Artificial Intelligent (AI) and Machine Learning (ML)

Artificial Intelligent (AI)

- Emphasizes on giving machines knowledge to make the machine work and act like human beings in every aspect.
- Some of the activities computers with AI are designed for include:
  - Speech recognition
  - Learning
  - Planning
  - Problem-solving
- Apple's Siri can be taken as an example of AI.

Source: https://itconnectus.com/emerging-technologies-innovation/

Artificial Intelligent (AI)

- AI is going mainstream, driven by machine learning, big data and cloud computing.
- These factors empower algorithms to identify increasingly complex patterns in large data sets.
- AI can improve efficiency, resource allocation, and thus drive productivity gains.
- AI also promises to help address complex challenges in many areas such as health, transport, Meteorology (weather forecast) and security.

AI Applications

A glimpse of what ML technology can do:

- Read text and work out whether the person who wrote it is making a complaint or offering congratulations.

- Listen to a piece of music, decide whether it is likely to make someone happy or sad, and find other pieces of music to match the mood.

- Compose their own music expressing the same themes, or which they know is likely to be appreciated by the admirers of the original piece.

Source: https://itconnectus.com/emerging-technologies-innovation/

AI Applications

- Artificial intelligence promises to help people address complex challenges in areas like health, transport and security.
  - AI helps detect health conditions early, deliver preventive services and discover new treatments
  - AI-powered autonomous driving and optimized traffic routes facilitate transportation and save lives.
  - AI helps identify and combat both cybersecurity threats and real-world security threats.

Policy Challenges

- The rise of AI amplifies existing policy challenges and raises new ones
  - While policy makers are starting to focus on AI, more awareness of its potential impacts is needed.

- AI outperforms humans in certain complex cognitive functions but still requires huge data sets.

- The renaissance of AI since about 2011 is largely attributed to the success of the branch of machine learning called “deep artificial neural networks”, supported by another branch of AI known as “reinforcement learning”.

- AI algorithms are able to perform complex computations of large datasets in parallel

- Therefore, are faster than biological human intelligence.

- Beyond computationally intensive tasks, AI increasingly outperforms humans for certain complex cognitive functions such as image recognition in radiology (Wang et al., 2016; lake et al., 2016).

Narrow AI

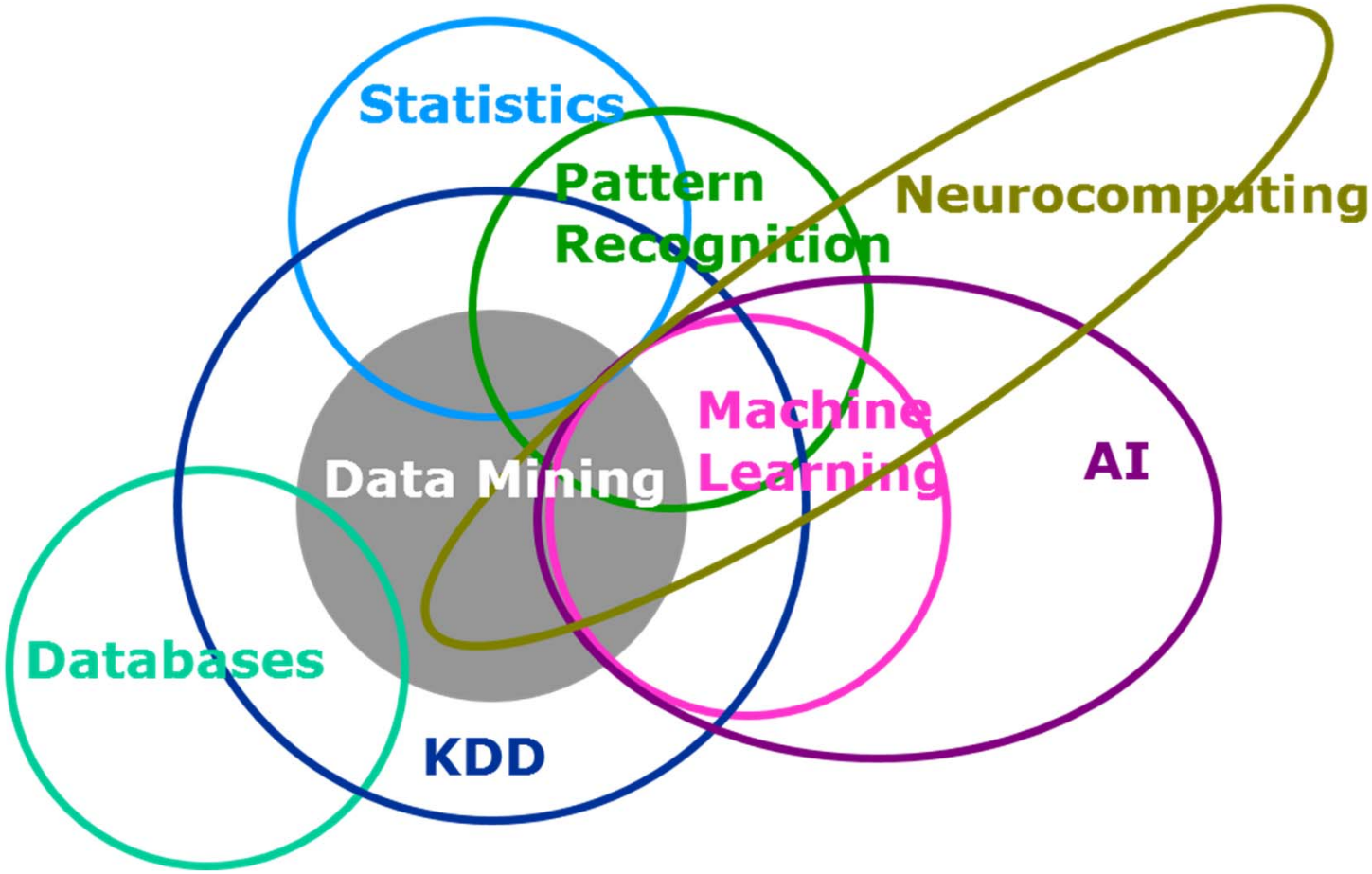
- Today's narrow AI focuses on specific tasks,
- A hypothetical future general AI could carry out general intelligent action, like humans.

