SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

9 April – 3 June 2022

TOPICAL REPORT

ARTIFICIAL INTELLIGENCE & DATA SCIENCE

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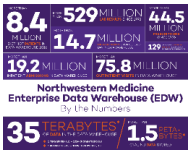
news

DATA SCIENCE



Data Science Transforming Northwestern Research

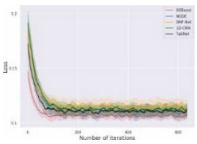
"Data science is changing the scale of research across all disciplines, Amaral stressed. "Naturally, changing the scale of the research greatly affects the way it needs to be done," he said. "If you're a historian used to looking at a few sources for your research but now want to integrate analyses from 1,000 sources, you can't do it the way you used to."
In engineering, for example, data science is helping Northwestern scholars form new collaborations with the humanities to visualize data to communicate insight into art. In cognitive sciences, it is helping researchers do computational modeling and analyze how machines process information to study and understand how human brains process information, he said."
Source: Northwestern University

The value of a data science degree, as told by Microsoft's chief data scientist

"These days, Lavista Ferres wears a lot of hats at Microsoft. He's the chief data scientist and a vice president at the technology giant, as well as a lab director overseeing Microsoft's AI for Good. This program uses artificial intelligence and data science to help develop solutions to world issues ranging from the preservation of

academic

DATA SCIENCE



Tabular data: Deep learning is not all you need

"A key element in solving real-life data science problems is selecting the types of models to use. Tree ensemble models (such as XGBoost) are usually recommended for classification and regression problems with tabular data. However, several deep learning models for tabular data have recently been proposed, claiming to outperform XGBoost for some use cases. This paper explores whether these deep models should be a recommended option for tabular data by rigorously comparing the new deep models to XGBoost on various datasets. In addition to systematically comparing their performance, we consider the tuning and computation they require. Our study shows that XGBoost outperforms these deep models across the datasets, including the datasets used in the papers that proposed the deep models. We also demonstrate that XGBoost requires much less tuning."
Source: Elsevier

A Python library for the Jupyteo IDE Earth observation processing tool enabling interoperability with the QGIS System for use in data science

"This paper describes JupyQgis – a new Python library for Jupyteo IDE enabling interoperability with the

reports

DATA SCIENCE

Here's how data science can help solve global crises

- "Global disruptions are growing more complex, taxing the capacities of social impact organizations and governments on the front lines.
- Innovative companies use data science to improve every aspect of their operations, but those sophisticated tools aren't available to many organizations and governments.
- Companies, funders and global institutions together can help organizations and governments build a robust data science infrastructure, to navigate future crises more equitably.

Across the world, local officials and NGO workers are heroically responding to overlapping, complex crises – whether they're battling new waves of the COVID-19 pandemic or delivering aid after natural disasters. The energy and determination of these frontline organizations is unmatched, but their technical capacity can fall short in crucial ways."
Source: World Economic Forum

The Future of Data Science

native languages to developing an emissions tracker to share the climate impacts caused by global shipping.
A data science veteran—or as much of a veteran as someone can be in this burgeoning field—Lavista Ferres has spent a majority of his 20-plus career in data roles. Prior to joining Microsoft in 2009 as a senior data scientist, he was the chief technology officer for Alerts.com and worked in software development at the InterAmerican Development Bank. Back then, there was no career path for data scientists, he says. That's since changed; job openings for data scientists have grown 480% since 2016, according to Glassdoor data."
Source: Fortune Education

Mapping the digital divide: Data reveals internet inequities across the country

"At UChicago's inaugural Data Science Institute Summit on May 9, the initiative unveiled a new data portal that combines public and private data from 20 cities around the nation. The website makes data accessible to governments, community groups, data scientists and other interested stakeholders seeking to improve internet connectivity to mitigate the "digital divide.""
Source: University of Chicago

How we communicate, what we value – even who we are: 8 surprising things data science has revealed about us over the past decade

"Over the past decade, a growing number of global open data sources have helped researchers reveal patterns in what we read, write and pay attention to. Google Books, Worldcat and Project Gutenberg are just some examples.
The release of the Google Books n-gram viewer in the early 2010s was a game changer on this front. Using the entire Google Books database, this tool shows you the relative frequency of a specific term or phrase as it has been used over hundreds of years. Researchers have used this data to explore the systematic suppression of the mention of Jewish painters, such as Marc Chagall, in German books during World War II."
Source: The Conversation

