SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

4 February – 2 March 2020

TOPICAL REPORT

ARTIFICIAL INTELLIGENCE & DATA SCIENCE

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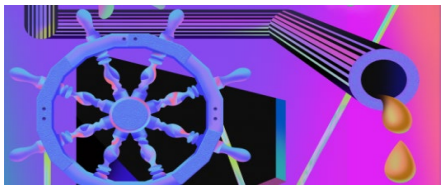
ARTIFICIAL INTELLIGENCE



What AI still can't do

"These shortcomings have something in common: they exist because AI systems don't understand causation. They see that some events are associated with other events, but they don't ascertain which things directly make other things happen. It's as if you knew that the presence of clouds made rain likelier, but you didn't know clouds caused rain."

Source: MIT Technology Review

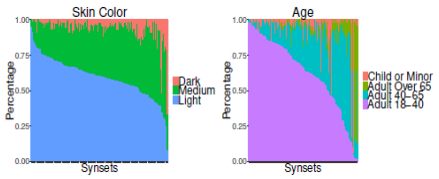
AI GOVERNANCE

New HAI-Funded Research Explores AI in Governance

"The impact of the private sector's use of artificial intelligence (AI) is already a pressing topic in the national conversation. Less known, but also highly significant and impactful, is the rapid proliferation of AI in government - and its corresponding impact."

Source: Stanford Institute for Human-Centered AI

COMPUTER VISION

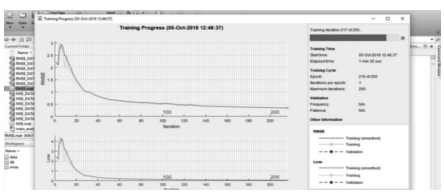


Towards fairer datasets: filtering and balancing the distribution of the people subtree in the ImageNet hierarchy

"Current computer vision models are typically developed using datasets consisting of manually annotated images or videos; the data and label distributions in these datasets are critical to the models' behavior. In this paper, we examine ImageNet, a large-scale ontology of images that has spurred the development of many modern computer vision methods."

Source: Proceedings of the 2020 Conference on Fairness, Accountability, and Transparency

DATA SCIENCE



Stock Market Prediction Using Optimized Deep-ConvLSTM Model

"This article proposes a stock market prediction system that effectively predicts the state of the stock market.

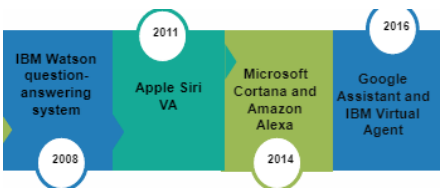
AI GOVERNANCE

Model Artificial Intelligence Governance Framework

"On 21 January 2020 at a meeting at the World Economic Forum, the Personal Data Protection Commission (PDPC) and Infocommunications Media Development Authority (IMDA) released the second edition of its Model Artificial Intelligence Governance Framework."

Source: Personal Data Protection Commission

AI & INDUSTRY



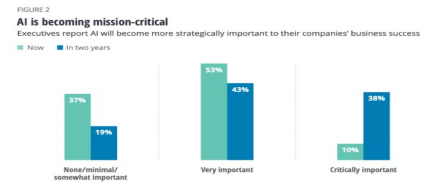
Artificial Intelligence in Enterprise Communications and Collaboration, Global, 2019

"This research study focuses on how AI is making inroads into the enterprise communications and collaboration arena. Subsequent to the dynamic technology shifts from on-premises enterprise communications to cloud-based communications services, the industry is further warming up to embrace AI and integrate it with

World order is going to be rocked by AI - this is how

"Measures such as GDP can't predict how well a country will cope with the wave of change brought about by the Fourth Industrial Revolution."
Source: World Economic Forum

MACHINE LEARNING



What the Convergence of Blockchain and Machine Learning Means for the Future of Finance

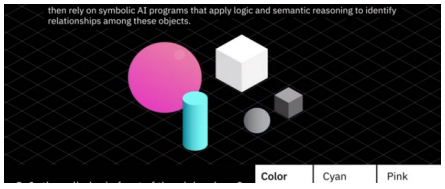
"To realize this potential, the original intent of blockchain technology must remain top of mind. In addition, quality data needs to drive machine learning applications in order to maintain effectiveness. Although uncertainties remain, these technologies are here to stay together, or apart. In a constantly evolving financial landscape, blockchain and machine learning integrations may be the next drivers of transformative change across the industry."
Source: Nasdaq

ETHICS

AI ethics backed by Pope and tech giants in new plan

"The Roman Catholic Church has joined up with IBM and Microsoft to work on the ethics of artificial intelligence."
Source: BBC News

NATURAL LANGUAGE PROCESSING



Mastering Language Is Key to More Natural Human–AI Interaction

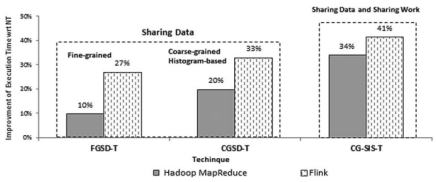
"Empower enterprises to deploy and scale sophisticated AI systems that leverage natural language processing (NLP) with greater accuracy and efficiency, while

