SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

4 June – 5 August 2022

TOPICAL REPORT

ARTIFICIAL INTELLIGENCE & DATA SCIENCE

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DATA SCIENCE

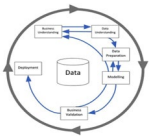
A new generation of data scientists could be our best weapon against climate change

"Data science is emerging as a powerful weapon in the fight against climate change. For example, an international team of researchers recently identified the top sites in the world releasing methane. They used machine learning algorithms to analyze thousands of satellite images and pinpoint "ultra-emitter" sites responsible for about 10% of the oil and gas industry's global methane emissions. Many are pipeline leaks that are impossible to detect from the ground, but relatively simple and cost-effective to fix once they have been found.
This new research on methane emissions is just the beginning. Using data science to get a global picture of pollution and identify easy targets for reducing it represents a leap forward in our efforts to address climate change."
Source: Fortune

Data scientists use new techniques to identify lakes and reservoirs around the world

"A University of Minnesota Twin Cities-led team of data scientists has published a first-of-its-kind comprehensive global dataset of the

DATA SCIENCE



Emerging Risks in the FinTech Industry -Insights from Data Science and Financial Econometrics Analysis

"The FinTech industry has exhibited very high growth levels since the Global Economic and Financial Crisis of 2008. The sector growth has been accelerated because of the disruption caused by COVID-19 and that derived in the global health crisis, a crisis with significant implications for global economic stability. To examine the risk profile of FinTech firms, the CRISP-DM methodology was followed to aid in the implementation of clustering and classification algorithms, combined with time series regression models. This research paper offers insights on financial risk assessment by combining machine learning techniques and traditional econometric modeling to acknowledge challenges associated with the analysis of time series in the financial context and framed in the US FinTech sector."
Source: Research Gate

Intelligent data science enabled reactive power optimization of a distribution system

"Recently, distributed generators (DG) and electric vehicles (EV) are commonly employed in recent days in spite of the power flow of the

DATA SCIENCE

How to unlock the full value of data? Manage it like a product

"At organizations employing the big-bang strategy, a centralized team extracts, cleanses, and aggregates data en masse. This approach can eliminate some of the rework that occurs, but it's often not aligned with business use cases and therefore fails to support end users' specific needs. End users often struggle to confirm that the data provide the necessary level of governance and quality, which limits the time savings. Later work on new use cases that are aligned with business value often triggers a grassroots approach and its associated problems.
These strategies fail to lay the foundation for current and future use cases that will create value."
Source: McKinsey

Is Data Scientist Still the Sexiest Job of the 21st Century?

"Ten years ago we published the article "Data Scientist: Sexiest Job of the 21st Century." Most casual readers probably remember only the "sexiest" modifier — a comment on their demand in the marketplace. The role was relatively new at the time, but as more companies attempted to make sense of big data, they realized they needed people who could combine programming, analytics, and experimentation skills. At the time, that demand was largely

lakes and reservoirs on Earth showing how they have changed over the last 30+ years.
The data will provide environmental researchers with new information about land and fresh water use as well as how lakes and reservoirs are impacted by humans and climate change. The research is also a major advancement in machine learning techniques."
Source: University of Minnesota

$20 Million Grant Drives IDEAL Research in Data Science

"A Chicago-based research coalition that includes researchers from Illinois Institute of Technology has been awarded a share of a five-year, $20 million grant from the National Science Foundation to accelerate innovations in data science.
The NSF announced award winners of its Transdisciplinary Research in Principles of Data Science (TRIPODS) Phase II program, which brings together scientists and engineers from different research communities to further the theoretical foundations of data science through integrated research and training activities. Jinqiao "Jeffrey" Duan, professor of applied mathematics at Illinois Tech, and Binghui Wang, assistant professor of computer science at Illinois Tech, are part of the coalition that received a TRIPODS grant."
Source: Illinois Institute of Technology

Surveillance of non-communicable diseases enhanced by big data

"Surveillance of non-communicable diseases (NCD) has evolved in the wake of data outbursts and the development of data analytics and other cutting-edge technologies, according to a recent perspective article in Health Data Science, a Science Partner Journal.