Dispelling the 'Digital Enchantment

"One of the central promises of the current UK government was to liberate the UK from the shackles of EU regulation, thereby doing away with much of the bureaucratic 'red tape' that EU laws the Brexiteers claimed placed unjustified burdens on QGIS system. Jupyteo is an online integrated development environment for earth observation data processing and is available on a cloud platform. It is targeted at remote sensing experts, scientists and users who can develop the Jupyter notebook by reusing embedded open-source tools, WPS interfaces and existing notebooks. In recent years, there has been an increasing popularity of data science methods that have become the focus of many organizations. Many scientific disciplines are facing a significant transformation due to data-driven solutions. This is especially true of geodesy, environmental sciences, and Earth sciences, where large data sets, such as Earth observation satellite data (EO data) and GIS data are used."
Source: Baz Tech

ARTIFICIAL INTELLIGENCE

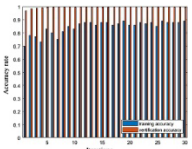


Image recognition algorithm based on artificial intelligence

"Convolutional neural networks also encountered some problems in the development of image recognition. The most prominent problem is that it is costly and time-consuming to collect data sets and train models. Limited data sets will cause the trained models to overfit. This paper proposes two methods to reduce overfitting based on the residual neural network architecture. The first type of method proposes a method of cross-combining waivers, reducing the size of the convolution kernel, and reducing the number of convolution kernels. The fitting method uses cross-combination to make the accuracy of Kaggle cat and dog data on the validation data set reach 95.37% and 90.31% on 30 types of engineering practice verification data set. The second method is based on the finetune residual neural network."
Source: Springer Link

A Long Short-Term Memory for AI Applications in Spike-based Neuromorphic Hardware

"Spike-based neuromorphic hardware holds promise for more energy-efficient implementations of deep neural networks (DNNs) than standard hardware such as GPUs. But this requires us to understand how DNNs can be emulated in an event-based sparse firing regime, as otherwise the energy advantage is lost. In particular, DNNs that solve sequence processing tasks typically employ long short-term memory units

"In 2022, data science ranked in the top five most in-demand and highest paying jobs in Australia[1]. Its annual average growth rate is predicted to be 2.4 per cent, according to Deloitte[2], a whole percentage point higher than the average job rate growth. The average base salary for data science professionals is also extremely generous, at around AUD$112,000, according to Indeed[3].
Data science is skyrocketing in demand and opportunities abound. Here's an overview of how far the field has come and the exciting path it will take in the future."
Source: James Cook University

Data Science Platform Market Share 2022 Global Business Industry Revenue, Demand and Applications Market Research Report to 2028

"Global Data Science Platform Market (2022-2028) Research report provides an in-depth market evaluation by highlighting information on various aspects covering global drivers, barriers, opportunities, threats and markets including progress trends, competitive landscape analysis, and expansion status of key regions. This report is a comprehensive numerical analysis of the Data Science Platform industry and provides data to make strategies for increasing market growth and success. The report also estimates market size, Price, Revenue, margin of profit and Data Science Platform Market Share, cost structure and growth rates for decision making."
Source: Market Watch

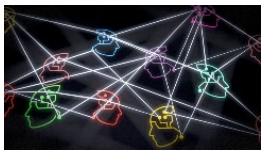
ARTIFICIAL INTELLIGENCE

2022 AI Index Report – Fifth Edition

"The AI Index is an independent initiative at the Stanford Institute for Human-Centered Artificial Intelligence (HAI), led by the AI Index Steering Committee, an interdisciplinary group of experts from across academia and industry. The annual report tracks, collates, distills, and visualizes data relating to artificial intelligence, enabling decision-makers to take meaningful action to advance AI responsibly and ethically with humans in mind.
The 2022 AI Index report measures and evaluates the rapid rate of AI advancement from research and development to technical performance and ethics, the economy and education, AI policy

business. The EU data protection regime is considered an exemplar. In his introduction to the consultation paper released on 10 September 2021, entitled 'Data: A New Direction', the sponsoring Minister Oliver Dowden proudly states, 'our ultimate aim is to create a more pro-growth and pro-innovation data regime whilst maintaining the UK's world-leading data protection standards'. Although he states that 'the protection of people's personal data must be at the heart of our new regime', the proposals are entirely directed towards removing existing data protection standards. At the same time, any reference to individual privacy and data protection as a fundamental right is strenuously avoided across the entire consultation document. Underpinning these proposed reforms lies an unshakeable belief that digital innovation is an unmitigated good that will lead to a prosperous future overflowing with abundance – or, to use Oliver Dowden's words 'usher in a new golden age of growth and innovation right across the UK as we build back better.'"
Source: University of Birmingham

ARTIFICIAL INTELLIGENCE



Is diversity the key to collaboration? New AI research suggests so

"As artificial intelligence gets better at performing tasks once solely in the hands of humans, like driving cars, many see teaming intelligence as a next frontier. In this future, humans and AI are true partners in high-stakes jobs, such as performing complex surgery or defending from missiles. But before teaming intelligence can take off, researchers must overcome a problem that corrodes cooperation: humans often do not like or trust their AI partners.

Now, new research points to diversity as being a key parameter for making AI a better team player.