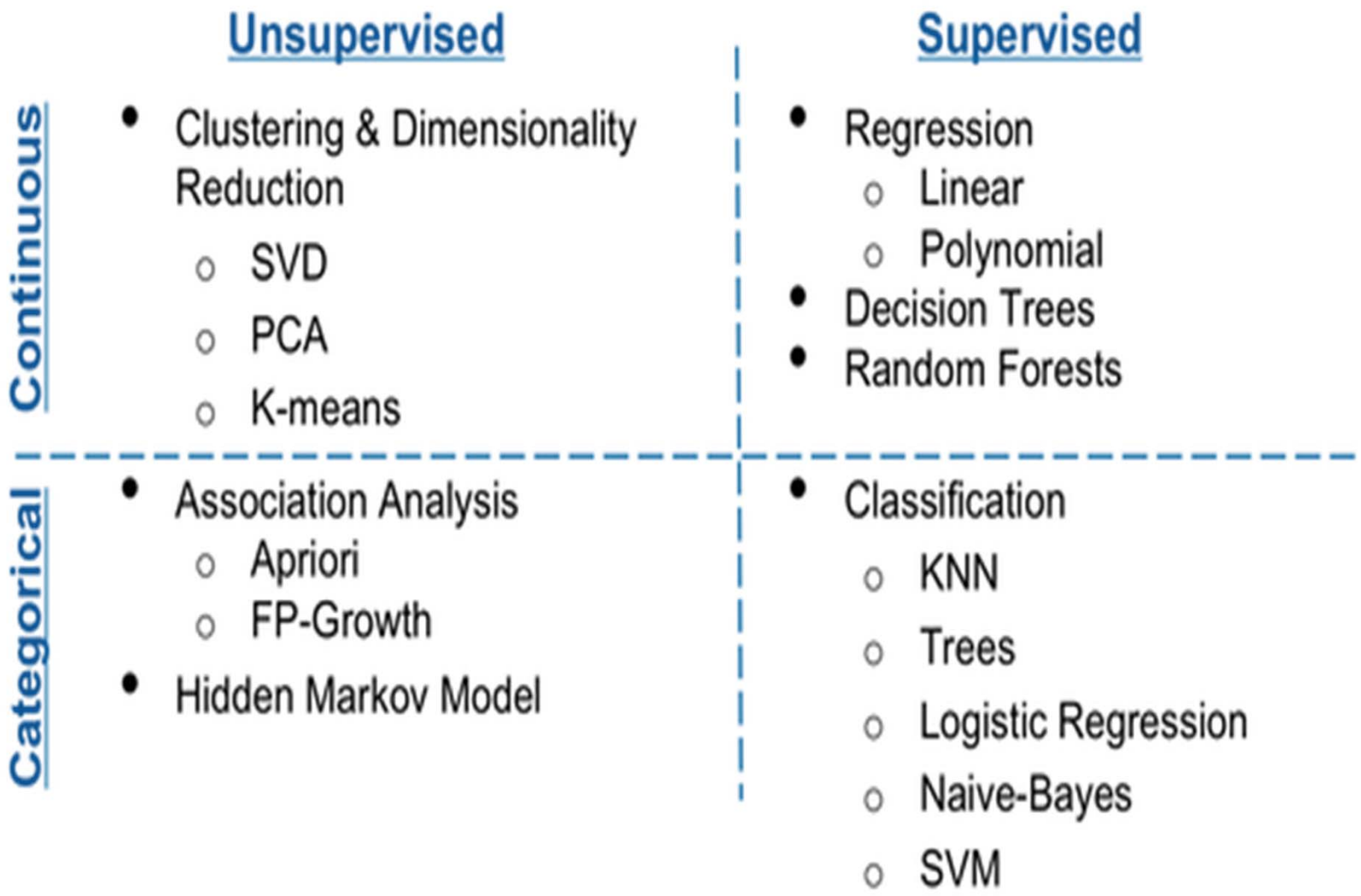
- Narrow AI is designed to accomplish a specific problem-solving or reasoning task. This is the current state-of-the-art.