Based on an overview of the latest evidence, the article intends to provide ideas on improving the practice and broaden the view of NCD surveillance, says Pengfei Li, author and researcher with the Advanced Institute of Information Technology, Peking University."
Source: Health Data Science

Researchers recognize activists' work using data science to monitor and challenge feminicide

"The team, led by Catherine D'Ignazio, the director of the Data + Feminism lab at Massachusetts Institute of Technology, explores the concept of counterdata, data that compiles incidents of gender-related killings from diverse sources. "This data distributed network (DN) being influenced by the intermittency and arbitrariness of DGs and electric vehicles (EVs). The massive increase in the distinct varieties of controllable devices has complicated controlling needs and is combined in the DN. Reactive power optimization (RPO) of the DNs helps to minimize the power loss, enhance the voltage quality, and inexpensive functioning of the DNs. ROR can be considered as a complicated high dimension non-linearity problem. The recent advances of data science approach containing machine learning (ML) and deep learning (DL) aid to make effective decisions. With this motivation, this paper presents a parameter tuned deep learning model for reactive power optimization (PTDL-RPO) in distributed systems."
Source: Elsevier

Teaching Programming for First-Year Data Science

"This paper describes experiences in teaching Python programming as part of a large-enrolment first-year subject, that is a foundation for an undergraduate major in data science and it is also taken by a wide variety of non-majors across the arts, sciences and business fields. The paper focuses on some central design decisions about the content, sequence, approach, and tool support, and we reflect on how they have worked out and what we changed, as we have taught the subject to about 2500 students over four offerings (including two which were entirely on-line due to the pandemic)."
Source: ACM Digital Library

Harnessing data science to improve integrated management of invasive pest species across Africa: An application to Fall armyworm

"After five years of its first report on the African continent, Fall armyworm (FAW), *Spodoptera frugiperda* (J.E. Smith) is considered a major threat to maize, sorghum, and millet production in sub-Saharan Africa. Despite the rigorous work already conducted to reduce FAW prevalence, the dynamics and invasion mechanisms of FAW in Africa are still poorly understood. This study applied interdisciplinary tools, analytics, and algorithms on a FAW dataset with a spatial lens to provide insights and project the intensity of FAW infestation across Africa. The data collected between January 2018 and December 2020 in selected locations were matched with the monthly average data of the climatic and environmental variables. The restricted to the San Francisco Bay Area and a few other coastal cities. Startups and tech firms in those areas seemed to want all the data scientists they could hire. We felt that the need would expand as mainstream companies embraced both business analytics and new forms and volumes of data."
Source: Harvard Business Review

AI, ML, and Data Engineering InfoQ Trends Report—August 2022

"Key Takeaways

- Natural Language Understanding (NLU) and Natural Language Generation (NLG) have been promoted to the early adopters category.
- Since last year, deep learning solutions and technologies have seen wider adoption in organizations, so we are moving deep learning from early adopters to the early majority category.
- Streaming data analytics and technologies like Spark Streaming have been moved to the late majority category.
- Resource Negotiators like YARN and container orchestration technologies like Kubernetes are now in the late majority category.
- New entrants in the innovators category include Cloud agnostic computing for AI, Knowledge Graphs, AI pair programmer (like Github Copilot), and Synthetic Data Generation.
- New entries in the early adopters category include Robotics and Virtual Reality and related technologies (VR/AR/MR/XR) and MLOps."

Source: Info Q

2022 AIOps Now Tech Data Overview Sheds Light On Current Capabilities

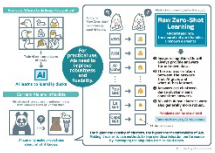
"The 2022 AIOps NowTech generated a wealth of data that has been captured in the AIOps Data Overview, Q2 2022 report about AIOps software vendor capabilities. Three items from the overview report; digital experience, OpenTelemetry, and audit trails are highlighted in this blog. Read the full data overview report to learn more about the other capabilities that it covers."
Source: Forrester

2022 EDUCAUSE Horizon Report | Data and Analytics Edition

"With the 2022 data and analytics edition, we further expand our series of Horizon Reports to focus on an

has the goal of enacting alternative epistemological approaches to data science that center care, memory, and justice," they write.
The authors acknowledge the tremendous toll that this data collection can take on the activists who collect it. "It is not easy to read ten cases of feminicide and put them on a table, disaggregate them, have to put a name, age, circumstances, and all that detail, without it affecting you emotionally," says one activist the team interviewed."
Source: EurekAlert!