The deep convolutional long short-term memory (Deep-ConvLSTM) model acts as the prediction module, which is trained by using the proposed Rider-based monarch butterfly optimization (Rider-MBO) algorithm."
Source: Big Data

Daily Traffic Flow Forecasting Through a Contextual Convolutional Recurrent Neural Network Modeling Inter-and Intra-Day Traffic Patterns

"In this paper, we propose a novel deep-learning-based method for daily traffic flow forecasting where incorporating contextual factors and traffic flow patterns can be critical."
Source: IEEE Transactions on Intelligent Transportation Systems

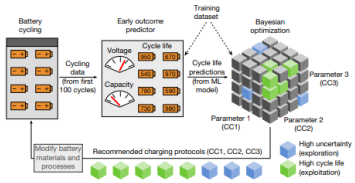
BIG DATA



SOOM: Sort-Based Optimizer for Big Data Multi-Query

"The proposed Sort-Based Optimizer over MOTH (SOOM) system consists of two additional modules to exploit sharing sort opportunities, namely query explorer and sort exploiter, which leverage our existing Multi-Query Optimization Using Tuple Size and Histogram (MOTH) system to fulfill optimizing multiple aggregation and sort queries."
Source: Big Data

MACHINE LEARNING



Closed-loop optimization of fast-charging protocols for batteries with machine learning

"Here we develop and demonstrate a machine learning methodology to efficiently optimize a parameter space specifying the current and voltage profiles of six-step, ten-minute fast-charging protocols for maximizing battery cycle life, which can alleviate range anxiety for electric-vehicle users."
Source: Nature

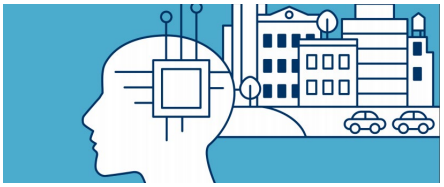
Improving Human-Robot Interaction Utilizing Learning

multifarious communication channels."
Source: Frost & Sullivan

Transforming Paradigms: A Global AI in Finance Services Survey

"Based on a survey sample of 151 firms which included both FinTechs and Incumbents, this study was able to depict a global Financial Services sector that is undergoing profound digital transformation underpinned by the advancement in AI."
Source: World Economic Forum

OUTLOOK

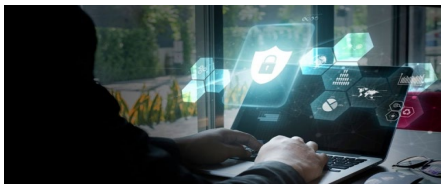


Artificial Intelligence Trends to Watch in 2020

"'Deepfakes' are becoming more mainstream, making it difficult to discern real media from fake media. We may also see an increase in malicious applications of open-source AI tools — which have been fundamental in democratizing AI. Some trends highlighted in our 40-page report include …"
Source: CB Insights

requiring less data and human supervision."
Source: IBM

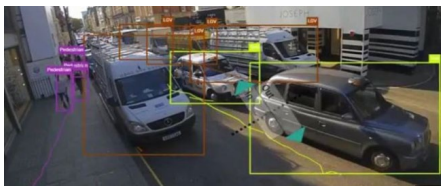
CYBERSECURITY



A human-machine collaboration to defend against cyberattacks

"PatternEx's Virtual Analyst Platform uses machine learning models to detect suspicious activity on a network. That activity is then presented to human analysts for feedback that improves the systems' ability to flag activity analysts care about."
Source: MIT News

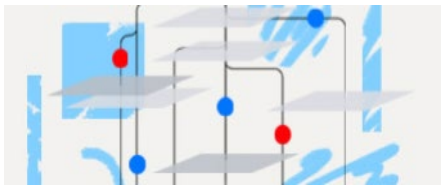
SMART CITIES



Smart cities: How data and artificial intelligence could change London

"With growing pressure to cut carbon emissions and reduce the number of vehicles on the road, some small cameras could help provide the answer to London's emission woes."
Source: BBC News

ALGORITHMS



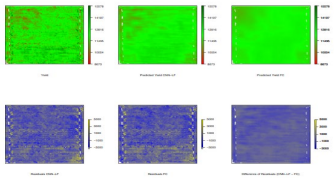
AutoAI set to make it easy to create machine learning algorithms

"A new deep learning design approach could help businesses and non-experts to write their own AI solutions."
Source: IBM

and Intelligence: A Human Factors-Based Approach

"This article examines relevant human factors and develops a framework for integrating the necessary elements of intelligent control and data processing to provide appropriate adaptability to robotic elements, consequently improving collaborative interaction with human colleagues."
Source: IEEE Transactions on Automation Science and Engineering

NEURAL NETWORKS



Modeling yield response to crop management using convolutional neural networks

"With the increase in the amount of data generated by agricultural machinery, more sophisticated models are necessary to get full advantage of such data. In this work, we propose a Convolutional Neural Network (CNN) to capture relevant spatial structures of different attributes and combine them to model yield response to nutrient and seed rate management."
Source: Computers and Electronics in Agriculture

