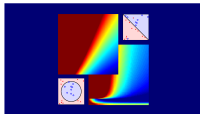


# Machine Learning Foundations

## (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;

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## 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

## Machine Learning Connects (Big) Data and AI

skill  $\approx$  artificial intelligence



ingredient



tools/steps



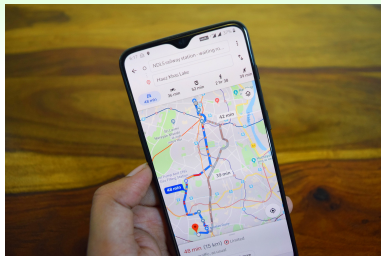
dish



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

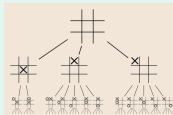
# Good AI Needs Both ML and Non-ML Techniques



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

## Non-ML Techniques

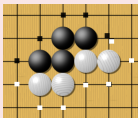
**Monte C. Tree Search**  
 $\approx$  **move simulation** in brain



(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 Bjon on  
 Wikipedia)

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

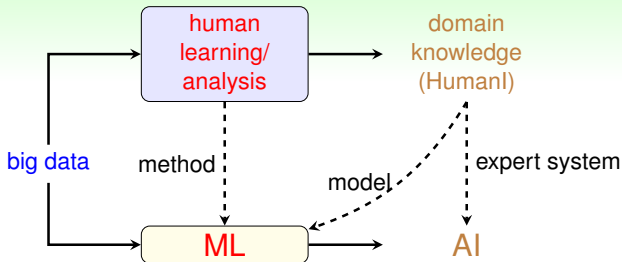


(Public Domain, from Wikipedia)

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