ARTIFICIAL INTELLIGENCE



Breaking AIs to make them better

"Today's artificial intelligence systems used for image recognition are incredibly powerful with massive potential for commercial applications. Nonetheless, current artificial neural networks—the deep learning algorithms that power image recognition—suffer one massive shortcoming: they are easily broken by images that are even slightly modified.
This lack of 'robustness' is a significant hurdle for researchers hoping to build better AIs. However, exactly why this phenomenon occurs, and the underlying mechanisms behind it, remain largely unknown."
Source: Kyushu University

Georgia Tech Researcher Finds that Military Cannot Rely on AI for Strategy or Judgment

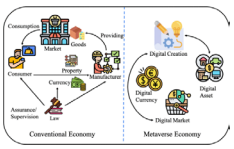
"Using artificial intelligence (AI) for warfare has been the promise of science fiction and politicians for years, but new research from the Georgia Institute of Technology argues only so much can be automated and shows the value of human judgment.
"All of the hard problems in AI really are judgment and data problems, and the interesting thing about that is when you start thinking about war, the hard problems are strategy and uncertainty, or what is well known as the fog of war," said Jon Lindsay, an associate professor in the School of Cybersecurity & Privacy and the Sam Nunn School of International Affairs. "You need human sense-making and to make moral, ethical, and intellectual decisions in an incredibly confusing, fraught, scary situation."."
Source: Georgia Tech

multilevel analytics aimed to identify the key factors that influence the dynamics of spatial and temporal pest density and occurrence at a 2 km x 2 km grid resolution."
Source: Elsevier

A Model-Driven Approach for Systematic Reproducibility and Replicability of Data Science Projects

"In the last few years, there has been an important increase in the number of tools and approaches to define pipelines that allow the development of data science projects. They allow not only the pipeline definition but also the code generation needed to execute the project providing an easy way to carry out the projects even for non-expert users. However, there are still some challenges that these tools do not address yet, e.g. the possibility of executing pipelines defined by using different tools or execute them in different environments (reproducibility and replicability) or models validation and verification by identifying inconsistent operations (intentionality). In order to alleviate these problems, this paper presents a Model-Driven framework for the definition of data science pipelines independent of the particular execution platform and tools."
Source: Springer Link

ARTIFICIAL INTELLIGENCE



Fusing Blockchain and AI With Metaverse: A Survey

"Metaverse as the latest buzzword has attracted great attention from both industry and academia. Metaverse seamlessly integrates the real world with the virtual world and allows avatars to carry out rich activities including creation, display, entertainment, social networking, and trading. Thus, it is promising to build an exciting digital world and to transform a better physical world through the exploration of the metaverse. In this survey, we dive into the metaverse by discussing how Blockchain and Artificial Intelligence (AI) fuse with it through investigating the state-of-the-art studies across the metaverse components, digital currencies, AI applications in the virtual world, and blockchain-empowered technologies. Further exploitation and interdisciplinary research on the fusion of AI and Blockchain towards metaverse will emerging area of practice that is driving institutional decision-making and strategic planning for the future—the trends, technologies, and practices that are shaping the world of postsecondary data and analytics. Based on a methodology that grounds the findings in the perspectives and expertise of a panel of leaders in higher education data and analytics, in this report we summarize the panel's input on the major trends shaping higher education, including panelists' reflections on the implications of this research for the future of higher education for particular institutional roles."
Source: Educause

ARTIFICIAL INTELLIGENCE

Sizing the prize PwC's Global Artificial Intelligence Study: Exploiting the AI Revolution

- "Artificial intelligence (AI) can transform the productivity and GDP potential of the global economy. Strategic investment in different types of AI technology is needed to make that happen.
- Labour productivity improvements will drive initial GDP gains as firms seek to "augment" the productivity of their labour force with AI technologies and to automate some tasks and roles.
- Our research also shows that 45% of total economic gains by 2030 will come from product enhancements, stimulating consumer demand. This is because AI will drive greater product variety, with increased personalisation, attractiveness and affordability over time.
- The greatest economic gains from AI will be in China (26% boost to GDP in 2030) and North America (14.5% boost), equivalent to a total of $10.7 trillion and accounting for almost 70% of the global economic impact."

