SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

Weekly Discovery

We SHARE to inspire and ignite ideas!

11 Sep – 15 Sep 2023

ARCHITECTURE

East River Waterfront / SHoP Architects

"Since 2004, we have designed and delivered a suite of related projects that together serve to reclaim and reinvigorate a long-neglected stretch of Lower Manhattan riverfront. Extending from the Financial District through the historic South Street Seaport to the historically underserved neighbourhoods of the Lower East Side, our work on the East River includes new parks, several active-use recreation piers, neighbourhood services such as play areas and dog runs, integrated bikeways, and designated structures for retail, dining, and entertainment at every scale. Throughout the project, from the master plan to the smallest architectural detail, we have engaged closely and concertedly with a vast range of community groups, stakeholders, and government entities. The result is a robust new civic amenity, embraced and enjoyed by visitors and residents alike."

Source: ArchDaily (1 Sep 2023)

ARCHITECTURE

Unveiling the Objectification: Gender and the Female Body in Architecture

"The issue of gender discrimination in architecture is receiving growing attention and discussion. Many instances, including salary discrepancies, disrespect by male employees in construction sites and team management, and the historical oversight leading to women's lack of recognition are detailed and illustrated. These demotivations mean that, despite being the majority in architecture courses worldwide, only a few women manage to consolidate and gain prominence in the profession. However, sexism doesn't end there. In addition to the discrimination experienced in professional contexts, one can observe the objectification of women in architectural images and concepts."

Source: ArchDaily (11 Sep 2023)

ARTIFICIAL INTELLIGENCE

Scientific Sleuths Spot Dishonest ChatGPT Use in Papers

"On 9 August, the journal Physica Scripta published a paper that aimed to uncover new solutions to a complex mathematical equation1. It seemed genuine, but scientific sleuth Guillaume Cabanac spotted an odd phrase on the manuscript's third page: 'Regenerate response'.

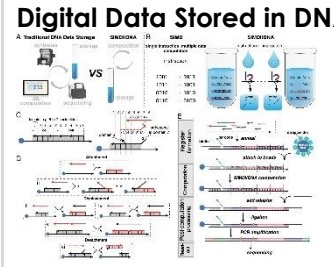
The phrase was the label of a button on ChatGPT, the free-to-use AI chatbot that generates fluent text when users prompt it with a question. Cabanac, a computer scientist at the University of Toulouse in France, promptly posted a screenshot of the page in question on PubPeer — a website where scientists discuss published research.

The authors have since confirmed with the journal that they used ChatGPT to help draft their manuscript, says Kim Eggleton, head of peer review and research integrity at IOP Publishing, Physica Scripta's publisher in Bristol, UK. The anomaly was not spotted during two months of peer review (the paper was submitted in May, and a revised version sent in July) or during typesetting. The publisher has now decided to retract the paper, because the authors did not declare their use of the tool when they submitted. "This is a breach of our ethical policies," says Eggleton. Corresponding author Abdullahi Yusuf, who is jointly affiliated with Biruni University in Istanbul and the Lebanese American University in Beirut, did not respond to Nature's request for comment."

Source: Nature (8 Sep 2023)

BIOPHYSICS AND COMPUTATIONAL BIOLOGY

Parallel Molecular Computation on Digital Data Stored in DNA

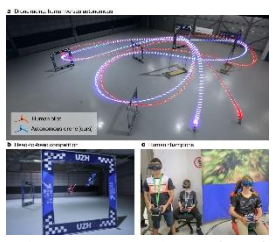


"DNA is an incredibly dense storage medium for digital data. However, computing on the stored information is expensive and slow, requiring rounds of sequencing, in silico computation, and DNA synthesis. Prior work on accessing and modifying data using DNA hybridization or enzymatic reactions had limited computation capabilities. Inspired by the computational power of "DNA strand displacement," we augment DNA storage with "in-memory" molecular computation using strand displacement reactions to algorithmically modify data in a parallel manner. We show programs for binary counting and Turing universal cellular automaton Rule 110, the latter of which is, in principle, capable of implementing any computer algorithm. Information is stored in the nicks of DNA, and a secondary sequence-level encoding allows high-throughput sequencing-based readout. We conducted multiple rounds of computation on 4-bit data registers, as well as random access of data (selective access and erasure). We demonstrate that large strand displacement cascades with 244 distinct strand exchanges (sequential and in parallel) can use naturally occurring DNA sequence from M13 bacteriophage without stringent sequence design, which has the potential to improve the scale of computation and decrease cost. Our work merges DNA storage and DNA computing, setting the foundation of entirely molecular algorithms for parallel manipulation of digital information preserved in DNA."

