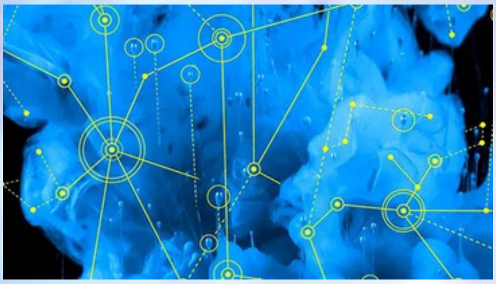
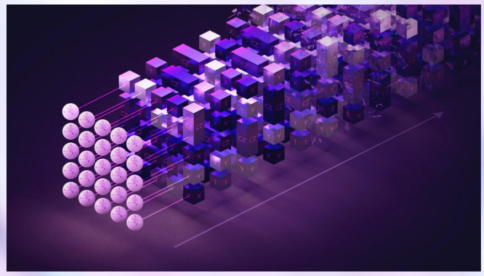
Byte Quest

Department of
CSE



SURREAL AI ETHICS



QUANTUM ERROR CORRECTION

GRAPH REVOLUTION

TENG'S SYNTHESIS

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.

FACULTY COORDINATORS

DR. BHARGAVI PEDDIREDDY
(ASSOCIATE PROFESSOR)
S. KOMAL KAUR
(ASST. PROFESSOR)

STUDENT COORDINATORS

VAMSI (3/4) CSE C
SPOORTHI (3/4) CSE C

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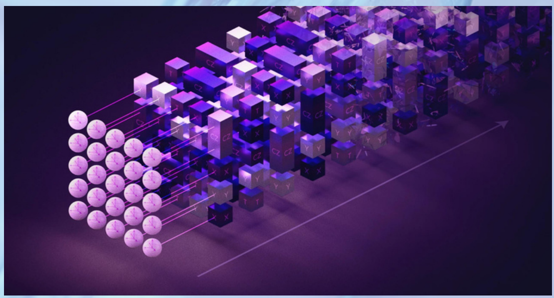
SURREAL AI ETHICS

OpenAI's DALL·E 2, a generative model, crafts surreal images like a "goldfish slurping Coca-Cola on a beach" by leveraging a physics-inspired diffusion model. This model, developed by physicist Jascha Sohl-Dickstein, transforms intricate training images into simpler distributions. Graduate students Yang Song and Jonathan Ho improved efficiency, leading to the creation of Denoising Diffusion Probabilistic Models (DDPM). These models now power cutting-edge image generators, including DALL·E 2.

While they produce remarkable results, concerns have surfaced regarding biases in generated images, mirroring societal issues. Large language models (LLMs), like GPT-3, combined with diffusion models, raise questions about perpetuating cultural biases due to training on internet-derived data. Researchers stress the necessity of careful safety testing and data curation to address these challenges in the evolving landscape of generative AI, expressing optimism about its potential applications and advancements.

QUANTUM ERROR CORRECTION



The realm of quantum computing achieved a milestone in 2019 with Google's demonstration of quantum supremacy using a 53-qubit machine. The pressing question, however, centers on the adaptability of classical algorithms as quantum computers scale up.

In a breakthrough within computational complexity theory, researchers focus on adapting classical algorithms to quantum computing, stressing the vital role of quantum error correction for sustained quantum advantage in random circuit sampling. The introduction of a classical algorithm capable of simulating such experiments with errors establishes a crucial connection between the efficiency of classical and quantum approaches. While applicable to intermediate-depth circuits, the algorithm emphasizes the pivotal role of quantum error correction for the long-term viability of practical quantum computing. Researchers unanimously recognize quantum error correction as the ultimate solution, addressing challenges posed by errors in quantum computations and ensuring the reliability of quantum applications.

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GRAPH REVOLUTION

In algorithms, negativity poses challenges, as seen in the quest for the shortest path on graphs with varying weights. Traditional methods excel when all weights are positive, but negative weights, representing scenarios like balancing delivery costs and profits, complicate matters. A breakthrough algorithm by computer scientists addresses this long-standing issue. By leveraging a decades-old mathematical technique, the algorithm achieves near-linear runtime, almost matching the speed of positive-weight algorithms. The approach involves identifying tight clusters in graphs using a modified low-diameter decomposition technique and breaking down the problem into manageable components. This innovative solution, rooted in combinatorial graph theory, bypasses the complexities of modern continuous optimization methods, sparking renewed interest in simpler, more practical algorithmic approaches to longstanding graph theory problems.

The researchers' novel algorithm not only efficiently finds shortest paths on graphs with negative weights but also extends its utility to identify negative cycles. By combining simplicity and effectiveness, this breakthrough breathes new life into combinatorial approaches, prompting further exploration of their applicability in addressing diverse challenges within graph theory.

This groundbreaking algorithm not only revolutionizes negative-weight graph problem-solving but also rekindles interest in simplistic yet effective combinatorial approaches for complex graph theory challenges.

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TENG'S SYNTHESIS

Shang-Hua Teng, a distinguished computer science professor at the University of Southern California, seamlessly intertwines theoretical and practical dimensions in his groundbreaking career. Born in Beijing during the Cultural Revolution, Teng initially aimed for biology but heeded his father's nudge toward computer science.

His pioneering work, including fluid dynamics applications of graph partitioning theorems and collaborations on intricate combinatorial games, showcases the practical implications of abstract theory. Teng's geometric methods found tangible use at NASA and Boeing Aerospace, underlining the broad reach of his contributions. Emphasizing enduring mathematical principles, his research spans optimization, game theory, and board games, reflecting a rich synthesis of personal and intellectual narratives.

Shang-Hua Teng's journey exemplifies the seamless integration of theory and practice, leaving an indelible mark on the landscape of computer science.

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