MIT Lincoln Laboratory researchers have found that training an AI model with mathematically "diverse" teammates improves its ability to collaborate with other AI it has never worked with before, in the card game Hanabi."
Source: MIT News

AI needs to serve people, science, and society

"Artificial intelligence today is ubiquitous.

that are hard to emulate with few spikes. We show that a facet of many biological neurons, slow after-hyperpolarizing currents after each spike, provides an efficient solution. After-hyperpolarizing currents can easily be implemented in neuromorphic hardware that supports multi-compartment neuron models, such as Intel's Loihi chip."
Source: Nature

Distributed Learning With Sparsified Gradient Differences

"A very large number of communications are typically required to solve distributed learning tasks, and this critically limits scalability and convergence speed in wireless communications applications. In this paper, we devise a Gradient Descent method with Sparsification and Error Correction (GD-SEC) to improve the communications efficiency in a general worker-server architecture. Motivated by a variety of wireless communications learning scenarios, GD-SEC reduces the number of bits per communication from worker to server with no degradation in the order of the convergence rate. This enables larger scale model learning without sacrificing convergence or accuracy."
Source: IEEE Xplore

Inverse design enables large-scale high-performance meta-optics reshaping virtual reality

"Meta-optics has achieved major breakthroughs in the past decade; however, conventional forward design faces challenges as functionality complexity and device size scale up. Inverse design aims at optimizing meta-optics design but has been currently limited by expensive brute-force numerical solvers to small devices, which are also difficult to realize experimentally. Here, we present a general inverse-design framework for aperiodic large-scale (20k × 20k λ2) complex meta-optics in three dimensions, which alleviates computational cost for both simulation and optimization via a fast approximate solver and an adjoint method, respectively. Our framework naturally accounts for fabrication constraints via a surrogate model."
Source: Nature Communications

A Review of the Potential of Artificial Intelligence Approaches to Forecasting COVID-19 Spreading

"The spread of SARS-CoV-2 can be considered one of the most complicated patterns with a large number of uncertainties and nonlinearities. Therefore, analysis and prediction of the distribution of this

and governance, and more. The latest edition includes data from a broad set of academic, private, and non-profit organizations as well as more self-collected data and original analysis than any previous editions."
Source: Stanford University

Global Artificial Intelligence in Big Data Analytics and IoT Market Report 2022-2027: How Different Forms of AI May be Best Used for Problem-Solving

"The World Robotics report shows that Europe is the region with the highest robot density globally, with an average value of 114 units per 10,000 employees in the manufacturing industry. For more facts about robots watch IFR´s video news about Europe in one minute."
Source: PRN News Wire

Artificial Intelligence & Machine Learning Report

"VC investment in AI startups slumped around 21% quarter-over-quarter to $23.9 billion in Q1. However, the total remained in line with quarters prior to Q4 2021, and median late-stage valuations rose more than 11% to $100.0 million.

While most of the categories within AI & ML are on pace to decline in VC funding this year, standout sectors including accounting automation, autoML, genetic analytics, and supply chain optimization continued to grow.

On the exit front, PitchBook analysts predict that an uptick in AI mega-exits will be pushed out until market conditions improve and acquirers can bear the high operating costs of building sophisticated AI models.

Our Q1 update of AI & ML Emerging Tech Research dives deep into the vertical's investment activity and trends, comprehensively assessing emerging opportunities in Conversational AI, silicon photonics, and revenue operations."
Source: Pitch Book

Study on the impact of artificial intelligence on product safety

"This study was commissioned by the Office for Product Safety and Standards from the Centre for Strategy and Evaluation Services (CSES). Its objective was to examine the current and forecasted future impacts of artificial intelligence in consumer products, and what this means for product safety. Its scope was manufactured consumer products subject to the General Product Safety Regulations 2005 and other legislation for specific goods. It involved a combination of desk research, an extensive interview programme and an online workshop

It is deployed in health to map the consequences of genetic variation in cancer. It is helping researchers find new pulsars and planets. It is providing faster approaches for solving complex equations to support climate science… The pervasiveness of AI sets it apart from other areas of technology innovation, such as nanotechnologies, graphene, or fusion. AI is both a rapidly-advancing research domain and an accelerator of innovation in other disciplines and industry sectors.
It is also a technology that is intertwined with diverse societal interests. Its impact is felt across society."
Source: University of Cambridge

When a machine invents things for humanity, who gets the patent?