Source: PWC

Appen's Annual State of AI and Machine Learning Report

Calculating the "fingerprints" of molecules with artificial intelligence

"With conventional methods, it is extremely time-consuming to calculate the spectral fingerprint of larger molecules. But this is a prerequisite for correctly interpreting experimentally obtained data. Now, a team at HZB has achieved very good results in significantly less time using self-learning graphical neural networks."

Source: Helmholtz-Zentrum Berlin für Materialien und Energie

Creating artificial intelligence that acts more human by 'knowing that it knows'

"A research group from the Graduate School of Informatics, Nagoya University, has taken a big step towards creating a neural network with metamemory through a computer-based evolution experiment. In recent years, there has been rapid progress in designing artificial intelligence technology using neural networks that imitate brain circuits. One goal of this field of research is understanding the evolution of metamemory to use it to create artificial intelligence with a human-like mind.

Metamemory is the process by which we ask ourselves whether we remember what we had for dinner yesterday and then use that memory to decide whether to eat something different tonight. While this may seem like a simple question, answering it involves a complex process. Metamemory is important because it involves a person having knowledge of their *own* memory capabilities and adjusting their behavior accordingly."

Source: Nagoya University

Using artificial intelligence to train teams of robots to work together

"The algorithms the researchers developed can also identify when an agent or robot is doing something that doesn't contribute to the goal. "It's not so much the robot chose to do something wrong, just something that isn't useful to the end goal."

They tested their algorithms using simulated games like Capture the Flag and StarCraft, a popular computer game.

"StarCraft can be a little bit more unpredictable – we were excited to see our method work well in this environment too.""

Source: University of Illinois Grainger College of Engineering

AI Pilot Can Navigate Crowded Airspace

definitely require collaboration from both academia and industries. We wish that our survey can help researchers, engineers, and educators build an open, fair, and rational future metaverse."

Source: IEEE Xplore

Monadic Pavlovian associative learning in a backpropagation-free photonic network

"Over a century ago, Ivan P. Pavlov, in a classic experiment, demonstrated how dogs can learn to associate a ringing bell with food, thereby causing a ring to result in salivation. Today, it is rare to find the use of Pavlovian type associative learning for artificial intelligence applications even though other learning concepts, in particular, backpropagation on artificial neural networks (ANNs), have flourished. However, training using the backpropagation method on "conventional" ANNs, especially in the form of modern deep neural networks, is computationally and energy intensive. Here, we experimentally demonstrate a form of backpropagation-free learning using a single (or monadic) associative hardware element. We realize this on an integrated photonic platform using phase-change materials combined with on-chip cascaded directional couplers."

Source: Optica

Regulating artificial intelligence: Proposal for a global solution

"With increasing ubiquity of artificial intelligence (AI) in modern societies, individual countries and the international community are working hard to create an innovation-friendly, yet safe, regulatory environment. Adequate regulation is key to maximize the benefits and minimize the risks stemming from AI technologies. Developing regulatory frameworks is, however, challenging due to AI's global reach, agency problems present in regulation, and the existence of widespread misconceptions about the very notion of regulation. This paper makes three claims: (1) Based on interdisciplinary insights, we show that AI-related challenges cannot be tackled effectively without sincere international coordination supported by robust, consistent domestic, regional, and international governance arrangements. (2) Against this backdrop, we propose the establishment of an international AI governance framework to spearhead initiatives to create a consistent, global enabling regulatory environment, which is necessary for

Identifies a Gap in Ideal Versus Reality of Data Quality

"According to the report's findings, 51% of participants agree that data accuracy is critical to their AI use case. To successfully build AI models, organizations need accurate and high-quality data. Unfortunately, business leaders and technologists report a significant gap in ideal vs reality in achieving data accuracy.

Appen's research also found that companies are shifting their focus to responsible AI and maturing in their use of AI. More business leaders and technologists are focusing on improving the data quality behind AI projects in order to promote more inclusive datasets and, as a result, unbiased and better AI. In fact, 80% of respondents stated data diversity is extremely important or very important, and 95% agree that synthetic data will be a key player when it comes to creating inclusive datasets."

Source: Appen Partners

The 2022 State of Marketing AI Report

"Marketers overwhelmingly believe AI will transform their work and want to use it for increased personalization, revenue acceleration, and insight.

But they're held back by a number of factors—factors that companies must address if they want to survive in the age of AI.