Source: PNAS (1 Sep 2023)

DEEP REINFORCEMENT LEARNING

Champion-Level Drone Racing Using Deep Reinforcement Learning



"First-person view (FPV) drone racing is a televised sport in which professional competitors pilot high-speed aircraft through a 3D circuit. Each pilot sees the environment from the perspective of their drone by means of video streamed from an onboard camera. Reaching the level of professional pilots with an autonomous drone is challenging because the robot needs to fly at its physical limits while estimating its speed and location in the circuit exclusively from onboard sensors. Here we introduce Swift, an autonomous system that can race physical vehicles at the level of the human world champions. The system combines deep reinforcement learning (RL) in simulation with data collected in the physical world. Swift competed against three human champions, including the world champions of two international leagues, in real-world head-to-head races. Swift won several races against each of the human champions and demonstrated the fastest recorded race time. This work represents a milestone for mobile robotics and machine intelligence, which may inspire the deployment of hybrid learning-based solutions in other physical systems."

Source: Nature (30 Aug 2023)

DESIGN

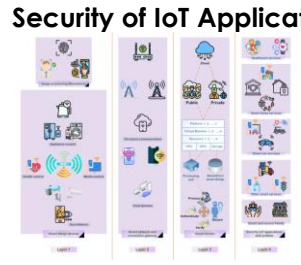
Design Institute of Australia Highlights Nine Award-Winning Student Projects

"Since 1939, the Design Institute of Australia (DIA) is the national body that champions the value of all design and the impact of designers. Its purpose is to enable designers by providing knowledge, thought leadership, access and inclusivity. The DIA is the leading advocate for design – it has the most extensive design professional network, champions design excellence, progressive change, and is a trusted voice in the national conversation. It engages with and educates designers, the government and our broader society, fostering collaborations for designers to engage across the industry and community. The DIA's Graduates of the Year Awards (GOTYA) is Australia's flagship programme for emerging designers, created to support and celebrate exceptional Australian designers as they embark on their careers. The programme has been mentoring students since 2005 and is instrumental in providing tertiary institutions and design graduates with vital, real-life feedback from experienced designers and industry figures."

Source: Dezeen (11 Sep 2023)

IOT

A Review on Role of Image Processing Techniques to Enhancing Security of IoT Applications

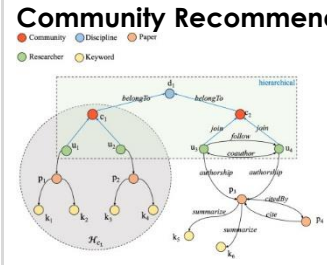


"Once an image has been processed by, for example, a robot machine, for the purpose of, for example, features extraction or meaningful information retrieval, has a secure scheme been applied to preserve security and privacy of such information before sending it to another processing party? A huge number of image-related Internet of Things (IoT) applications face such an issue. But what are applied and potentially being applied image processing techniques that have contributed to enhance the security and privacy of IoT applications? There are numerous IoT applications that utilize image processing techniques in this direction. This article aims to survey and review a number of recently published papers and research studies that encompass proposed methods in which image processing techniques are applied to enhance the security, privacy, and safety of IoT applications. It also aims to help interested researchers in related fields have insights on what the role of image processing in enhancing the security of IoT applications is and what those techniques applied to enhance the security of IoT applications are. A comprehensive framework has been graphically extracted to give readers in the field of IoT security a map with the suitable image processing techniques that serve better to enhancing IoT applications in terms of security and privacy."

Source: IEEE (7 Sep 2023)

KNOWLEDGE GRAPH

KSGAN: Knowledge-aware Subgraph Attention Network for Scholarly Community Recommendation

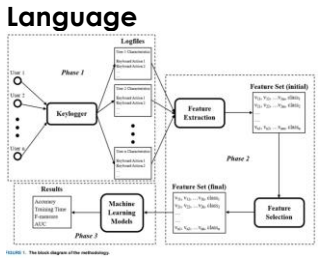


"On online scholarly platforms, recommending suitable communities to researchers matters for researchers' communication and collaboration. Previous studies on community recommendation either treat a community as a single item or simply aggregate its member features while ignoring rich user interactions and side information in scholarly communities. Existing knowledge-aware recommenders fail to capture the complicated knowledge graph structures and profile the rich information in scholarly communities, and thus not suitable for the scenario of scholarly community recommendation. In this paper, we propose a knowledge-aware subgraph attention network (KSGAN) for scholarly community recommendation. Specifically, by using a scholarly KG to profile rich information of scholarly communities, we design a biquaternion-based embedding method to capture its multiple relational patterns and hierarchical structures. Then, by profiling a scholarly community as a subgraph, we design a scalable subgraph representation learning module to learn enhanced community representation. Last, we design an attention-based historical community fusion module that captures both global dependencies and target dependencies for recommendation. Extensive experiments on two real-world scholarly datasets show that KSGAN significantly outperforms state-of-the-art baselines for scholarly community recommendation. The proposed KSGAN can find potential practical implementations on scholarly platforms to recommend scholarly communities."