- Such as the IBM Watson or Google's AlphaGo

Brief Introduction of Machine Learning (ML)

Data Science





http://www.cc.ntu.edu.tw/chinese/epaper/0031/20141220_3105.html

Machine Learning

- Machine Learning is a current application of AI
- Give machines access to data and let them learn for themselves.
- The basic concept is to receive input data and use statistical analysis to predict an output value within an acceptable range.

Source: https://itconnectus.com/emerging-technologies-innovation/

Machine Learning

Aims: patterns recognition, predictions

Applications:

- computer vision,
- natural language processing,
- search engine,
- medical diagnosis,
- analysis of securities market,
- DNA sequencing,
- voice and handwriting recognition,
- computer games, robotics, etc…

source: Wikipedia

Machine Learning

Methods

- linear and logistic regression,
- support vector machines,
- tree classifiers,
- boosting,
- maximum likelihood and MAP inference,
- EM algorithm,
- hidden Markov models,
- Kalman filters,
- k-means,
- Gaussian mixture models.

Source: https://itconnectus.com/emerging-technologies-innovation/

Machine Learning

- ML algorithms are categorized into Supervised, Unsupervised and reinforcement learning.

- Supervised algorithms require humans to provide both input and desired output along with providing feedback on the accuracy of predictions during training.

- Once training is complete, the algorithm will apply what was learned to new data.

Source: https://itconnectus.com/emerging-technologies-innovation/

Machine Learning

- Unsupervised algorithms are far more complex processing tasks than supervised algorithms.

- Unsupervised algorithms also do not need to be trained with desired outcome data. Instead, they use an iterative approach to review data and arrive at conclusions.

Source: https://itconnectus.com/emerging-technologies-innovation/

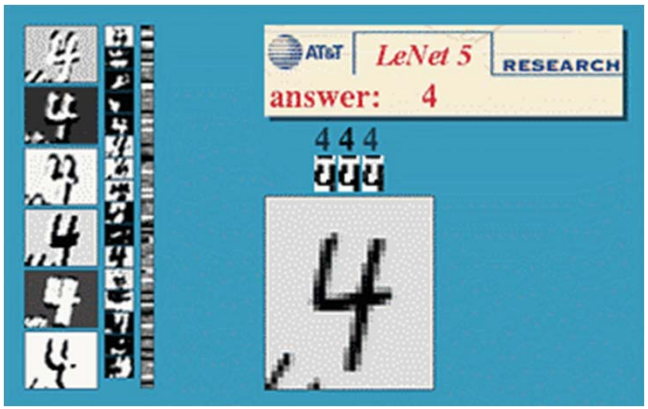
Category of Machine Learning

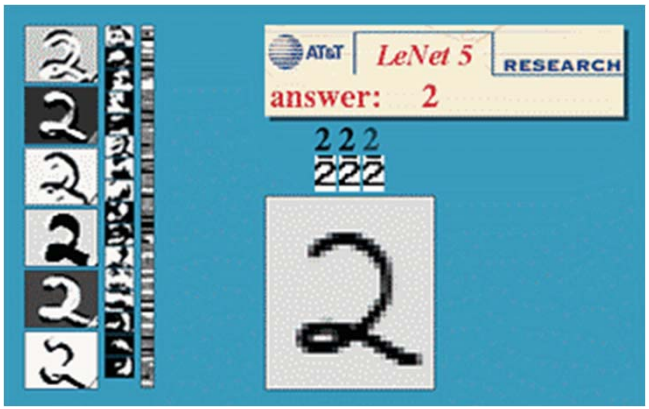
- Supervised learning
  - classification (分類)
- Unsupervised learning
  - clustering (分群)
  - dimensions reduction
- Reinforcement learning

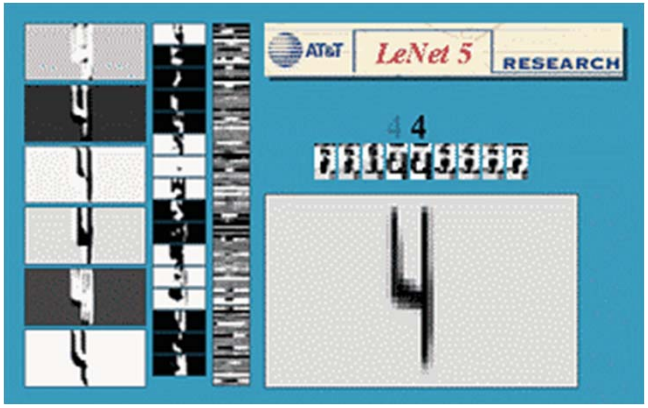
Supervised Learning

- Analogy to learn from teacher
- Tell you the questions and also the answers. You learn from them
- Often use in regression and classification