Key findings from the report include:

- **The majority of marketers believe AI will transform their work**, and automate the majority of their tasks.
- In fact, some marketers are already using AI to achieve outcomes in **personalization, revenue acceleration, and analytics**.
- But the majority of those who want to start—or expand—AI implementations are **held back by a lack of education and training**.
- That's because their **companies overwhelmingly don't offer formal AI training,** or **AI ownership is highly fragmented**."

Source: Marketing Institute

"A team of researchers at Carnegie Mellon University believe they have developed the first AI pilot that enables autonomous aircraft to navigate a crowded airspace.
The artificial intelligence can safely avoid collisions, predict the intent of other aircraft, track aircraft and coordinate with their actions, and communicate over the radio with pilots and air traffic controllers. The researchers aim to develop the AI so the behaviors of their system will be indistinguishable from those of a human pilot."
Source: Carnegie Mellon University

New project to explore the use of conversational AI in libraries

"Her project, "Empowering Libraries with Conversational AI," will explore the potential for using conversational artificial intelligence (AI) in libraries to strengthen engagement between libraries and diverse audiences. Conversational agents (CA) are AI-enabled software technologies designed to interact with users via natural language or text in lieu of direct contact with human beings. According to Huang, CA-enabled services could potentially benefit both libraries and their communities by providing convenient 24/7 service to community members and addressing low-level questions when librarians are not available, collecting and analyzing community input in different languages to help librarians understand emerging needs, and releasing librarians from tedious and time-consuming tasks."
Source: University of Illinois Urbana-Champaign

Making AI Faster and More Energy Efficient

The team will focus on three types of deep-generative models:

- Vision transformer-based generative modeling uses a transformer architecture over patches of an image to improve image recognition. If AI can use environmental clues to determine what it is seeing rather than having to sort through many images, it will require less energy and time.
- Masked generative modeling hides data that is not valuable to the task at hand, lessening the amount of data that AI must sort through. Later, that masked data can be recovered and used to fill in gaps that could allow for earlier decision-making.
- Cross-modal generative modeling uses two kinds of models to simultaneously sort through multimodal data and identify what is useful and what is not."

Source: University of Texas at Arlington

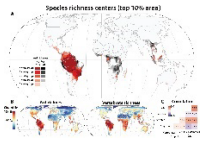
MACHINE LEARNING

the successful and responsible adoption of AI technologies."
Source: Elsevier

An eye for an 'I:' a critical assessment of artificial intelligence tools in migration and asylum management

"The promise of artificial intelligence has been originally to put technology at the service of people utilizing powerful information processors and 'smart' algorithms to quickly perform time-consuming data analysis. It soon though became apparent that the capacity of artificial intelligence to scrape and analyze big data would be particularly useful in surveillance policies. In the wider areas of migration and asylum management, increasingly sophisticated artificial intelligence tools have been used to register and manage vulnerable populations without much concern about the potential misuses of the data collected and the overall ethical and legal underpinnings of these operations. This article examines three cases in point."
Source: Springer Open

MACHINE LEARNING



The global distribution of known and undiscovered ant biodiversity

"Invertebrates constitute the majority of animal species and are critical for ecosystem functioning and services. Nonetheless, global invertebrate biodiversity patterns and their congruences with vertebrates remain largely unknown. We resolve the first high-resolution (~20-km) global diversity map for a major invertebrate clade, ants, using biodiversity informatics, range modeling, and machine learning to synthesize existing knowledge and predict the distribution of undiscovered diversity. We find that ants and different vertebrate groups have distinct features in their patterns of richness and rarity, underscoring the need to consider a diversity of taxa in conservation."
Source: Science Advances

Lessons from infant learning for unsupervised machine learning

"The desire to reduce the dependence on curated, labeled datasets and to leverage the vast quantities of unlabeled data has triggered renewed interest in unsupervised (or self-supervised)

What New Cell Biology Can AI Reveal Just by Looking at Images? A Lot!

"Humans are good at looking at images and finding patterns or making comparisons. Look at a collection of dog photos, for example, and you can sort them by color, by ear size, by face shape, and so on. But could you compare them quantitatively? And perhaps more intriguingly, could a machine extract meaningful information from images that humans can't?