"It's not surprising these days to see new inventions that either incorporate or have benefitted from artificial intelligence (AI) in some way, but what about inventions dreamt up by AI – do we award a patent to a machine?
This is the quandary facing lawmakers around the world with a live test case in the works that its supporters say is the first true example of an AI system named as the sole inventor.
In commentary published in the journal Nature, two leading academics from UNSW Sydney examine the implications of patents being awarded to an AI entity.
Intellectual Property (IP) law specialist Associate Professor Alexandra George and AI expert, Laureate Fellow and Scientia Professor Toby Walsh argue that patent law as it stands is inadequate to deal with such cases and requires legislators to amend laws around IP and patents – laws that have been operating under the same assumptions for hundreds of years."
Source: UNSW Sydney

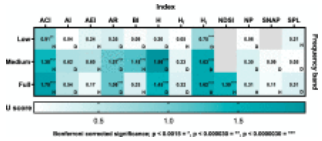
Meet CoAuthor, an Experiment in Human-AI Collaborative Writing

"AI that helps people write is not new. Google's predictive search is an easy example, as are the next-word text suggestion algorithms on a smartphone. Other apps help you compose an email or even write code. *So why not create AI that helps humans write well?*
Writing computer code or a text to your friend is a far cry from writing an arresting poem or a deft essay. Those pieces require *creative* writers who invent combinations of words that are original, interesting, and thought provoking. *It's hard to imagine a machine writing, say, Cormac McCarthy. But perhaps all that's* virus are one of the most challenging problems, affecting the planning and managing of its impacts. Although different vaccines and drugs have been proved, produced, and distributed one after another, several new fast-spreading SARS-CoV-2 variants have been detected. This is why numerous techniques based on artificial intelligence (AI) have been recently designed or redeveloped to forecast these variants more effectively. The focus of such methods is on deep learning (DL) and machine learning (ML), and they can forecast nonlinear trends in epidemiological issues appropriately. This short review aims to summarize and evaluate the trustworthiness and performance of some important AI-empowered approaches used for the prediction of the spread of COVID-19."
Source: MDPI

Data-driven shape memory alloy discovery using Artificial Intelligence Materials Selection (AIMS) framework

"One of the obstacles to the deployment of shape memory alloys (SMAs) in solid-state actuation is the low efficiency and functional instability due to the transformation thermal hysteresis and large temperature ranges during martensitic phase transformation. Numerous studies have been conducted in an effort to minimize the thermal hysteresis and transformation temperature range of SMAs through ternary and quaternary alloying of known binary alloy systems, such as NiTi, and considerable success has been achieved."
Source: Elsevier

MACHINE LEARNING



Enhancing automated analysis of marine soundscapes using ecoacoustic indices and machine learning

"Historically, ecological monitoring of marine habitats has primarily relied on labour-intensive, non-automated survey methods. The field of passive acoustic monitoring (PAM) has demonstrated the potential of this practice to automate surveying in marine habitats. This has primarily been through the use of 'ecoacoustic indices' to quantify attributes from natural soundscapes. However, investigations using individual indices have had mixed success. Using PAM recordings collected at one of the world's largest coral reef restoration programmes, we instead apply a with participants from all relevant stakeholder groups."
Source: Gov.UK

Global Healthcare Artificial Intelligence Growth Opportunities

"In this report, Frost & Sullivan examines the role of artificial intelligence (AI) in the healthcare sector. Stakeholders across the healthcare continuum increasingly use AI to cater to the descriptive, diagnostic, predictive, and prescriptive aspects of care provision. These aspects help improve healthcare delivery efficiency, provide personalized treatments to patients, and enhance clinical outcomes to improve patient and staff experience. The study helps healthcare providers to understand the key trends emerging in the AI and healthcare space as they consider investing in cognitive capabilities. It provides an overview of AI and healthcare market growth drivers and restraints set to impact the deployment of AI-based solutions."
Source: Frost & Sullivan

Growth Opportunities In No-Code/Low-Code, Artificial Intelligence, High Performance Computing And Edge Computing

"This edition of IT, Computing and Communications (ITCC) Technology Opportunity Engine (TOE) provides a snapshot of the emerging ICT led innovations in No-Code/Low-Code, Artificial Intelligence, High Performance Computing and Edge Computing. This issue focuses on the application of information and communication technologies in alleviating the challenges faced across industry sectors in areas such as retail, healthcare, BFSI, and manufacturing.
ITCC TOE's mission is to investigate emerging wireless communication and computing technology areas including 3G, 4G, Wi-Fi, Bluetooth, Big Data, cloud computing, augmented reality, virtual reality, artificial intelligence, virtualization and the Internet of Things and their new applications; unearth new products and service offerings; highlight trends in the wireless networking, data management and computing spaces; provide updates on technology funding; evaluate intellectual property; follow technology transfer and solution deployment/integration; track development of standards and software; and report on legislative and policy issues and many more."
Source: Frost & Sullivan

missing is the right artificial intelligence tool.
CoAuthor is based on GPT-3, one of the recent large language models from OpenAI, trained on a massive collection of already-written text on the internet."
Source: Stanford University