Application: Handwriting Pattern Recogn



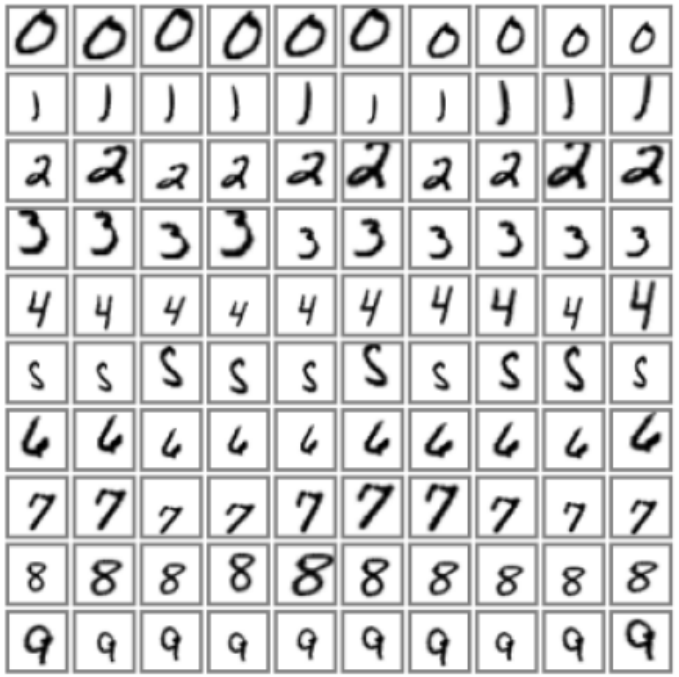




Application: Handwriting Pattern Recogn

60,000 original datasets

Test error: 0.95%



540,000 artificial distortions

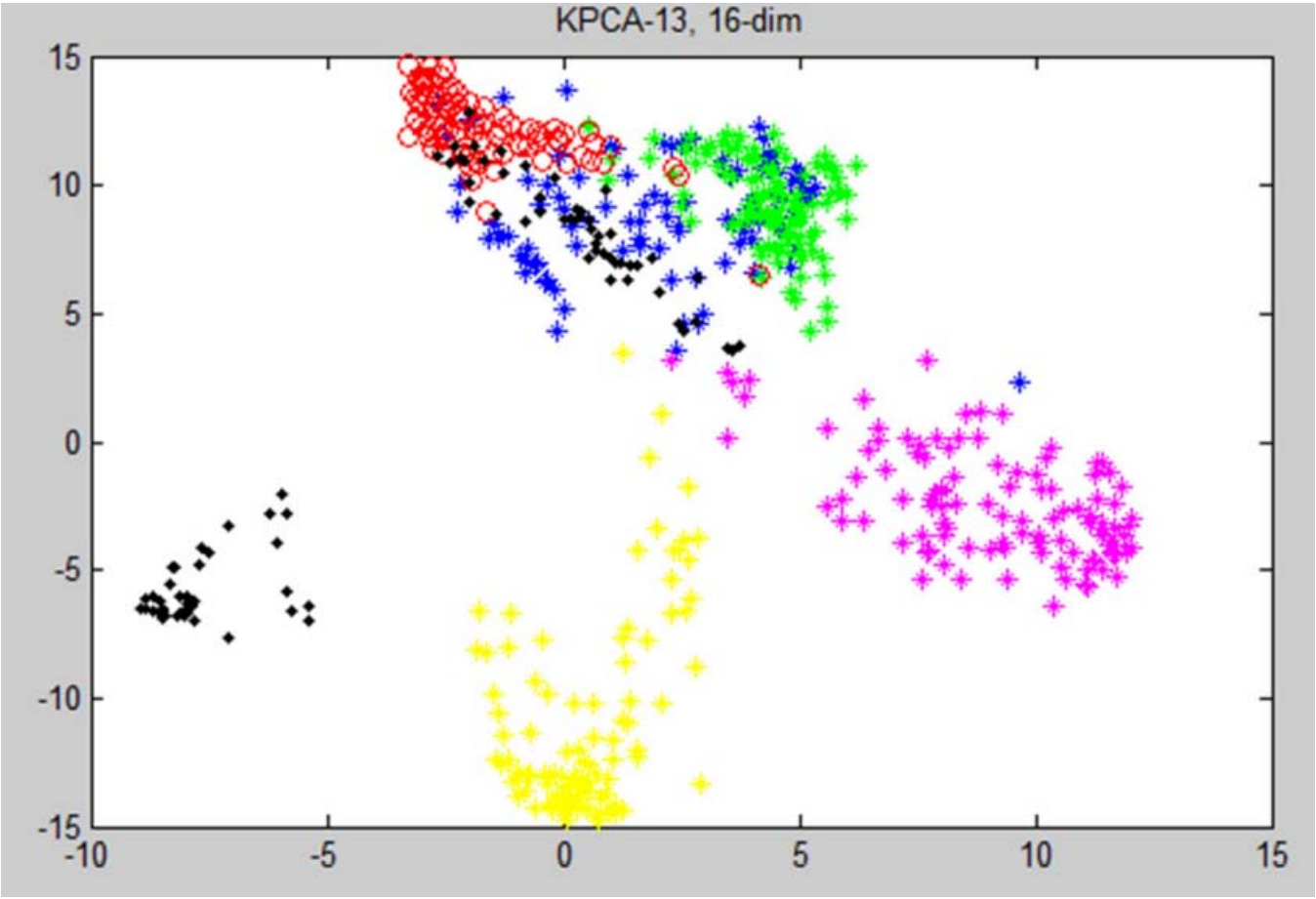
+ 60,000 original

Test error: 0.8%

Unsupervised Learning

- No standard answer or label.
- Learn the rules from the examples.
- Often use in clustering or dimensions reduction.