Now a team of Chan Zuckerberg Biohub scientists has developed a machine learning method to quantitatively analyze and compare images – in this case microscopy images of proteins – with no prior knowledge. As reported in *Nature Methods*, their algorithm, dubbed "cytoself," provides rich, detailed information on protein location and function within a cell. This capability could quicken research time for cell biologists and eventually be used to accelerate the process of drug discovery and drug screening."

Source: Chan Zuckerberg Biohub

NATURAL LANGUAGE PROCESSING

Proteins and natural language: Artificial intelligence enables the design of novel proteins

"Artificial intelligence (AI) has created new possibilities for designing tailor-made proteins to solve everything from medical to ecological problems. A research team at the University of Bayreuth led by Prof. Dr. Birte Höcker has now successfully applied a computer-based natural language processing model to protein research. Completely independently, the ProtGPT2 model designs new proteins that are capable of stable folding and could take over defined functions in larger molecular contexts. The model and its potential are detailed scientifically in "Nature Communications"."

Source: Universität Bayreuth

NEURAL NETWORK

learning algorithms. Despite improved performance due to approaches such as the identification of disentangled latent representations, contrastive learning and clustering optimizations, unsupervised machine learning still falls short of its hypothesized potential as a breakthrough paradigm enabling generally intelligent systems. Inspiration from cognitive (neuro)science has been based mostly on adult learners with access to labels and a vast amount of prior knowledge. To push unsupervised machine learning forward, we argue that developmental science of infant cognition might hold the key to unlocking the next generation of unsupervised learning approaches."

Source: Nature Machine Learning

Automation of human behaviors and its prediction using machine learning

"Prediction is a method of detecting a person's behavior toward online buying by evaluating publically available evaluations on the web. Understanding expressive human communication involves a simultaneous examination of speech and gestures since human behavior is communicated through a combination of verbal and nonverbal channels. Machine learning algorithms are utilized in this work to extract evaluations from the net and categorize these into five classes, namely, highly favorable, favorable, neutrality, bad, and strongly negative, for the prediction of human behavior. A person's behavior is analyzed, and the experimental comparison is made to machine learning methodologies."

Source: Springer Link

Machine Learning in Chemoinformatics and Medicinal Chemistry

"In chemoinformatics and medicinal chemistry, machine learning has evolved into an important approach. In recent years, increasing computational resources and new deep learning algorithms have put machine learning onto a new level, addressing previously unmet challenges in pharmaceutical research. In silico approaches for compound activity predictions, de novo design, and reaction modeling have been further advanced by new algorithmic developments and the emergence of big data in the field. Herein, novel applications of machine learning and deep learning in chemoinformatics and medicinal chemistry are reviewed. Opportunities and challenges for new methods and applications are discussed, placing emphasis on

Neural Networks and 'Ghost' Electrons Accurately Reconstruct Behavior of Quantum Systems

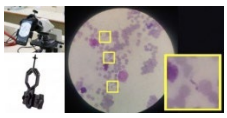
"Physicists at the Flatiron Institute's Center for Computational Quantum Physics and their collaborators have created a new way to simulate quantum entanglement between interacting particles. Their approach involves adding extra, fictitious particles controlled by an artificial intelligence technique called a neural network."
Source: Simons Foundation

DIGITAL MANUFACTURING

Using artificial intelligence to control digital manufacturing

"Scientists and engineers are constantly developing new materials with unique properties that can be used for 3D printing but figuring out how to print with these materials can be a complex, costly conundrum.
Often, an expert operator must use manual trial-and-error — possibly making thousands of prints — to determine ideal parameters that consistently print a new material effectively. These parameters include printing speed and how much material the printer deposits.
MIT researchers have now used artificial intelligence to streamline this procedure. They developed a machine-learning system that uses computer vision to watch the manufacturing process and then correct errors in how it handles the material in real-time."
Source: Massachusetts Institute of Technology

HEALTHCARE



Technique based on artificial intelligence detects Chagas disease using images taken with smartphone

"When Brazilian immunologist Helder Nakaya visited Evandro Chagas Institute in Belém (the capital of Pará state, Brazil) in 2017, there was a commotion because one of its best microscopists was retiring and much of the knowledge used for fast and accurate identification of the protozoan Leishmania would be lost…Five years later, a group of researchers led by Nakaya and scientist Mauro César Cafundó de Morais published the findings of a proper baseline comparisons, robust validation methodologies, and new applicability domains."
Source: Annual Reviews

