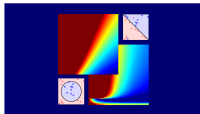


Machine Learning Foundations

(機器學習基石)



Lecture 1: The Learning Problem, Extended

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ML-driven Applications: Medicine



By DataBase Center for Life Science;
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for computer-assisted diagnosis

- **data:**
 - **patient status**
 - **past diagnosis from doctors**
- **skill:** dialogue system that **efficiently identifies disease of patient**

my student's earlier work
as intern @ HTC DeepQ

ML-driven Applications: Communication



By JulianVilla26;

licensed under CC BY-SA 4.0 via Wikimedia Commons

for 4G LTE communication

- **data**:
 - **channel information** (the channel matrix representing mutual information)
 - **configuration** (precoding, modulation, etc.) that reaches the highest throughput
- **skill**: predict **best configuration to the base station** in a new environment

my student's earlier work as intern @ MTK

ML-driven Applications: Manufacturing



By Raimond Spekking;

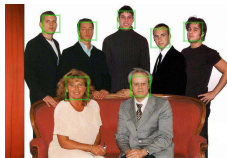
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for PCB fault detection

- data: **PCB images of normal and abnormal PCBs**
& maybe human-marked faulty locations
- skill: predict **which PCBs are faulty**

ongoing research for smart factory

ML-driven Applications: Security



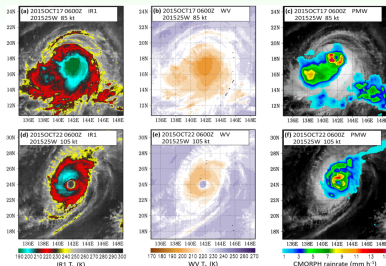
original picture by F.U.S.I.A. assistant and derivative work by Sylenius via Wikimedia Commons

face recognition

- data: **faces and non-faces**
- skill: predict **which boxes contain faces**

mature **ML technique**, but often need **tuning**
for different needs

ML-driven Applications: Meteorology



from TCIR dataset

for Tropical Cyclone intensity estimation

- **data**: satellite images
- **skill**: like experienced meteorologists, who can ‘feel’ and estimate TC intensity from image

Chen et al., KDD '18;
Chen et al., Weather & Forecasting '19

Machine Learning Connects (Big) Data and AI

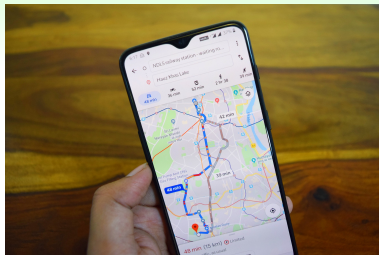
skill $\approx$ artificial intelligence



Photos Licensed under CC BY 2.0 from Andrea Goh on Flickr

ML not the only tools, but
a **popular family of tools**

Bigger Data Enable Easier-to-use AI



By deepanker70 on <https://pixabay.com/>

past

best route by
shortest path

present

best route by
current traffic

future

best route by
predicted travel time

big data **can** make machine look smarter

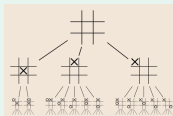
Good AI Needs Both ML and Non-ML Techniques



(Public Domain, from Wikipedia; used here for education purpose; all other rights still belong to Google DeepMind)

Non-ML Techniques

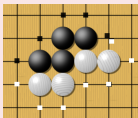
Monte C. Tree Search
 $\approx$ **move simulation** in
brain



(CC-BY-SA 3.0 by Stannered on
Wikipedia)

ML Techniques

Deep Learning
 $\approx$ **board analysis** in
human brain



(CC-BY-SA 2.0 by Frej Bjøn on
Wikipedia)

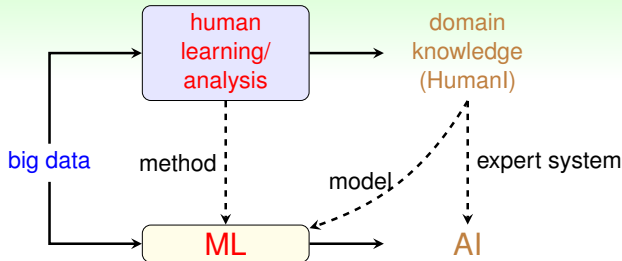
Reinforcement Learn.
 $\approx$ **(self)-practice** in
human training



(Public Domain, from Wikipedia)

good AI: important to use the **right**
techniques—ML **& others, including human**

Full Picture of ML for Modern AI



Human Learning

- subjective
- produce domain knowledge
- fast basic solution

Machine Learning

- objective
- leverage computing power
- continuous improvement

tip: **use humans as much as possible first**
before going to machines