Face Representations via Tensorfaces of Various Complexities

"In this theoretical study, we explore the effects of complexity, defined as algorithmic information (Kolmogorov complexity) and logical depth, on possible ways that face cells may be organized."
Source: Neural Computation

Artificial Neural Network Approach to the Analytic Continuation Problem

"The analytic continuation problem is ill defined and currently no analytic transformation for solving it is known. We present a general framework for building an artificial neural network (ANN) that solves this task with a supervised learning approach."
Source: Physical Review Letters

Experimental neural network enhanced quantum tomography

"Here we develop a framework based on machine learning which generally applies to both the tomography and state-preparation-and-measurement (SPAM) mitigation problem."
Source: npj Quantum Information

Relation Network for Multilabel Aerial Image Classification

"… Although a long short term memory (LSTM) layer can be introduced to modeling such label dependencies in a chain propagation manner, the efficiency might be questioned when certain labels are improperly inferred. To address this, we propose a novel aerial image multilabel classification network, attention-aware label relational reasoning network."

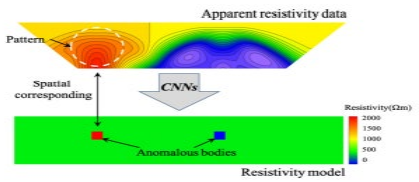
Source: IEEE Transactions on Geoscience and Remote Sensing

Minimalistic Attacks: How Little it Takes to Fool Deep Reinforcement Learning Policies

"Recent studies have revealed that neural network based policies can be easily fooled by adversarial examples. However, while most prior works analyze the effects of perturbing every pixel of every frame assuming white-box policy access, in this paper we take a more restrictive view towards adversary generation - with the goal of unveiling the limits of a model's vulnerability."

Source: IEEE Transactions on Cognitive and Developmental Systems

DEEP LEARNING



Deep Learning Inversion of Electrical Resistivity Data

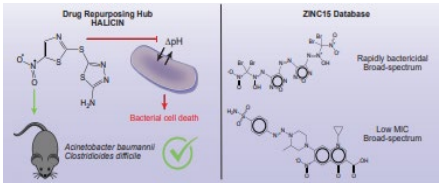
"Inspired by the remarkable nonlinear mapping ability of deep learning approaches, in this article, we propose to build the mapping from apparent resistivity data (input) to resistivity model (output) directly by convolutional neural networks (CNNs)."

Source: IEEE Transactions on Geoscience and Remote Sensing

Complexity control by gradient descent in deep networks

"Overparametrized deep networks predict well, despite the lack of an explicit complexity control during training, such as an explicit regularization term. For exponential-type loss functions, we solve this puzzle by showing an effective regularization effect of gradient descent in terms of the normalized weights that are relevant for classification."

Source: Nature Communications



A Deep Learning Approach to Antibiotic Discovery

"We trained a deep neural network capable of predicting molecules with antibacterial activity … This work highlights the utility of deep learning approaches to expand our antibiotic arsenal through the discovery of structurally distinct antibacterial molecules."
Source: Cell

The Prognostic Significance of Quantitative Myocardial Perfusion: An Artificial Intelligence Based Approach Using Perfusion Mapping

"In patients with known or suspected coronary artery disease, reduced MBF and MPR measured automatically inline using artificial intelligence quantification of CMR perfusion mapping provides a strong, independent predictor of adverse cardiovascular outcomes."
Source: Circulation

Deriving disease modules from the compressed transcriptional space embedded in a deep autoencoder

"In summary, we believe that our data-driven analysis using deepAE with a subsequent knowledge-based interpretation scheme, enables systems medicine to become sufficiently powerful to allow unbiased identification of complex novel gene-cell type interactions."
Source: Nature Communications

Automatic extraction of cancer registry reportable information from free-text pathology reports using multitask convolutional neural networks

"The hard parameter sharing Multitask Convolutional Neural Network (MTCNN) offers superior classification accuracy for automated coding support of pathology documents across a wide range of cancers and multiple information extraction tasks while maintaining similar training and inference time as those of a single task–specific model."
Source: Journal of the American Medical Informatics Association

Benchmarking machine learning algorithms on blood

glucose prediction for Type 1 Diabetes in comparison with classical time-series models

"This paper aims to compare the performance of several commonly known machine-learning (ML) models versus a classic Autoregression with Exogenous inputs (ARX) model in the prediction of blood glucose (BG) levels using time-series data of patients with Type 1 diabetes (T1D)."

Source: IEEE Transactions on Biomedical Engineering

Drug-Target Interaction Prediction: End-to-End Deep Learning Approach

"In this paper, we present a deep learning architecture model, which exploits the particular ability of Convolutional Neural Networks (CNNs) to obtain 1D representations from protein sequences (amino acid sequence) and compounds SMILES (Simplified Molecular Input Line Entry System) strings."

Source: EEE/ACM Transactions on Computational Biology and Bioinformatics