DEEP LEARNING

Using Deep-Learning in Fetal Ultrasound Analysis For Diagnosis Of Cystic Hygroma In The First Trimester

"**Objective**
To develop and internally validate a deep-learning algorithm from fetal ultrasound images for the diagnosis of cystic hygromas in the first trimester.
Methods
All first trimester ultrasound scans with a diagnosis of a cystic hygroma between 11 and 14 weeks gestation at our tertiary care centre in Ontario, Canada were studied. Ultrasound scans with normal nuchal translucency were used as controls. The dataset was partitioned with 75% of images used for model training and 25% used for model validation. Images were analyzed using a DenseNet model and the accuracy of the trained model to correctly identify cases of cystic hygroma was assessed by calculating sensitivity, specificity, and the area under the receiver-operating characteristic (ROC) curve. Gradient class activation heat maps (Grad-CAM) were generated to assess model interpretability."
Source: International Federation of Robotics

Nanosecond protonic programmable resistors for analog deep learning

"Nanoscale ionic programmable resistors for analog deep learning are 1000 times smaller than biological cells, but it is not yet clear how much faster they can be relative to neurons and synapses. Scaling analyses of ionic transport and charge-transfer reaction rates point to operation in the nonlinear regime, where extreme electric fields are present within the solid electrolyte and its interfaces. In this work, we generated silicon-compatible nanoscale protonic programmable resistors with highly desirable characteristics under extreme electric fields. This operation regime enabled controlled shuttling and intercalation of protons in nanoseconds at room temperature in an energy-efficient manner."
Source: Science

Lightweight Deep Learning Models for Resource Constrained Devices

study showing that artificial intelligence can be used to detect Trypanosoma cruzi, the parasite that causes Chagas disease, in images of blood samples taken with a smartphone camera and analyzed by optical microscope."
Source: International Federation of Robotics

Research shows artificial intelligence can improve stroke diagnostics, expanding access to lifesaving stroke care

"A new study presented today at the Society of NeuroInterventional Surgery's (SNIS) 19th Annual Meeting shows that artificial intelligence (AI) technology can identify when a patient is having a stroke caused by emergent large vessel occlusion (LVO), therefore making them a candidate for endovascular therapy (EVT). Getting a diagnosis quickly is critical and can be the difference between a life of disability versus rehabilitation for stroke patients.
The study, "AI Based Gaze Deviation Detection to Aid LVO Diagnosis in NCCT," used AI algorithms to detect gaze deviation from a non-contrast computed tomography (NCCT scan). These scans predict if a patient is having an LVO, which is a type of ischemic stroke that occurs when a major artery in the brain is blocked. If a patient is having this type of stroke, they can receive EVT to treat it."
Source: EurekAlert!

AI performs as well as medical specialists in analyzing lung disease

"Taiki Furukawa, Assistant Professor of the Nagoya University Hospital, in collaboration with RIKEN and Tosei General Hospital, has developed a new technology to diagnose idiopathic pulmonary fibrosis. Using artificial intelligence (AI), the group analyzed medical data from patients in Tosei General Hospital's interstitial pneumonia treatment facility, collected during normal care. They found that their AI diagnosed idiopathic pulmonary fibrosis with a similar level of accuracy as a human specialist. They published their results in the journal Respirology."
Source: Nagoya University

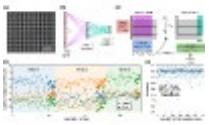
"Green finance can be referred to as financial investments made on sustainable projects and policies that focus on a sustainable economy. The procedures include promoting renewable energy sources, energy efficiency, water sanitation, industrial pollution control, transportation pollution control, reduction of deforestation, and carbon emissions, etc. Mainly, these green finance… In this research, for performing the green finance analysis, financial maximally filtered graph (FMFG) algorithm is implemented in different domains. The proposed algorithm is compared with the neural model and observed that the proposed model has obtained 98.85% of accuracy which is higher than the neural model."
Source: Hindawi

