



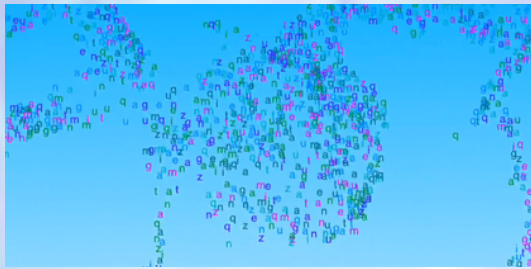
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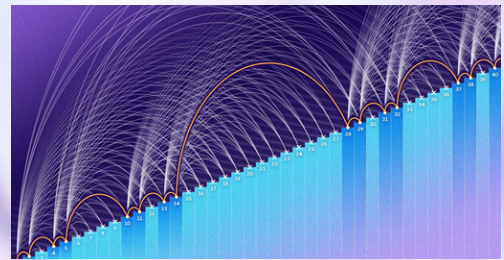
Department of

**CSE**

# Byte Quest



**THE UNPREDICTABLE ABILITIES**



**GROUNDBREAKING REVELATION**



**NETWORKING INNOVATOR**



**HOW RANDOMNESS  
IMPROVES ALGORITHMS**

## 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.*

### **FACULTY COORDINATORS**

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

## 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.*

### **STUDENT COORDINATORS**

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



# Byte Quest

## THE UNPREDICTABLE ABILITIES

The emergent abilities they display, like handling complex tasks or exhibiting zero-shot learning, seem to push the boundaries of what we previously thought possible. Yet, this unpredictability also brings challenges, especially regarding biases and inaccuracies.

Understanding how and why these models exhibit these emergent behaviors is crucial. It's like uncovering new aspects of their "intelligence" that weren't explicitly programmed. The potential for both positive applications and risks necessitates a closer look at how these models operate and evolve.

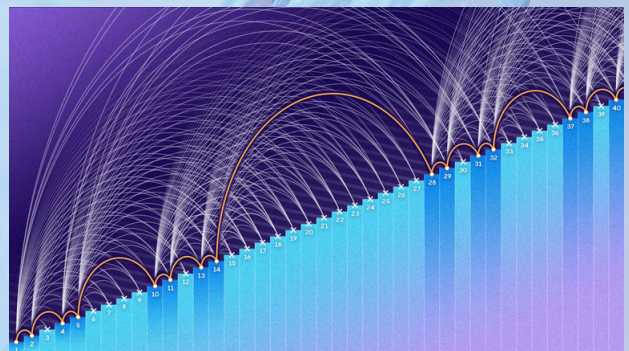


The fact that prompting them in certain ways can influence their behavior is intriguing. It implies that we might be able to steer these models away from biases or harmful tendencies, but it also highlights the complexity of their inner workings.

The evolving nature of these language models and their abilities makes it crucial for researchers to continually study and comprehend their capabilities and limitations, especially as they become more integrated into various applications.

## GROUNDBREAKING REVELATION

Zander Kelley and Raghu Meka, computer scientists, stunned the mathematics community with a breakthrough on the problem of finding the largest set of integers without evenly spaced triples. Their discovery significantly lowered the limit on the size of such sets, surpassing the prior record set by Olof Sisask and Thomas Bloom in 2020. Kelley and Meka's work revamped decades of research on arithmetic progressions, an area initiated by Erdős and Turán in 1936.



Behrend and Roth had previously established upper and lower limits respectively, but Kelley and Meka's approach, leveraging techniques from complexity theory, led to a remarkable reduction in the upper bound. Their method involved investigating the density of sets and exploiting redundancies within them, ultimately showing that a set without progressions would have contradictory properties if it grew beyond a certain size.

Kelley and Meka's innovation lay in reinterpreting existing techniques like the density increment strategy and introducing a new method called "sifting," revealing the potency of previously overlooked tools.



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## NETWORKING INNOVATOR

Bob Metcalfe, an influential figure in computer networking, received the A.M. Turing Award for his pivotal role in revolutionizing connectivity. He co-invented Ethernet, a foundational technology linking personal computers worldwide to the internet. Metcalfe's journey began at MIT and Harvard, where he proposed network interfaces. Faced with challenges in traffic coordination, he adapted queuing theory to improve data flow, later integrating these principles into a practical local network design.



Metcalfe's concept, Ethernet, integrated randomized retransmission and collision mitigation, deviating from the centralized models of Arpanet and ALOHAnet. By 1973, his team had a functioning network. He founded 3Com after leaving Xerox's PARC and advocated for Ethernet's standardization, which led to its widespread adoption as an industry standard.

Despite Ethernet's evolution, its simplicity and adaptability remain integral to modern computer networks. Metcalfe, known for his career shifts, now explores supercomputing's applications at MIT. His pioneering work continues to shape our hyperconnected world, reinforcing the significance of his contributions to computer science and networking.



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## HOW RANDOMNESS IMPROVES ALGORITHMS

Randomness plays a fundamental role in computer science, aiding in problem-solving and managing uncertainties across various fields. It's been historically used to simulate complex processes in nuclear physics, astrophysics, climate science, and economics, allowing researchers to incorporate uncertainty into algorithmic predictions. In deterministic problems like primality testing, where determining if a number is prime or composite is challenging, randomness offers an efficient alternative. Algorithms based on Fermat's little theorem leverage randomness by selecting random values for 'x' and checking if the result of  $x^N - x$  is a multiple of 'N.' While seemingly paradoxical to introduce randomness to find non-random patterns, these randomized algorithms provide quick solutions and have been remarkably successful in solving complex problems.

Nisan and Wigderson's 1994 proof offered insights into the relationship between randomized and deterministic algorithms. They proposed that either problems efficiently solvable with randomness have fast deterministic solutions or that inherently difficult problems might be secretly easier than perceived. Despite this, de-randomizing these algorithms can be intricate, leading to continued reliance on randomized approaches in computer science. Recent breakthroughs, such as the 2022 graph theory algorithm, demonstrate the strategic use of randomness to tackle problems impossible to solve deterministically. Even though determining optimal solutions remains elusive, leveraging randomness allows for efficient and practical problem-solving, shaping advancements in various computational domains.



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