Clustering

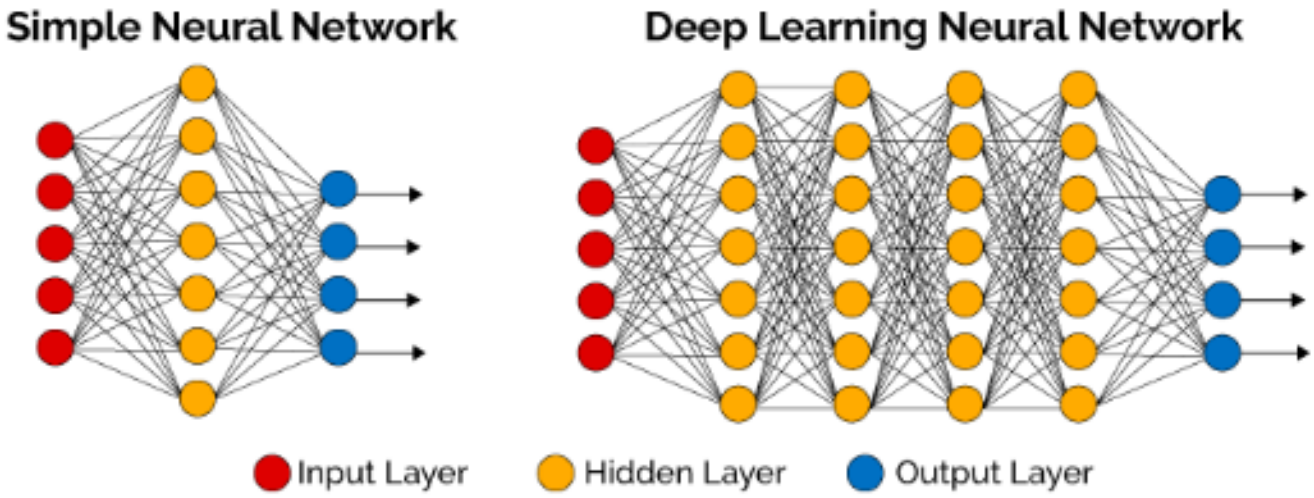


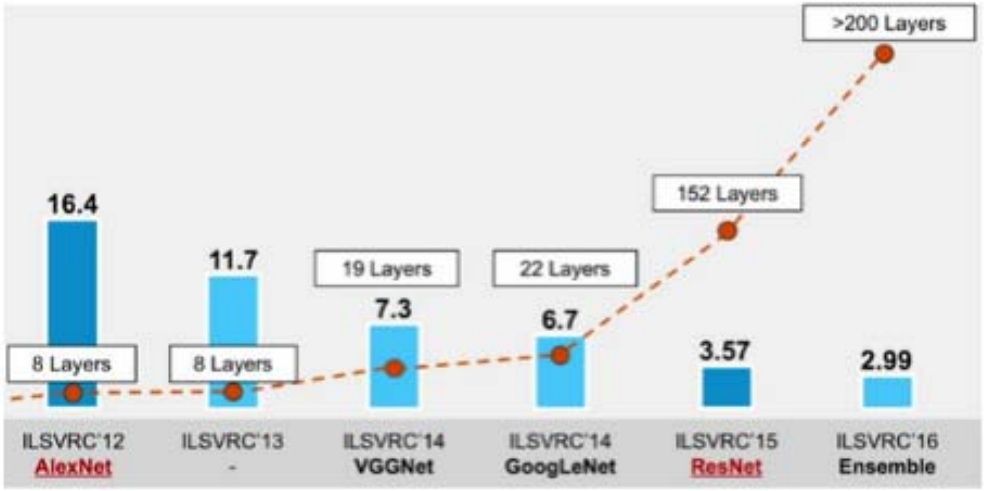
Reinforcement Learning

- No standard answer.
- Revise the action by observing the environment to optimize its benefit.
- If the action can step towards to the goal, positive reward will be got; otherwise (against the goal), negative reward will result.