AI traffic light system could make traffic jams a distant memory

"The system – the first of its kind – reads live camera footage and adapts the lights to compensate, keeping the traffic flowing and reducing congestion. The work is detailed in the paper 'Fully-Autonomous, Vision-based Traffic Signal Control: from Simulation to Reality' which is is being presented at the Autonomous Agents and Multi-agent Systems Conference 2022 today (11 May).
The system uses deep reinforcement learning, where a program understands when it is not doing well and tries a different course of action – or continues to improve when it makes progress.
In testing, the system significantly outperformed all other methods, which typically rely on manually-designed phase transitions."
Source: Aston University

Artificial intelligence predicts patients' race from their medical images

"The study, "AI recognition of patient race in medical imaging: a modeling study," was published in Lancet Digital Health on May 11. Celi and Ghassemi wrote the paper alongside 20 other authors in four countries.
To set up the tests, the scientists first showed that the models were able to predict race across multiple imaging modalities, various datasets, and diverse clinical tasks, as well as across a range of academic centers and patient populations in the United States. They used three large chest X-ray datasets, and tested the model on an unseen subset of the dataset used to train the model and a completely different one. Next, they trained the racial identity detection models for non-chest X-ray images from multiple body locations, including digital radiography, mammography, lateral cervical spine radiographs, and chest CTs to see whether the model's performance was limited to chest X-rays."
Source: MIT News

Artificial intelligence system learns concepts shared across video, audio, and text

"Liu and his collaborators developed an artificial intelligence technique that learns to represent data in a way machine-learning approach across a suite of ecoacoustic indices to improve predictive power of ecosystem health. Healthy and degraded reef sites were identified through live coral cover surveys, with 90–95% and 0–20% cover respectively. A library of one-minute recordings were extracted from each. Twelve ecoacoustic indices were calculated for each recording, in up to three different frequency bandwidths (low: 0.05–0.8 kHz, medium: 2–7 kHz and broad: 0.05–20 kHz)."
Source: Elsevier

A ubiquitous unifying degeneracy in two-body microlensing systems

"While gravitational microlensing by planetary systems1,2 provides unique vistas on the properties of exoplanets3, observations of a given two-body microlensing event can often be interpreted with multiple distinct physical configurations. Such ambiguities are typically attributed to the close–wide4,5 and inner–outer6 types of degeneracy, which arise from transformation invariances and symmetries of microlensing caustics. However, there remain unexplained inconsistencies (see, for example, ref. 7) between the aforementioned theories and observations. Here, leveraging a fast machine learning inference framework8, we present the discovery of the offset degeneracy, which concerns a magnification-matching behaviour on the lens axis and is formulated independently of caustics. This offset degeneracy unifie."
Source: Nature

Predicting zip code-level vaccine hesitancy in US Metropolitan Areas using machine learning models on public tweets

"Although the recent rise and uptake of COVID-19 vaccines in the United States has been encouraging, there continues to be significant vaccine hesitancy in various geographic and demographic clusters of the adult population. Surveys, such as the one conducted by Gallup over the past year, can be useful in determining vaccine hesitancy, but can be expensive to conduct and do not provide real-time data. At the same time, the advent of social media suggests that it may be possible to get vaccine hesitancy signals at an aggregate level, such as at the level of zip codes. Theoretically, machine learning models can be learned using socioeconomic (and other) features from publicly available sources. Experimentally, it remains an open question whether such an endeavor is

Growth Opportunities In Cloud, Artificial Intelligence, And Edge Computing

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Source: Frost & Sullivan

that captures concepts which are shared between visual and audio modalities. For instance, their method can learn that the action of a baby crying in a video is related to the spoken word "crying" in an audio clip. Using this knowledge, their machine-learning model can identify where a certain action is taking place in a video and label it.
It performs better than other machine-learning methods at cross-modal retrieval tasks, which involve finding a piece of data, like a video, that matches a user's query given in another form, like spoken language. Their model also makes it easier for users to see why the machine thinks the video it retrieved matches their query."
Source: MIT News

Opinion: AI could help us spot viruses like monkeypox before they cross over

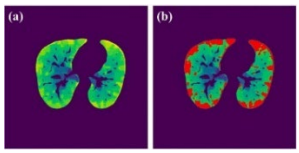
"To be better prepared for the next spillover of viruses from animals, we must focus on the connections between human, environmental and animal health. This is known as the One Health approach, endorsed by the World Health Organization and many others.
We believe artificial intelligence can help us better understand this web of connection, and teach us how to keep life in balance.
Fully 60% of all infectious diseases affecting humans are zoonoses, meaning they came from animals. That includes the lethal Ebola virus, which came from primates, swine flu, from pigs, and the novel coronavirus, most likely from bats. It's also possible for humans to give animals our diseases, with recent research suggesting transmission of COVID-19 from humans to cats as well as deer."
Source: University College London

MACHINE LEARNING

In bias we trust?

