SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

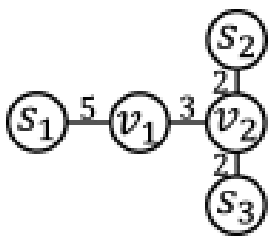
Weekly Discovery

We SHARE to inspire and ignite ideas!

14 Aug – 18 Aug 2023

ARTIFICIAL INTELLIGENCE

Conflict-Tolerant and Conflict-Free Multi-Agent Meeting



"In the Multi-Agent Meeting problem (MAM), the task is to find the optimal meeting location for multiple agents, as well as a path for each agent to that location. Among all possible meeting locations, the optimal meeting location has the minimum cost according to a given cost function. Two cost functions are considered in this research: (1) the sum of all agents paths' costs to the meeting location (SOC) and (2) the cost of the longest path among them (MKSP). MAM has many real-life applications, such as choosing a gathering point for multiple traveling agents (humans, cars, or robots).

In this paper, we divide MAM into two variants. In its basic version, MAM allows multiple agents to occupy the same location, i.e., it is conflict tolerant. For MAM, we introduce MM*, a Multi-Directional Heuristic Search algorithm, that finds the optimal meeting location under different cost functions. MM* generalises the Meet in the Middle (MM) bidirectional search algorithm to the case of finding an optimal meeting location for multiple agents. Several admissible heuristics are proposed for MM*, and experiments demonstrate the benefits of MM*."

Source: ScienceDirect (Sep 2023)

ARTIFICIAL INTELLIGENCE

How Sure Is Sure? Incorporating Human Error into Machine Learning

"Human error and uncertainty are concepts that many artificial intelligence systems fail to grasp, particularly in systems where a human provides feedback to a machine learning model. Many of these systems are programmed to assume that humans are always certain and correct, but real-world decision-making includes occasional mistakes and uncertainty.

Researchers from the University of Cambridge, along with The Alan Turing Institute, Princeton, and Google DeepMind, have been attempting to bridge the gap between human behaviour and machine learning, so that uncertainty can be more fully accounted for in AI applications where humans and machines are working together. This could help reduce risk and improve trust and reliability of these applications, especially where safety is critical, such as medical diagnosis.

The team adapted a well-known image classification dataset so that humans could provide feedback and indicate their level of uncertainty when labelling a particular image. The researchers found that training with uncertain labels can improve these systems' performance in handling uncertain feedback, although humans also cause the overall performance of these hybrid systems to drop. Their results will be reported at the AAAI/ACM Conference on Artificial Intelligence, Ethics and Society (AIES 2023) in Montréal."

Source: HARVARD (10 Aug 2023)

ARTIFICIAL INTELLIGENCE

AI Transformation of Medicine: Why Doctors Are Not Prepared

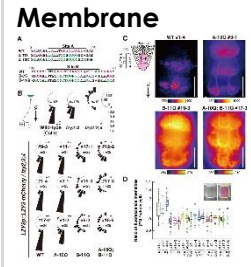
"As artificial intelligence systems like ChatGPT find their way into everyday use, physicians will start to see these tools incorporated into their clinical practice to help them make important decisions on diagnosis and treatment of common medical conditions. These tools, called clinical decision support (CDS) algorithms, can be enormously helpful in helping guide health care providers in determining, for example, which antibiotics to prescribe or whether to recommend a risky heart surgery.

The success of these new technologies, however, depends largely on how physicians interpret and act upon a tool's risk predictions – and that requires a unique set of skills that many are currently lacking, according to a new perspective article published today in the New England Journal of Medicine that was written by faculty in the University of Maryland School of Medicine (UMSOM).."

Source: U Maryland (7 Aug 2023)

BIOSENSOR

Cell Polarity Linked to Gravity Sensing Is Generated by LZY Translocation from Statoliths to The Plasma Membrane



"Organisms have evolved under gravitational force and many sense the direction of gravity via statoliths in specialised cells. In flowering plants, starch-accumulating plastids, known as amyloplasts, act as statoliths to facilitate downstream gravitropism. The gravity sensing mechanism has long been considered a mechano-sensing process by which amyloplasts transmit forces to intracellular structures, but the molecular mechanism underlying this has not been elucidated. We show here that LAZY1-LIKE (LZY) family proteins involved in statocyte gravity signalling associate with amyloplasts and its proximal plasma membrane. This results in polar localisation according to the direction of gravity. We propose a gravity sensing mechanism by which LZY translocation to the plasma membrane signals the direction of gravity by transmitting information on the position of amyloplasts."

DATA SECURITY

How Randomised Data Can Improve Our Security

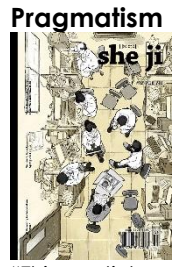
"With an innovative approach, Bochum scientists and international colleagues are creating new standards for data security in the cache of electronic devices.

Huge streams of data pass through our computers and smartphones every day. In simple terms, technical devices contain two essential units to process this data: A processor, which is a kind of control centre, and a RAM, comparable to memory. Modern processors use a cache to act as a bridge between the two, since memory is much slower at providing data than the processor is at processing it. This cache often contains private data that could be an attractive target for attackers. A team of scientists from Bochum, Germany, in cooperation with researchers from Japan, has now developed an innovative cipher that not only offers greater security than previous approaches, but is also more efficient and faster. They are presenting their work at the prestigious Usenix Security Symposium in Anaheim, California (USA)."