ML 應用：Flappy Bird

Deep Learning


Simple Neural Network
Deep Learning Neural Network
Input Layer
Hidden Layer
Output Layer


>200 Layers
152 Layers
22 Layers
19 Layers
8 Layers
8 Layers
16.4
11.7
7.3
6.7
3.57
2.99
ILSVRC'12 AlexNet
ILSVRC'13 -
ILSVRC'14 VGGNet
ILSVRC'14 GoogLeNet
ILSVRC'15 ResNet
ILSVRC'16 Ensemble

Applications

Examples of AI Applications

1. Automated customer support
2. Personalized shopping experience
3. Healthcare
4. Finance
5. Smart cars and drones
6. Travel and navigation
7. Social media
8. Smart home devices
9. Creative arts
10. Security and surveillance

SCIENTIFIC REPORTS

OPEN

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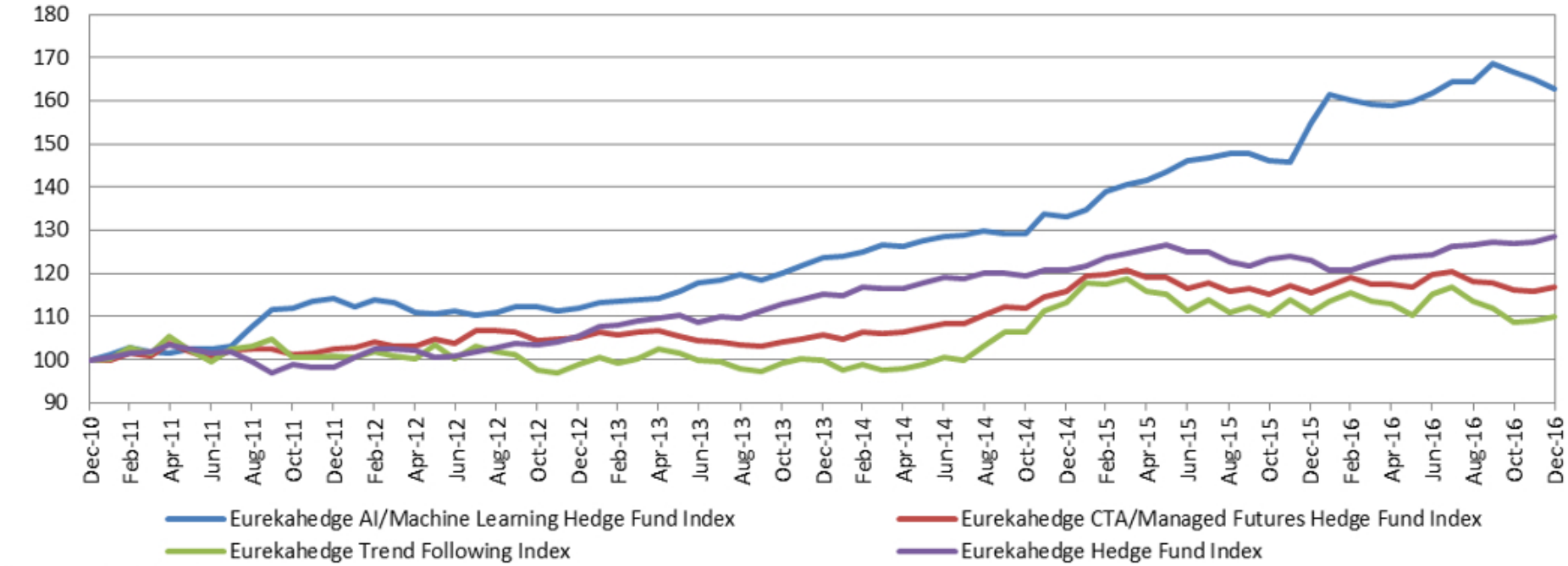
Computer-Aided Diagnosis with Deep Learning Architecture: Applications to Breast Lesions in US Images and Pulmonary Nodules in CT Scans

Jie-Zhi Cheng[1], Dong Ni[1], Yi-Hong Chou[2], Jing Qin[1], Chui-Mei Tiu[2], Yeun-Chung Chang[3], Chiun-Sheng Huang[4], Dinggang Shen[5,6] & Chung-Ming Chen[7]

This paper performs a comprehensive study on the deep-learning-based computer-aided diagnosis (CADx) for the differential diagnosis of benign and malignant nodules/lesions by avoiding the potential errors caused by inaccurate image processing results (e.g., boundary segmentation), as well as the classification bias resulting from a less robust feature set, as involved in most conventional CADx algorithms. Specifically, the stacked denoising auto-encoder (SDAE) is exploited on the two CADx applications for the differentiation of breast ultrasound lesions and lung CT nodules. The SDAE architecture is well equipped with the automatic feature exploration mechanism and noise tolerance advantage, and hence may be suitable to deal with the intrinsically noisy property of medical image data from various imaging modalities. To show the outperformance of SDAE-based CADx over the conventional scheme, two latest conventional CADx algorithms are implemented for comparison. 10 times of 10-fold cross-validations are conducted to illustrate the efficacy of the SDAE-based CADx algorithm. The experimental results show the significant performance boost by the SDAE-based CADx algorithm over the two conventional methods, suggesting that deep learning techniques can potentially change the design paradigm of the CADx systems without the need of explicit design and selection of problem-oriented features.