"MIT researchers took a hard look at the fairness of some widely used explanation methods. They found that the approximation quality of these explanations can vary dramatically between subgroups and that the quality is often significantly lower for minoritized subgroups.
In practice, this means that if the approximation quality is lower for female applicants, there is a mismatch between the explanations and the model's predictions that could lead the admissions officer to feasible, and how it would compare to non-adaptive baselines. In this article, we present a proper methodology and experimental study for addressing this question."
Source: PLOS

DEEP LEARNING



An interpretable deep learning workflow for discovering subvisual abnormalities in CT scans of COVID-19 inpatients and survivors

"The World Robotics report shows that Europe is the region with the highest robot density globally, with an average value of 114 units per 10,000 employees in the manufacturing industry. For more facts about robots watch IFR´s video news about Europe in one minute."
Source: Nature Machine Intelligence

A graph-transformer for whole slide image classification

"Deep learning is a powerful tool for whole slide image (WSI) analysis. Typically, when performing supervised deep learning, a WSI is divided into small patches, trained and the outcomes are aggregated to estimate disease grade. However, patch-based methods introduce label noise during training by assuming that each patch is independent with the same label as the WSI and neglect overall WSI-level information that is significant in disease grading. Here we present a Graph-Transformer (GT) that fuses a graph-based representation of an WSI and a vision transformer for processing pathology images, called GTP, to predict disease grade. We selected 4; 818 WSIs from the Clinical Proteomic Tumor Analysis Consortium (CPTAC), the National Lung Screening Trial (NLST), and The Cancer Genome Atlas (TCGA), and used GTP to distinguish adenocarcinoma (LUAD) and squamous cell carcinoma (LSCC) from adjacent non-cancerous tissue (normal)."
Source: IEEE Xplore

Automated recognition of the cricket batting backlift technique in video footage using deep learning architectures

"There have been limited studies demonstrating the validation of batting techniques in cricket using machine learning. This study demonstrates how the batting

wrongly reject more women than men.
Once the MIT researchers saw how pervasive these fairness gaps are, they tried several techniques to level the playing field. They were able to shrink some gaps but couldn't eradicate them."
Source: MIT News

On the road to cleaner, greener, and faster driving

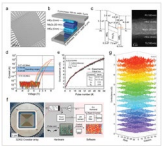
"In a new study, MIT researchers demonstrate a machine-learning approach that can learn to control a fleet of autonomous vehicles as they approach and travel through a signalized intersection in a way that keeps traffic flowing smoothly.
Using simulations, they found that their approach reduces fuel consumption and emissions while improving average vehicle speed. The technique gets the best results if all cars on the road are autonomous, but even if only 25 percent use their control algorithm, it still leads to substantial fuel and emissions benefits.
"This is a really interesting place to intervene. No one's life is better because they were stuck at an intersection. With a lot of other climate change interventions, there is a quality-of-life difference that is expected, so there is a barrier to entry there. Here, the barrier is much lower," says senior author Cathy Wu, the Gilbert W. Winslow Career Development Assistant Professor in the Department of Civil and Environmental Engineering and a member of the Institute for Data, Systems, and Society (IDSS) and the Laboratory for Information and Decision Systems (LIDS)."
Source: MIT News

Unpacking black-box models

"Modern machine-learning models, such as neural networks, are often referred to as "black boxes" because they are so complex that even the researchers who design them can't fully understand how they make predictions. To provide some insights, researchers use explanation methods that seek to describe individual model decisions. For example, they may highlight words in a movie review that influenced the model's decision that the review was positive.
But these explanation methods don't do any good if humans can't easily understand them, or even misunderstand them. So, MIT researchers created a mathematical framework to formally quantify and evaluate the understandability of explanations for machine-learning models."
Source: MIT News

backlift technique in cricket can be automatically recognised in video footage and compares the performance of popular deep learning architectures, namely, AlexNet, Inception V3, Inception Resnet V2, and Xception. A dataset is created containing the lateral and straight backlift classes and assessed according to standard machine learning metrics... This study provides a way forward in the automatic recognition of player patterns and motion capture, making it less challenging for sports scientists, biomechanists and video analysts working in the field."
Source: Nature Scientific Reports

NEURAL NETWORKS



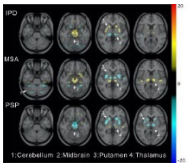
Demonstration of Neuromodulation-inspired Stashing System for Energy-efficient Learning of Spiking Neural Network using a Self-Rectifying Memristor Array

"Neuromorphic engineering aims to mimic brain functions to achieve energy-efficient artificial intelligence. Since researchers have indicated that memristors can mimic synapses and neurons, various studies have demonstrated the operation of neural networks using memristive dot product engine (MDPE) hardware. However, although several feasible implementations of synapse and neuron behaviors have been reported, few studies have demonstrated the system-level energy-efficient operation on the hardware. This work proposes a novel system inspired by the neuromodulation of the brain, referred to as a "stashing system." In the system, the trained synapses are stashed temporarily during the training of the spiking neural network and then merged for inferencing. The software simulation first confirmed the working principle of the stashing system."
Source: Wiley Online Library