Source: RUB (9 Aug 2023)

DESIGN PRACTICE

Value in Design: Neoliberalism versus Pragmatism

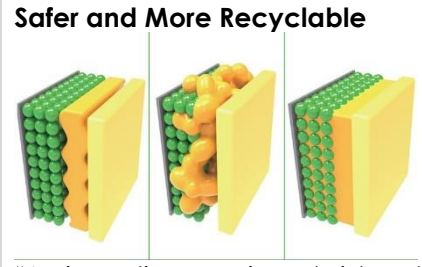


"This article conceptualises the relation between design, economics, and innovation. Rather than connecting design to economics through the notion of value, it explores how economics construes negative side-effects of market activities. Aligning itself with recent She Ji contributions that tie design to the economic sociology of Michel Callon, this article argues that markets assume a constant process of managing such side-effects. The invention of car safety and the development of safety design features in 1950s Sweden illustrate this. Automotive design through safety innovations can be seen as a design process that transcended the clear separation between business and politics assumed by neoclassical economics. This article argues that this phenomenon is a concern for design scholars as well as social scientists. I assert that it is important to explore this line of inquiry by investigating design processes in different economic settings."

Source: ScienceDirect (Jul 2023)

ENERGY

How Electric-Car Batteries Could Be Safer and More Recyclable



"An innovative organic material could make lithium-ion batteries lighter, safer, and easy to recycle.

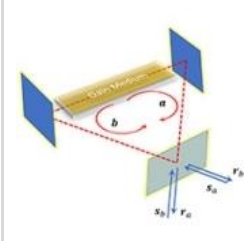
Batteries generate electricity by moving ions between two layers, called a cathode and an anode. A third layer in between, called the electrolyte, is designed to allow ions to pass easily between the anode and the cathode.

The lithium-ion batteries in modern electric vehicles and electronic gadgets typically use a liquid or gel electrolyte that is highly flammable. An important aim of battery research is to replace such electrolytes with solid materials, which would be safer and could reduce the battery's weight.

Source: Nature (11 Aug 2023)

LASER GYRO

Frequency Noise of Laser Gyros

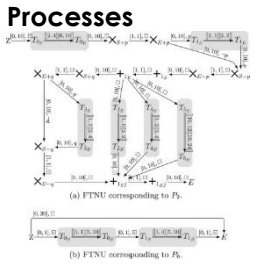


"Laser gyros are powerful tools used to test the predictions of the general theory of relativity. The precision of a measurement of the rotation rate with a laser gyro is limited by the frequency noise of the beat between two counterpropagating modes of a ring laser. The frequency noise of a single mode of a laser is limited by quantum mechanical constraints because it is related to the maximum precision with which the phase of a coherent state can be measured. If two modes are not correlated, the variance of the fluctuations of the difference of their frequencies is the sum of the variance of the frequency noise of the two modes. If the two modes are correlated, this result does not hold any longer. In this paper, we show that a laser gyro has mechanisms capable of dynamically locking the two modes together without forcing them to the same frequency. The lock of modes decouples the noise of the beat note from the frequency noise of the individual modes, thus allowing the realisation of sub-shot noise laser gyros."

Source: Optica (14 Aug 2023)

PROCESS-AWARE INFORMATION SYSTEM

Flexible Temporal Constraint Management in Modularised Processes



"Managing temporal process constraints in modularised processes is an important task, both during the design, as it allows the reuse of temporal (child) process models, and during the checking of temporal properties of processes, as it avoids the necessity of "unfolding" child processes within the main process model. Taking into account the capability of providing modular solutions, modelling, and checking temporal features of processes is still an open problem in the context of process-aware information systems.

In this paper, we present and discuss a novel approach to represent flexible temporal constraints in modularised time aware BPMN process models."

Source: ScienceDirect (Sep 2023)

SCAMS

A New Weapon in the War on Robocall Scams

"The latest weapon in the war on robocalls is an automated system capable of analysing the content of these unsolicited bulk calls to shed light on both the scope of the problem and the type of scams being perpetuated by robocalls. The tool, called SnorCall, is designed to help regulators, phone carriers and other stakeholders better understand and monitor robocall trends – and take action against related criminal activity.

"Although telephone service providers, regulators and researchers have access to call metadata – such as the number being called and the length of the call – they do not have tools to investigate what is being said on robocalls at the vast scale required," says Brad Reaves, corresponding author of a paper on the work and an assistant professor of computer science at North Carolina State University.."

Source: NCSU (8 Aug 2023)

SOCIAL MEDIA

Social Media Use Interventions Alleviate Symptoms of Depression

"The research, published in the Journal of Medical Internet Research, found that social media use interventions could help adults for whom social media use has become problematic or interferes with their mental health.

Problematic use is when a person's pre-occupation with social media results in a distraction from their primary tasks and the neglect of responsibilities in other aspects of their life.

Previous research* has suggested that social media use can become problematic when it starts to interfere with a person's daily life and leads to poor mental wellbeing, including depression, anxiety, stress, and loneliness.

To address these issues, and improve users' mental health, social media use interventions have been developed and evaluated by researchers. Such techniques include abstaining from or limiting use of social media, alongside therapy-based techniques such as Cognitive Behavioural Therapy (CBT).

Source: UCL (11 Aug 2023)

WEARABLES

Wearables Will Transform Health, But Change Brings Challenges Say Researchers

"Wearable technology presents immense opportunities to improve the way we live our lives, but a group of international researchers say the rapidly developing field also brings big challenges.

In a series of three editorials published in the British Journal of Sports Medicine, the international team of scientists discuss issues facing the wearables field including lack of standardisation of devices and data, disconnects between research and industry and the impact of inequality in ownership."

Source: Sydney (9 Aug 2023)