ML Application: Hedge Fund

Figure 1: AI/Machine Learning Hedge Fund Index vs. quants and traditional hedge funds



Source: Eurekahedge

- The annual returns of AI funds over the past six years is 8.44% 。
- The annual returns of active fund managers is 2.62%。

港產AI炒股基金 克服人性弱點

6個月回報12% 機械人三度叫坐貨食盡升浪

大型金融機構AI投資部署 信報

瑞銀	貝萊德	摩根大通	平安集團
UBS	BLACKROCK	J.P.Morgan	中国平安 PING AN
增加內部人工智能業務人手，包括數據科學家、架構師及商業分析師	市傳今年裁走7名基金經理，引入人工智能為ETFs等基金執行操作，並調整主動型基金人手	歐洲基金業務今年首季已有採用人工智能系統「LOXM」，並準備陸續引進到美洲及亞洲市場	平安證券推出人工智能管理理財產品，由機械人負責操盤

AI Application: Auto-driving

來源：https://blogs.nvidia.com.tw/tag/automotive/

AlphaGo

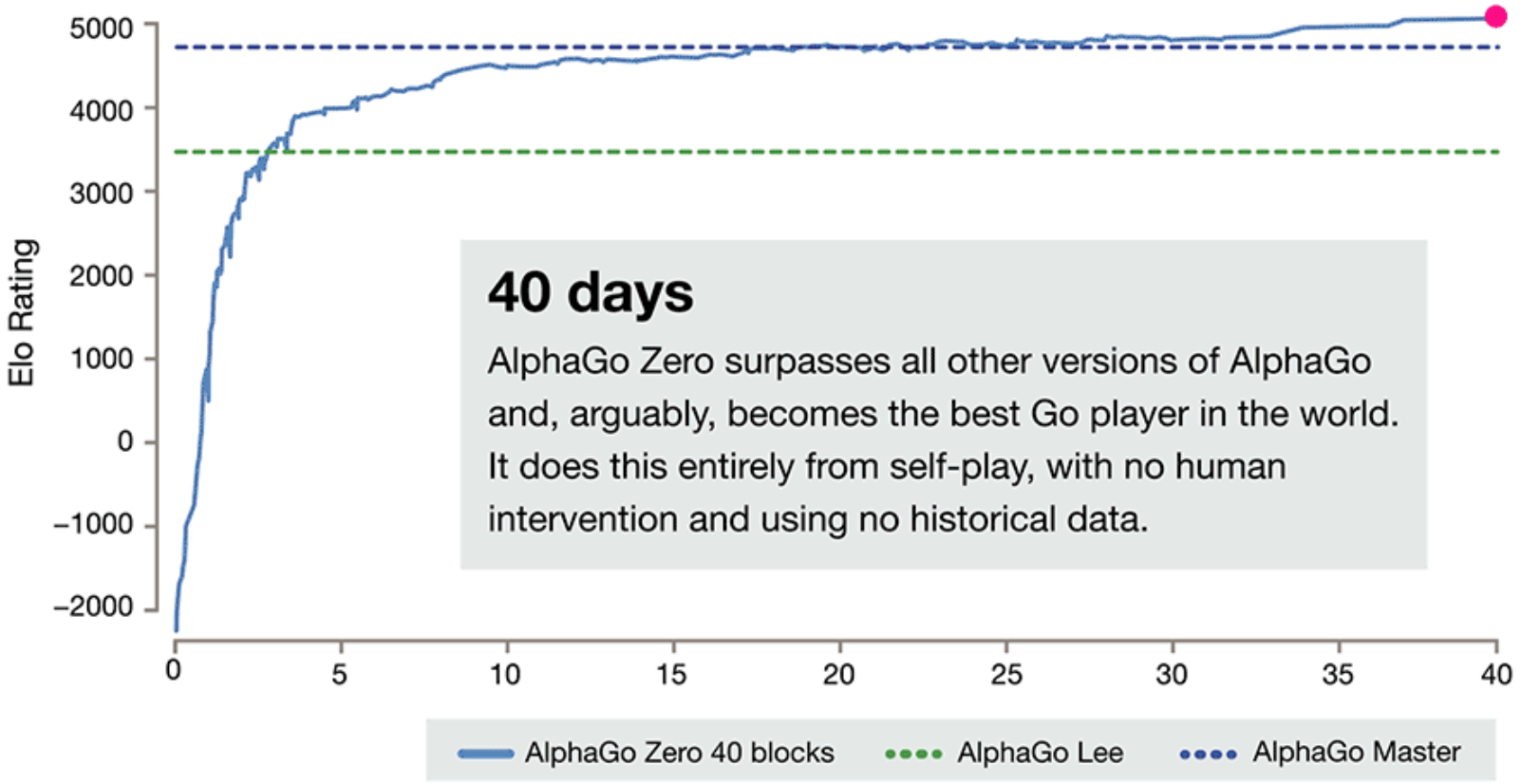

Google DeepMind
Challenge Match
8 - 15 March 2016
MATCH 1
AlphaGo
Google DeepMind
vs
Lee Sedol

- March 8-15, 2016, AlphaGo 4:1 beat South Korean GO player 李世乭。
- May 23-27, 2017年5月23至27日，AlphaGo beat all Chinese GO players in 烏鎮.
- AlphaGo Zero : purely reinforcement Learning

全新強化學習演算法：無需任何人類指導

這篇論文的最大亮點，在於無需任何人類指導，透過全新的強化學習方式成為自己的老師，在圍棋這最具挑戰性的領域達到超過人類的精通程度。相比之前使用人類對弈資料，此演算法訓練時間更短，僅用 3 天就達到擊敗李世乭的 AlphaGo Lee 水準，21 天達到之前擊敗柯潔的 AlphaGo Master 水準。