Deep Learning with Functional Inputs

"We present a methodology for integrating functional data into deep neural networks. The model is defined for scalar responses with multiple functional and scalar covariates. A by-product of the method is a set of dynamic functional weights that can be visualized during the optimization process. This visualization leads to a greater interpretability of the relationship between the covariates and the response relative to conventional neural networks. The model is shown to perform well in a number of contexts including prediction of new data and recovery of the true underlying relationship between the functional covariate and scalar response; these results were confirmed through real data applications and simulation studies."
Source: Taylor & Francis Online

Data-Driven Nonlinear Modal Analysis: A Deep Learning Approachv

"We present a data-driven method based on deep learning for identifying nonlinear normal modes of unknown nonlinear dynamical systems using response data only. We leverage the modeling capacity of deep neural networks to identify the forward and inverse nonlinear modal transformations and the associated modal dynamics evolution. We test the method on Duffing systems with cubic nonlinearity and observe that the identified NNMs with invariant manifolds from response data agree with those analytical or numerical ones using closed-form equations."
Source: Springer Link



Implementation of a Binary Neural Network on a Passive Array of Magnetic Tunnel Junctions

"The increasing scale of neural networks and their growing application space have produced demand for more energy- and memory-efficient artificial-intelligence-specific hardware. Avenues to mitigate the main issue, the von Neumann bottleneck, include in-memory and near-memory architectures, as well as algorithmic approaches. Here we leverage the low-power and the inherently binary operation of magnetic tunnel junctions (MTJs) to demonstrate neural network hardware inference based on passive arrays of MTJs. In general, transferring a trained network model to hardware for inference is confronted by degradation in performance due to device-to-device variations, write errors, parasitic resistance, and nonidealities in the substrate."
Source: APS Physics

The Deep Radial Basis Function Data Descriptor (D-RBFDD) Network: A One-Class Neural Network for Anomaly Detection

"Anomaly detection is a challenging problem in machine learning, and is made even more so when dealing with instances that are captured in low-level, raw data representations without a well-known and well-behaved set of engineered features. Images or data streams from sensors are good examples of such low-level, raw data representations. The Radial Basis Function Data Descriptor (RBFDD) network is an effective solution for anomaly detection, however, it is a shallow model that does not deal well with low-level, raw data representations. This article investigates approaches to transform an RBFDD network into a deep one-class classifier that works well for anomaly detection problems with low-level, raw data representations."
Source: IEEE Xplore

FocusedDropout for Convolutional Neural Network

"In a convolutional neural network (CNN), dropout cannot work well because dropped information is not entirely obscured in convolutional layers where features are correlated spatially. Except for randomly

discarding regions or channels, many approaches try to overcome this defect by dropping influential units. In this paper, we propose a non-random dropout method named FocusedDropout, aiming to make the network focus more on the target. In FocusedDropout, we use a simple but effective method to search for the target-related features, retain these features and discard others, which is contrary to the existing methods. We find that this novel method can improve network performance by making the network more target focused. Additionally, increasing the weight decay while using FocusedDropout can avoid overfitting and increase accuracy."
Source: MDPI

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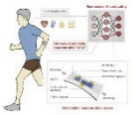

Intrinsically stretchable neuromorphic devices for on-body processing of health data with artificial intelligence

"For leveraging wearable technologies to advance precision medicine, personalized and learning-based analysis of continuously acquired health data is indispensable, for which neuromorphic computing provides the most efficient implementation of artificial intelligence (AI) data processing. For realizing on-body neuromorphic computing, skin-like stretchability is required but has yet to be combined with the desired neuromorphic metrics, including linear symmetric weight update and sufficient state retention, for achieving high computing efficiency."
Source: Cell Press Journal

An Artificial Intelligence Algorithm to Predict Nodal Metastasis in Lung Cancer

"Background
Endobronchial ultrasound (EBUS) has features that allow a high accuracy for predicting lymph node (LN) malignancy. However their clinical application remains limited because of high operator dependency. We hypothesized that an artificial intelligence algorithm (NeuralSeg; NeuralSeg Ltd, Hamilton, Ontario, Canada) is capable of accurately identifying and predicting LN malignancy based on EBUS images.
Methods
In the derivation phase EBUS images were segmented twice by an endosonographer and used as controls in 5-fold cross-validation

training of NeuralSeg. In the validation phase the algorithm was tested on new images it had not seen before. Logistic regression and receiver operator characteristic curves were used to determine NeuralSeg's capability of discrimination between benign and malignant LNs, using pathologic specimens as the gold standard."
Source: Elsevier