



Artificial Intelligence in Finance
at
Hong Kong University of Science and Technology

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#UST

Final Assignment & Presentation

- NO exam
- Final assignment (group) in the form of an eight (8)-page report based on the NIPS format documenting:
 1. Progress and learning from group project (technical report)
 2. Reflection on an AI article and a finance one (essay)
 3. Synthesis and suggestions for further study
 4. Note individual contribution
- Final presentation (group) in short YouTube videos (10 mins)
- Peer review for both final assignments and final presentations
- Due date: May 26, 2019 (Sunday)

Date	Topic	Instructor
01/02/2019, Fri	<ul style="list-style-type: none"> Lecture 01: History and Overview of Artificial Intelligence. [slides] 	A.W. and Y.Y.
15/02/2018, Fri	<ul style="list-style-type: none"> Lecture 02: Introduction to Supervised Learning [YY's slides][Topic]Google Experiments: Vision Sensing and Case study: HireVue (Video Analytics for Recruitment)[AW's slides] 	A.W. Y.Y.
02/22/2019, Fri	<ul style="list-style-type: none"> Lecture 03: Regression, Classification, Model Assessment and Selection [YY's slides] [Reference]:SLR, Chapter 3-6. [Topic]:Katrina Fong's talk [AW's slides] 	Y.Y.
03/1/2019, Fri	<ul style="list-style-type: none"> Lecture 04: Decision Tree, Random Forests and Boosting [YY's slides] [Reference]:SLR, Chapter 3-6. [Topic]Credit analysis and Mock interview by Katrina [AW's slides] 	Y.Y.
03/8/2019, Fri	<ul style="list-style-type: none"> Lecture 05: Tutorials [Reference]:Yifei HUANG: Tutorial on Machine Learning by Python Yifei HUANG: Tutorial on GPU server A dataset used in python tutorial: okex future BTC USD this week 1H.csv File links in Piazza >> 	Yifei Huang; Katrina Fong; Anthony Woo
03/15/2019, Fri	<ul style="list-style-type: none"> Lecture 06. Topics in Blockchains [Invited Talk]: Fintech and BlockchainSpeaker: Dr. Alex YANG, CEO, VEE Technology LLC and Dr. Chen NING. Abstract: This is a brief introduction of Blockchain consensus and its current application in Finance, V.Systems' vision and outlook of Blockchain in Fintech. Bio: Dr Alex Yang is a FinTech entrepreneur/investor with over 14 years of experience in banking and finance. VEE Technology is led by Sunny King, a blockchain legendary developer and creator of Proof-of-Stake consensus. As CEO of VEE Tech, Alex is driving the project to solve the core scalability and stability problems in the development of the blockchain industry. His deep experience of the industry has been gained through his investing activity where he has sponsored many world-leading blockchain foundations. Prior to his role at VEE, Alex was the founder and CEO of Fund V, one of the first token funds to focus on blockchain companies and related investment opportunities. He was also the founding partner of Beam VC and CyberCarrier Capital which together have successfully invested in over 30 startups in the TMT sector. Alex is a founding partner of Protoss Global Opportunity Fund, a fixed income hedge fund based in Hong Kong. Prior to moving into venture capital investing, Alex was based in Hong Kong as head of APAC structured rates trading at Nomura International, and VP of exotic derivatives trading at UBS. He started his career as a quantitative developer at Jump Trading in Chicago. Alex has a PhD from Northwestern University and a BA in Mathematics from Peking University. An Introduction to Blockchains: [AW's slides] 	A.W. Y.Y.
03/22/2019, Fri	<ul style="list-style-type: none"> Lecture 07: An Introduction to Neural Networks and Deep Learning [Reference]:[slides-A] [slides-B] [Invited Talk]Speaker: Dr. Jeffrey Hui Title: Igniting the i-Marketing Revolution - 5 KEY Digital and Social Media Trends in 2019+ [slides] 	A.W. Y.Y.