3 天內—就是 AlphaGo Zero 擊敗 AlphaGo Lee 之前，曾進行 490 萬次自我對弈練習。 相比之下，AlphaGo Lee 的訓練時間達數月之久。AlphaGo Zero 不僅發現人類數千年來已有的許多圍棋策略，還設計了人類玩家未知的策略。



來源：https://technews.tw/2017/10/19/alphago-zero-learning-from-scratch/

AlphaGo Zero的啟示

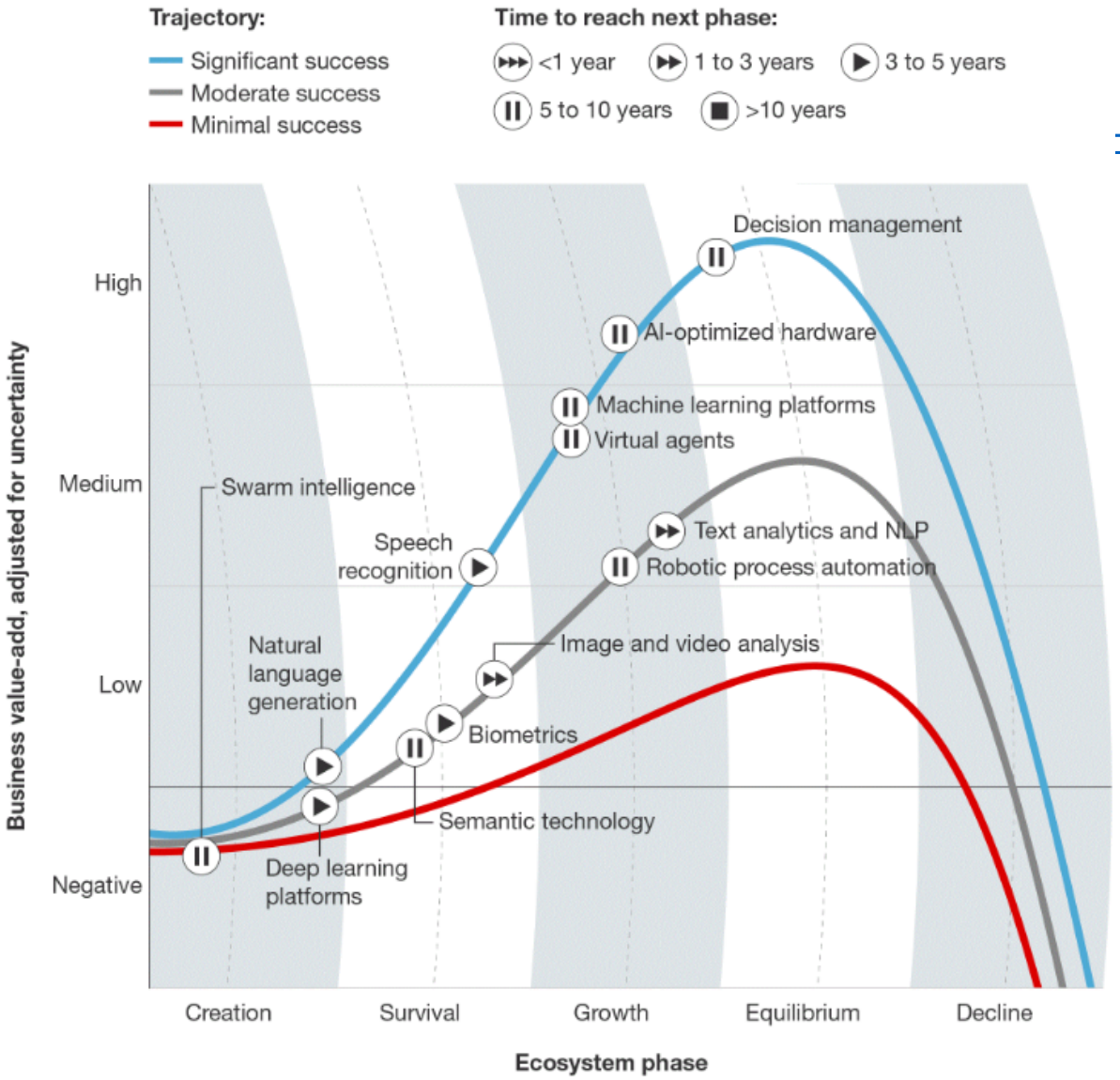
- 但 AlphaGo Zero 的突破使我們未來面對人類一些重大挑戰（如蛋白質摺疊、減少能源消耗、搜尋革命性的新材料等）充滿信心。

- 眾所周知，深度學習需要大量資料，在很多情況下，獲得大量人類資料的成本過於高昂，甚至根本難以獲得。如果將該技術應用到其他問題，有可能對我們的生活產生根本性的影響。

FORRESTER® RESEARCH

TechRadar™: Artificial Intelligence Technologies, Q1 '17

TechRadar™: Artificial Intelligence Technologies, Q1 2017



-10-hot-artificial-intelligence-