Learning the Physics of All-Dielectric Metamaterials with Deep Lorentz Neural Networks

"Deep neural networks (DNNs) have shown marked achievements across numerous research and commercial settings. Part of their success is due to their ability to "learn" internal representations of the input (x) that are ideal to attain an accurate approximation ($f\hat{}$) of some unknown function (f) that is, y = f(x). Despite

DEEP LEARNING



Novel deep learning method provides early and accurate differential diagnosis for Parkinsonian diseases

"A new deep learning method has been created to aid in the diagnosis of parkinsonian diseases, according to research published ahead of print by *The Journal of Nuclear Medicine*. Using a 3D deep convolutional neural network to extract deep metabolic imaging indices from ^{18}F-FDG PET scans, scientists can effectively differentiate between Parkinson's disease and other parkinsonian syndromes, such as multiple system atrophy and progressive supranuclear palsy."
Source: EurekAlert!

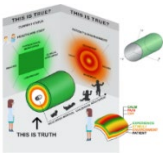
Deep learning and disease detection

"**WHO? Marcel Gehrung** co-founded Cyted with his PhD advisor, Rebecca Fitzgerald, Professor of Cancer Prevention at the University of Cambridge and with Maria O'Donovan, lead pathologist for upper gastrointestinal cancer and diagnostic cytology at Cambridge University Hospitals NHS Foundation Trust.
WHAT? A rapidly growing start-up, Cyted combines AI with a new technique for detecting oesophageal cancer, invented at Cambridge by Rebecca Fitzgerald.
WHY? Oesophageal cancers are the eighth most common cancer and the sixth most common cause of cancer death. Fitzgerald's Cytosponge (or 'sponge on a string') identifies people who may go on to develop it.
But analysing the samples creates extra work for an already overstretched health service. Cyted uses deep learning pathology techniques to do the leg work, so that human pathologists need only look at the cases that aren't clear cut.
WHAT NEXT? Finding markers for oesophageal cancer is just the beginning. The platform technology can be applied to lots of other diseases including prostate, skin and bowel cancer."
Source: University of Cambridge

Study evaluates deep learning models that decode the functional properties of proteins

"Deep learning–based language models, such as BERT, T5, XLNet and their universal approximation capability, a drawback of DNNs is that they are black boxes, and it is unknown how or why they work. Thus, the physics discovered by the DNN remains hidden. Here, the condition of causality is enforced through a Lorentz layer incorporated within a deep neural network. This Lorentz NN (LNN) takes in the geometry of an all-dielectric metasurface, and outputs the causal frequency-dependent permittivity $\tilde{\varepsilon}(\omega)$ and permeability $\tilde{\mu}(\omega)$. Additionally, this LNN gives the spatial dispersion (k) inherent in the effective material parameters, as well as the Lorentz terms, which constitute both $\tilde{\varepsilon}(\omega,k)$ and $\tilde{\mu}(\omega,k)$."
Source: Wiley Online Library

HEALTH CARE



Predicting clinical outcomes using artificial intelligence and machine learning in neonatal intensive care units: a systematic review

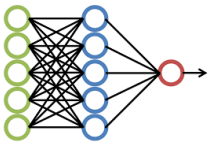
"Background
Advances in technology, data availability, and analytics have helped improve quality of care in the neonatal intensive care unit.
Objective
To provide an in-depth review of artificial intelligence (AI) and machine learning techniques being utilized to predict neonatal outcomes.
Methods
The PRISMA protocol was followed that considered articles from established digital repositories. Included articles were categorized based on predictions of: (a) major neonatal morbidities such as sepsis, bronchopulmonary dysplasia, intraventricular hemorrhage, necrotizing enterocolitis, and retinopathy of prematurity; (b) mortality; and (c) length of stay."
Source: Journal of Perinatology

Parental perceptions on use of artificial intelligence in pediatric acute care

"Background
Family engagement is critical in the implementation of artificial intelligence (AI)-based clinical decision support tools, which will play an increasing role in healthcare in the future. We sought to understand parental perceptions of computer-assisted health care of children in the emergency department (ED).
Methods

GPT, are promising for analyzing speech and texts. In recent years, however, they have also been applied in the fields of biomedicine and biotechnology to study genetic codes and proteins…Bioinformaticians, genetics researchers and neuroscientists have been trying to infer the biological roles of genes and proteins for decades. To do this, however, they need to analyze extremely large and highly complex biological data."
Source: Phys. Org

NEURAL NETWORK



Rational neural network advances machine-human discovery

"This machine-human partnership is a step toward the day when deep learning will enhance scientific exploration of natural phenomena such as weather systems, climate change, fluid dynamics, genetics and more. "Data-Driven Discovery of Green's Functions With Human-Understandable Deep Learning" was published in Scientific Reports, Nature on March 22.
A subset of machine learning, neural networks are inspired by the simple animal brain mechanism of neurons and synapses – inputs and outputs, Townsend said. Neurons – called "activation functions" in the context of computerized neural networks – collect inputs from other neurons. Between the neurons are synapses, called weights, that send signals to the next neuron."
Source: Cornell University

HEALTH CARE

Can artificial intelligence overcome the challenges of the health care system?