Date	Topic	Instructor
03/29/2019, Fri	<ul style="list-style-type: none"> Lecture 08: An Introduction to Recurrent Neural Networks (RNN) and Long Short Term Memory (LSTM) [Reference]:[slides] [Topic]Google Image Recognition. Case study: SenseTime (Computer Vision) [slides] 	A.W. Y.Y.
04/12/2019, Fri	<ul style="list-style-type: none"> Lecture 09: An Introduction to Reinforcement Learning [YY's slides] [Topic]:Competition of Cryptocurrency Trading with Deep Learning, by DE LAVERGNE Cyril [slides] Introduction to Deep Reinforcement Learning Trading, by HUANG Yifei [slides] [Reference]:Cyril's training dataset and demos [link] Ceruleanacg's GitHub Repo for Reinforcement Learning and Supervized Learning Methods and Envs For Quantitative Trading 	Cyril DE LAVERGNE Y.Y.
04/26/2019, Fri	<ul style="list-style-type: none"> Lecture 10: An Introduction to Unsupervised Learning: PCA, AutoEncoder, VAE, and GANs [Reference]:[slides] 	A.W. Y.Y.
05/03/2019, Fri	<ul style="list-style-type: none"> Seminar: Investment Trends and FinTech Outlook [Invited Talk]:Focus : Sales and Trading Business in Global Investment Banks – Ripe for Disruption by AI? Speaker: Mr. Christopher Lee Biography: Mr. Chris Lee is a partner at FAA Investments and a board director with expertise in financial markets, risk management, governance and leadership development. Currently, he serves as an Independent Board Member with Matthews Asia Funds (AUM: US\$30.2 billion), the largest US investment company with a focus on Asia Pacific markets and Asian Masters Fund, an investment company listed in Australia. Previously, Chris was an investment banker for 18 years, acting as Managing Director and divisional and regional heads at Deutsche Bank AG, UBS Investment Bank and Bank of America Merrill Lynch. He worked in global capital markets, managed derivative products, and provided equity sales and trading functions to institutional investors. Academically, Chris is an associate professor of science practice at HKUST and teaches financial mathematics and risk management courses. He completed the AMP at Harvard University and holds a BS in Mechanical Engineering and an MBA from U.C. Berkeley. Bloomberg Profile: [link] 	Chris Lee A.W.
05/10/2019, Fri	<ul style="list-style-type: none"> Lecture 12: Tutorial on deep learning in Python [Reference]:[Python Notebook] 	Yifei Huang
05/17/2019, Fri	<ul style="list-style-type: none"> Lecture 13: Final [Reference]:[slides] 	A.W.

Frontier Technologies & Applications



- World's best-performing cybersecurity solutions provider
- Proprietary deep learning framework designed for cybersecurity
- Zero-day threat detection and prevention
- A step beyond signature-based virus and malware detection