Source: ScienceDirect (9 Sep 2023)

MACHINE LEARNING

The Way We Type Reveals Our Native Language



"Knowing some characteristics of an unknown user is useful information for security and commercial purposes. One of the acquired characteristics is the user's native language, and its recognition can be achieved with data derived from the text he/she types, since text is the most widespread means of communication between Internet users. Keystroke dynamics, which leverages data derived from how user types, ensures that no sensitive data are leaked. In this work, data from the daily typing of users of five different

Source: Nature (30 Aug 2023)

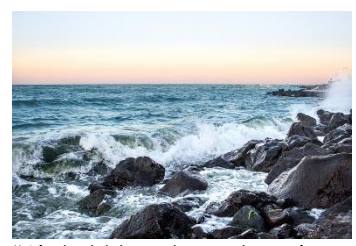
MECHANICAL ENGINEERING

Hot Summer Air Turns into Drinking Water with New Gel Device

"For significant portions of the globe faced with water shortage problems, a beacon of hope may be on the way: the ability to easily turn hot air into drinking water. For the past few years, researchers at The University of Texas at Austin have focused on the moisture present in the air as a potential source of drinking water for drought-stressed populations. In new research published in the Proceedings of the National Academy of Sciences, they reached a significant breakthrough in their efforts to create drinkable water out of thin air: a

PHYSICS

Why Seawater is Foamy



"Air bubbles churned up in pure water can easily merge. But bubbles merge far more slowly in seawater or in other liquids containing dissolved impurities, which is why such liquids often generate enduring foams. Now a team of engineers believes that it has identified the fundamental cause of the difference—subtle forces set up by electrolytes, mobile ions created when substances dissolve in liquids [1]. In a collision between two bubbles, these forces greatly reduce the rate at which the liquid separating the bubbles can flow away.

READING LIST

Artificial Intelligence and Education: A Reading List

"How should education change to address, incorporate, or challenge today's AI systems, especially powerful large language models? What role should educators and scholars play in shaping the future of generative AI? The release of ChatGPT in November 2022 triggered an explosion of news, opinion pieces, and social media posts addressing these questions. Yet many are not aware of the current and historical body of academic work that offers clarity, substance, and nuance to enrich the discourse.

native languages are collected, keystroke dynamics features are extracted, the most suitable ones are selected using a feature selection algorithm, well-known machine learning models and a boosting algorithm are used, and a rate of correct prediction that exceeds 90% is achieved. Knowing a user's native language can help strengthen authentication systems, make better use of online services, and protect unsuspecting users from falling victim to fraud."

Source: IEEE (8 Sep 2023)

molecularly engineered hydrogel that can create clean water using just the energy from sunlight. The researchers were able to pull water out of the atmosphere and make it drinkable using solar energy, in conditions as low as 104 degrees, aligning with summer weather in Texas and other parts of the world. That means people in places with excess heat and minimal access to clean water could someday simply place a device outside, and it would make water for them, with no additional effort necessary."

Source: EurekAlert! (11 Sep 2023)

This understanding, the researchers say, explains why foams arise so easily in salty seawater and could be useful in many industrial applications.

Solutions with high electrolyte concentrations often produce persisting foams, so researchers have suspected for decades that dissolved electrolytes somehow slow bubble mergers. The effect has remained mysterious, however, and many theories even suggest that electrolytes should speed up bubble mergers, says mechanical engineer Bo Liu of the University of Alberta in Canada."

Source: APS (8 Sep 2023)

Linking the terms "AI" and "education" invites a constellation of discussions. This selection of articles is hardly comprehensive, but it includes explanations of AI concepts and provides historical context for today's systems. It describes a range of possible educational applications as well as adverse impacts, such as learning loss and increased inequity. Some articles touch on philosophical questions about AI in relation to learning, thinking, and human communication. Others will help educators prepare students for civic participation around concerns including information integrity, impacts on jobs, and energy consumption. Yet others outline educator and student rights in relation to AI and exhort educators to share their expertise in societal and industry discussions on the future of AI."

Source: JSTOR (8 Sep 2023)