"Even as rapid improvements in artificial intelligence have led to speculation over significant changes in the health care landscape, the adoption of AI in health care has been minimal. A 2020 survey by Brookings, for example, found that less than 1 percent of job postings in health care required AI-related skills.
The Abdul Latif Jameel Clinic for Machine Learning in Health (Jameel Clinic), a research center within the MIT Schwarzman College of

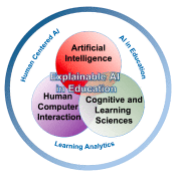
We conducted a population-weighted household panel survey of parents with minor children in their home in a large US city to evaluate perceptions of the use of computer programs for the care of children with respiratory illness. We identified demographics associated with discomfort with AI using survey-weighted logistic regression."
Source: Elsevier

SUSTAINABILITY

Artificial intelligence in green building

"The Architecture, Engineering and Construction (AEC) sector faces severe sustainability and efficiency challenges. The application of artificial intelligence in green building (AI-in-GB) is an effective solution to enhance the sustainability and efficiency of the sector. While studies have been conducted in the AI-in-GB domain, an *in-depth* study on the state-of-the-art of AI-in-GB research is hitherto lacking. To provide a better understanding of this underexplored area, this study was initiated via a bibliometric-systematic analysis method. The study aims to reveal the synthesis between AI and GB, as well as to highlight research trends along with knowledge gaps that may be tackled in future AI-in-GB research. A quantitative bibliometric analysis was conducted to objectively identify the major research hotspots, trends, knowledge gaps and future research needs based on 383 research publications identified from Scopus."
Source: Elsevier

EDUCATION



Explainable Artificial Intelligence in education

"There are emerging concerns about the Fairness, Accountability, Transparency, and Ethics (FATE) of educational interventions supported by the use of Artificial Intelligence (AI) algorithms. One of the emerging methods for increasing trust in AI systems is to use eXplainable AI (XAI), which promotes the use of methods that produce transparent explanations and reasons for decisions AI systems make. Considering the existing literature on

Computing, recently hosted the MITxMGB AI Cures Conference in an effort to accelerate the adoption of clinical AI tools by creating new opportunities for collaboration between researchers and physicians focused on improving care for diverse patient populations."
Source: MIT News

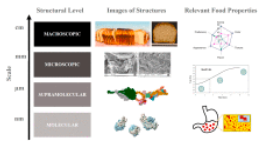
Using Artificial Intelligence to improve the health and wellbeing of people with learning disabilities

"A new study led by Loughborough University and the Leicestershire Partnership NHS Trust will use Artificial Intelligence to improve the health and wellbeing of people with learning disabilities…The researchers will analyse healthcare data on people with learning disabilities from England and Wales to find out what MLTCs are more likely to occur together, what happens to some of these MLTCs over time, and the role other factors, such as lifestyle choices, financial position, and social situations, play in their MLTCs.

The team will also work directly with people with learning disabilities, their carers, and the professionals who support them. This will help them to identify the most important MLTCs affecting the lives of people with learning disabilities, make informed recommendations about the care of people with MLTCs, and produce visual information such as graphs and infographics that can be easily understood."
Source: Loughborough University

XAI, this paper argues that XAI in education has commonalities with the broader use of AI but also has distinctive needs. Accordingly, we first present a framework, referred to as XAI-ED, that considers six key aspects in relation to explainability for studying, designing and developing educational AI tools."
Source: Elsevier

FOOD SCIENCE



Food structure, function and artificial intelligence

"This review aims to analyse the current knowledge about the structure of foods and its potential use to numerically define the sensory and nutritional quality, as well as the stability properties. Starting from this information, a possible methodology is explored to build, even in an automated way, mathematical models for simulating and predicting the properties of food. A model pipeline has been proposed and applied to pasta, in particular exploiting the description of the structural changes occurring upon cooking. Foods may be designed in silico, based on automated pipelines for direct extraction of information on rheological and sensory properties as derived from structure images and from data on the dynamic state of the water. The ultimate goal of these approaches is to make more limited use of expensive and time-consuming experiments on physically prepared foods to get to use digital twins of foods designed in the laboratory."
Source: Elsevier