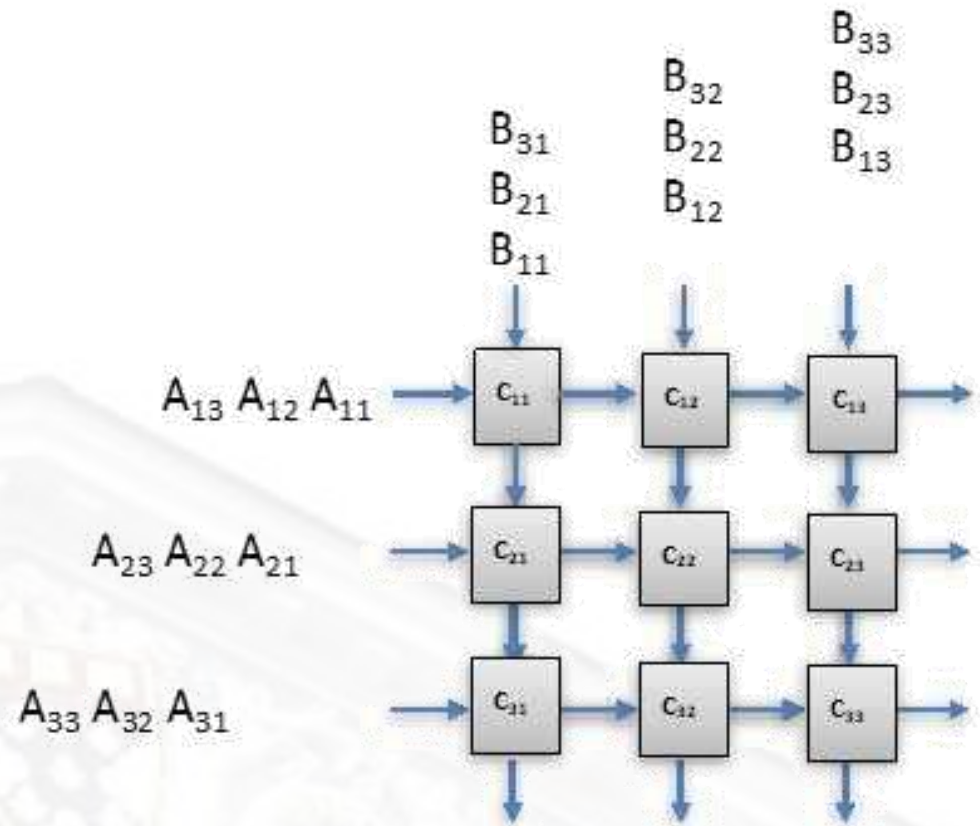
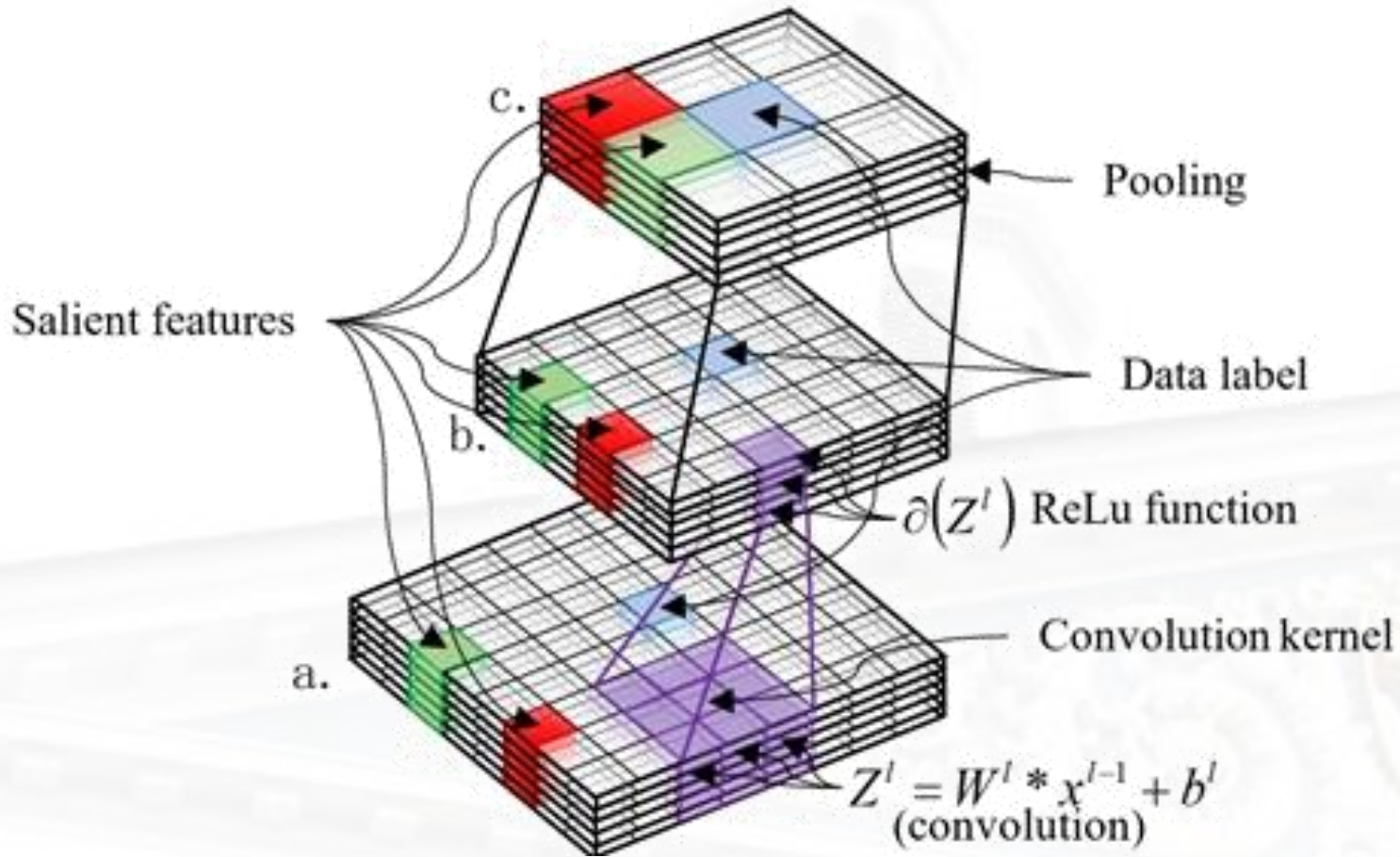
- World's first and only certified company offering fully-autonomous BVLOS (Beyond Visual Line of Sight) drone solutions
- Potential to become platform for scaled aerial data analytics, and become a critical enabler of AI/ML ecosystem
- Foundational role for the future of smart cities

AI Chipset

- AI chipset optimized for parallel processing
- Radical architectural design allows for scaling down for edge intelligence
- Vast market potential in low power, low cost, high volume use cases
- Dynamic Reconfigurable Systolic Array eliminating I/O bottlenecks

Drug Discovery AI

- World's best results for new drug hit discovery, binding affinity prediction, and toxicity detection
- Utilizes deep learning (3D convolutional neural networks) for structure-based drug discovery
- Enabler of drug discovery in an extremely large and diverse chemical space (order of magnitude: 10^{60})



AtomNet: A Deep Convolutional Neural Network for Bioactivity Prediction in Structure-based Drug Discovery

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Abstract

Deep convolutional neural networks comprise a subclass of deep neural networks (DNN) with a constrained architecture that leverages the spatial and temporal structure of the domain they model. Convolutional networks achieve the best predictive performance in areas such as speech and image recognition by hierarchically composing simple local features into complex models. Although DNNs have been used in drug discovery for QSAR and ligand-based bioactivity predictions, none of these models have benefited from this powerful convolutional architecture. This paper introduces AtomNet, the first structure-based, deep convolutional neural network designed to predict the bioactivity of small molecules for drug discovery applications. We demonstrate how to apply the convolutional concepts of feature locality and hierarchical composition to the modeling of bioactivity and chemical interactions. In further contrast to existing DNN techniques, we show that AtomNet's application of local convolutional filters to structural target information successfully predicts new active molecules for targets with no previously known modulators. Finally, we show that AtomNet outperforms previous docking approaches on a diverse set of benchmarks by a large margin, achieving an AUC greater than 0.9 on 57.8% of the targets in the DUDE benchmark.

1 Introduction



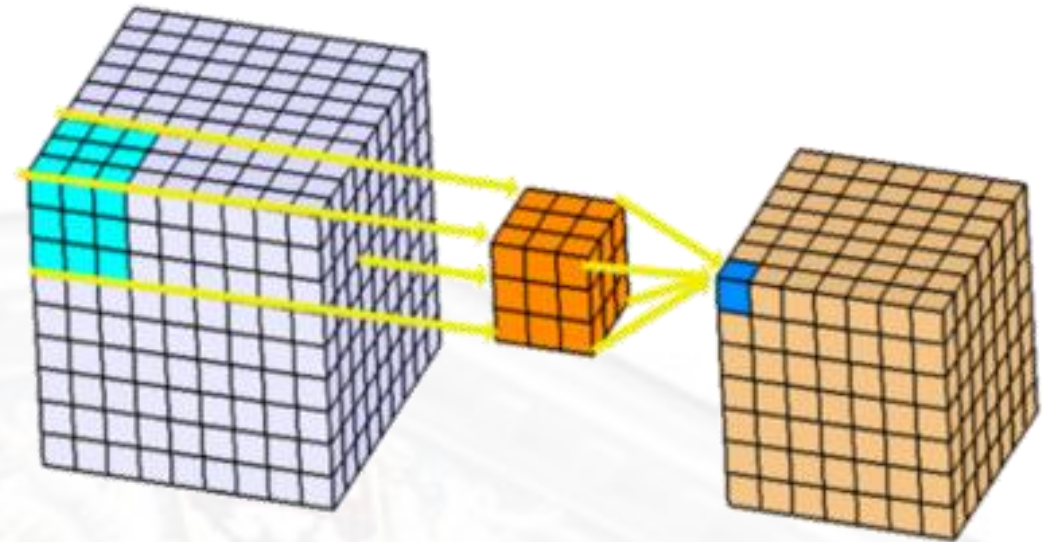
Convolution: 2D & 3D

1 _{x1}	1 _{x0}	1 _{x1}	0	0
0 _{x0}	1 _{x1}	1 _{x0}	1	0
0 _{x1}	0 _{x0}	1 _{x1}	1	1
0	0	1	1	0
0	1	1	0	0

Image

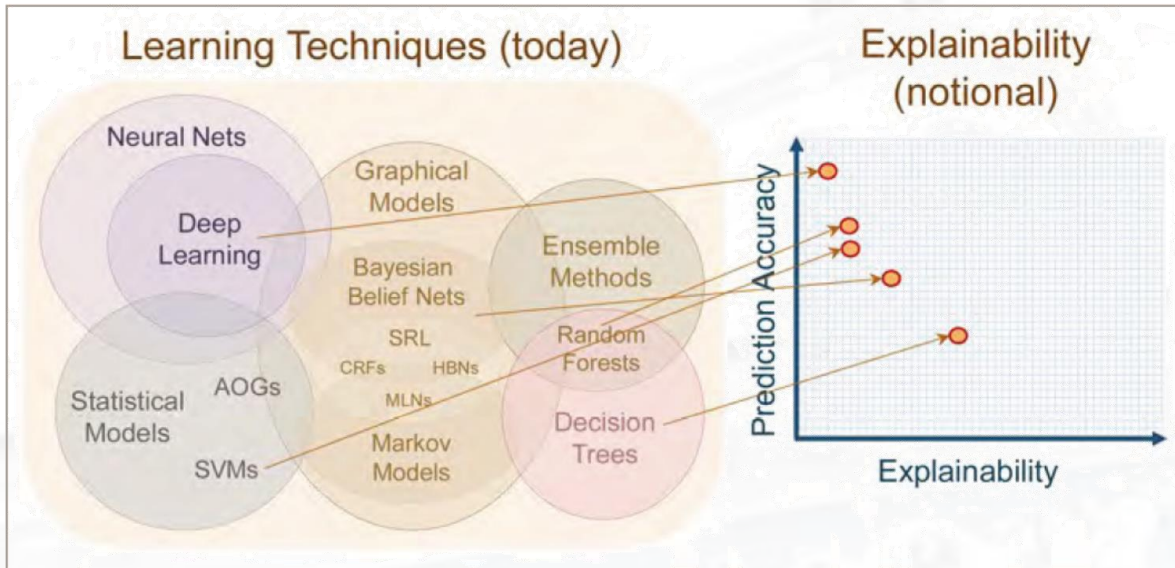
4		

Convolved
Feature



Explainability & Usability

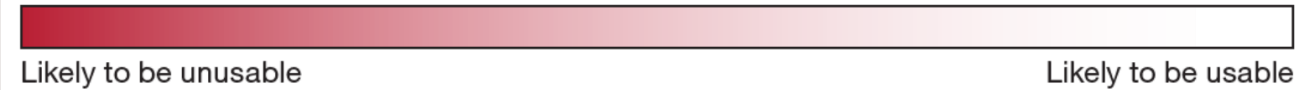
Exhibit 6 | Relative explainability of learning algorithms



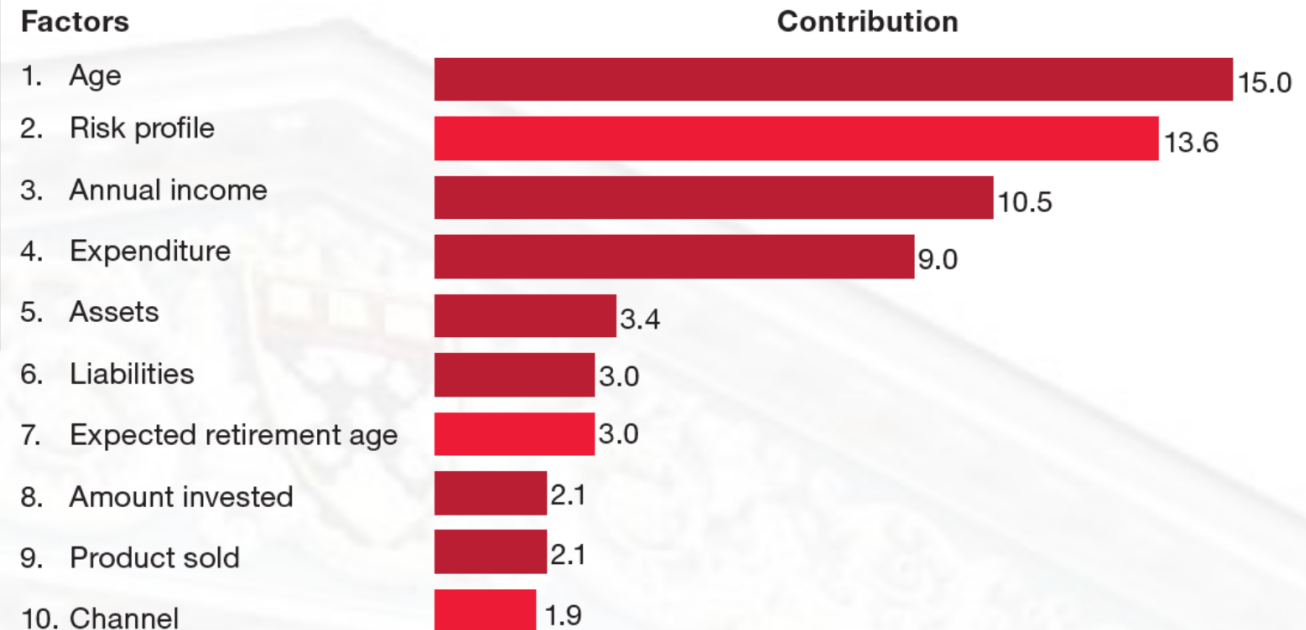
Source: DARPA

Exhibit 7 | Feature importances in investment product suitability

Suitability metre



Top contributing factors



Source: PwC

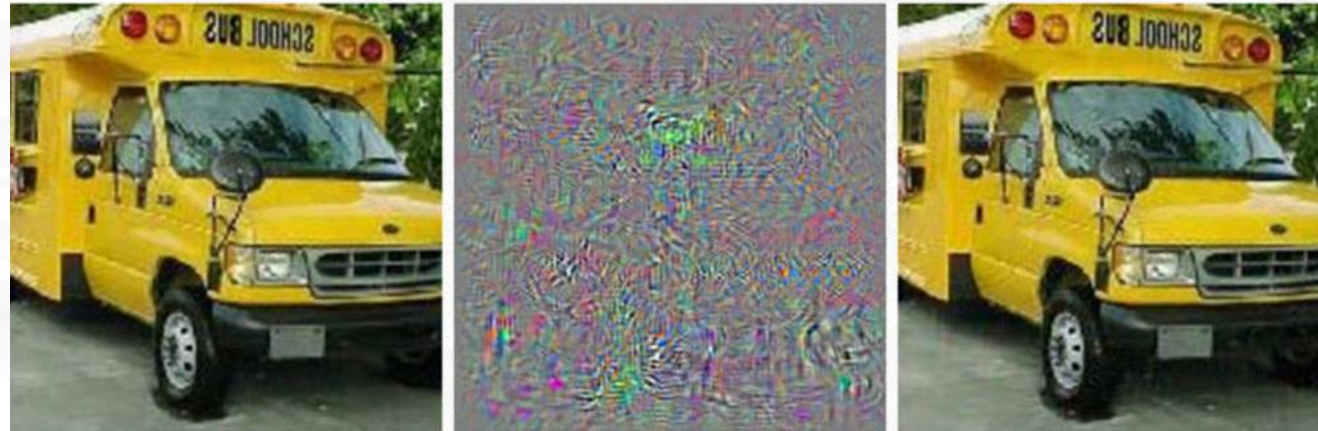
Adversarial Examples in Deep Learning



“panda”
57.7% confidence

“nematode”
8.2% confidence

“gibbon”
99.3 % confidence



“bus”

adversarial noise

“ostrich”



Predictive Maintenance
预测性维护

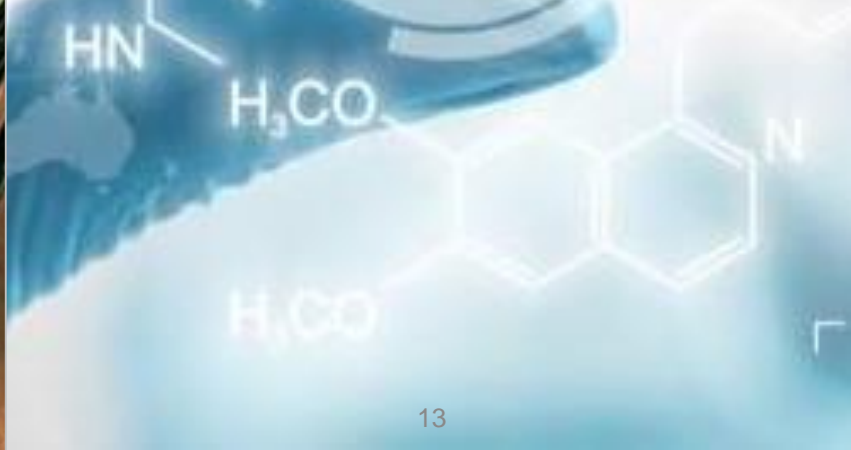
Drug Discovery
药物研发

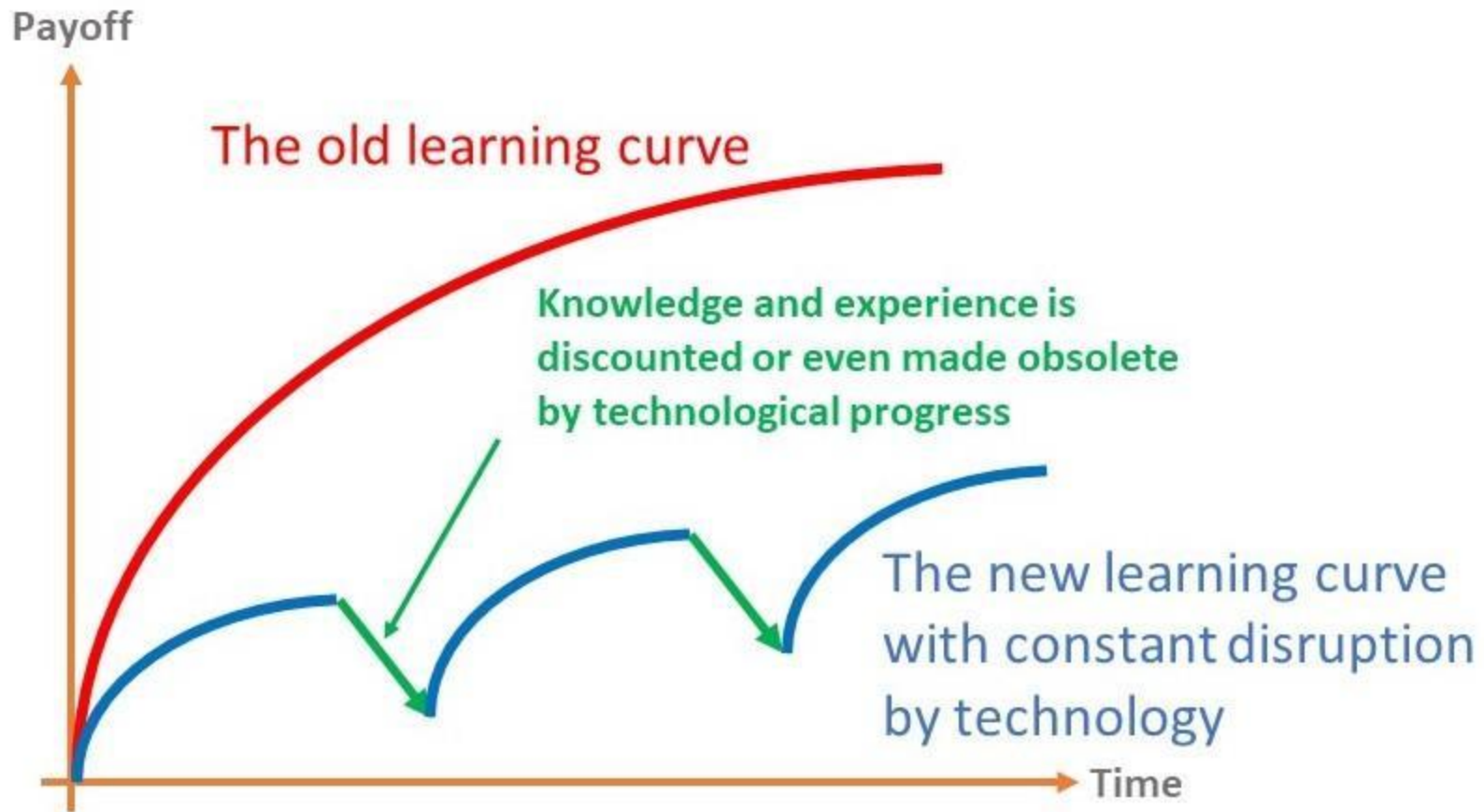
General Purpose Decision Engine
通用决策引擎

Hypothetical Scenario Generator
假设场景生成器
Symbolic Reasoning
符号推理
Reinforcement Learning
强化学习

Generative Adversarial Networks
生成对抗网络
Computational Biology
计算生物学
Convolutional Neural Networks
卷积神经网络

Probabilistic Modeling
概率建模
Reinforcement Learning
强化学习
Multi-Agent Systems
多代理系统





如果我不是技术出身·怎么办?

- 参与研讨会, 与专家交流
- 网上讲座及课程 (Coursera, Udacity)
- 数据科学、大数据或人工智能硕士 (Berkeley)
- 学习相关职业发展或高管课程 (如: MIT CSAIL)
- 大量阅读期刊文章 (NIPS, ICML, ICCV, CVPR)