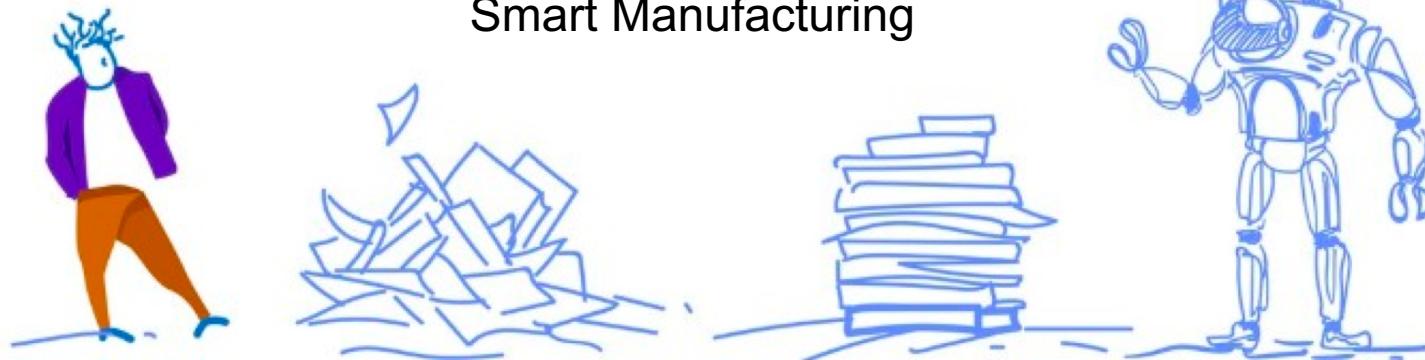




Digital Transformation & Artificial Intelligence

Yet Another Application for
Smart Manufacturing



Dr. Squall Wu
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Dr. Chun-Yi (Squall) Wu

- Massachusetts Institute of Technology
 - Smart Manufacturing Program 2019
- Taiwan AI Academy, Hsinchu 2018
- Glass Manufacturing Industry
 - Image Classification, Text Mining, Deep Learning
- IBM Research Almaden 2017
 - Nature Language Processing (SystemT)
- System Integration Company
 - Feature Engineering, Predictive Maintenance, Industry 4.0
- Intellectual Property Service
 - Patent Map (Visualization) & Patent Quality (PCA, BPANN)
- NTHU IEEM
 - Neural Network, Clustering Algorithm, Genetic Algorithm, etc.



What is Digital Transformation?

Mechanism
Robot

It's a
Fan!

Quality
Computer
Vision

It's a
Spear!

Measurement
Sensors

It's
a
Rope!

Data Scientist
Machine
Learning

It's
a Snake!

Control
PLC

IT
Cyber Security

It's a
Tree!

The Technology of Digital Transformation



Sensors



3D printing



Cloud computing



Software as a service



The Internet of Things



Robotics



AI and machine learning



Data analytics

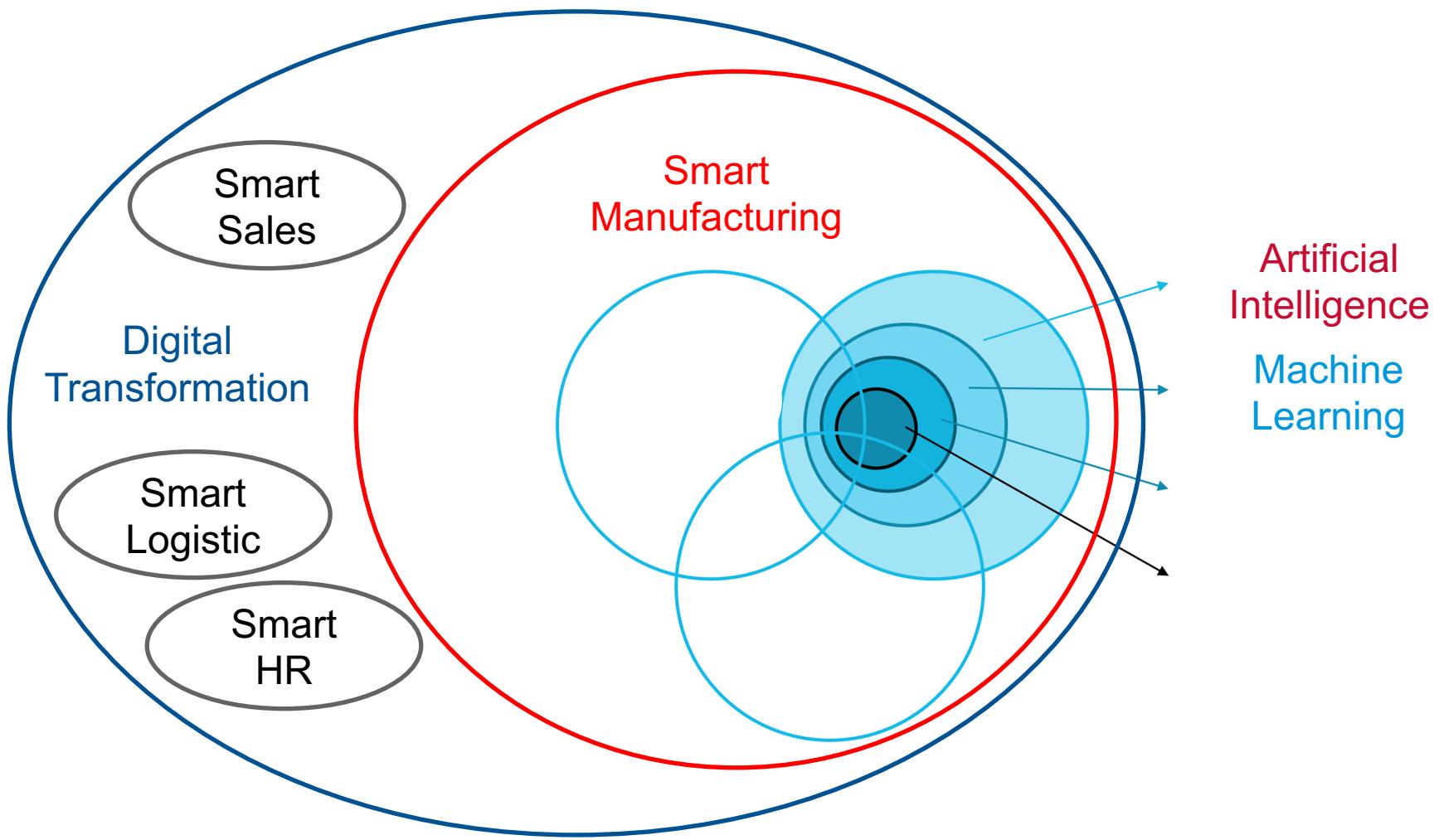


Big data

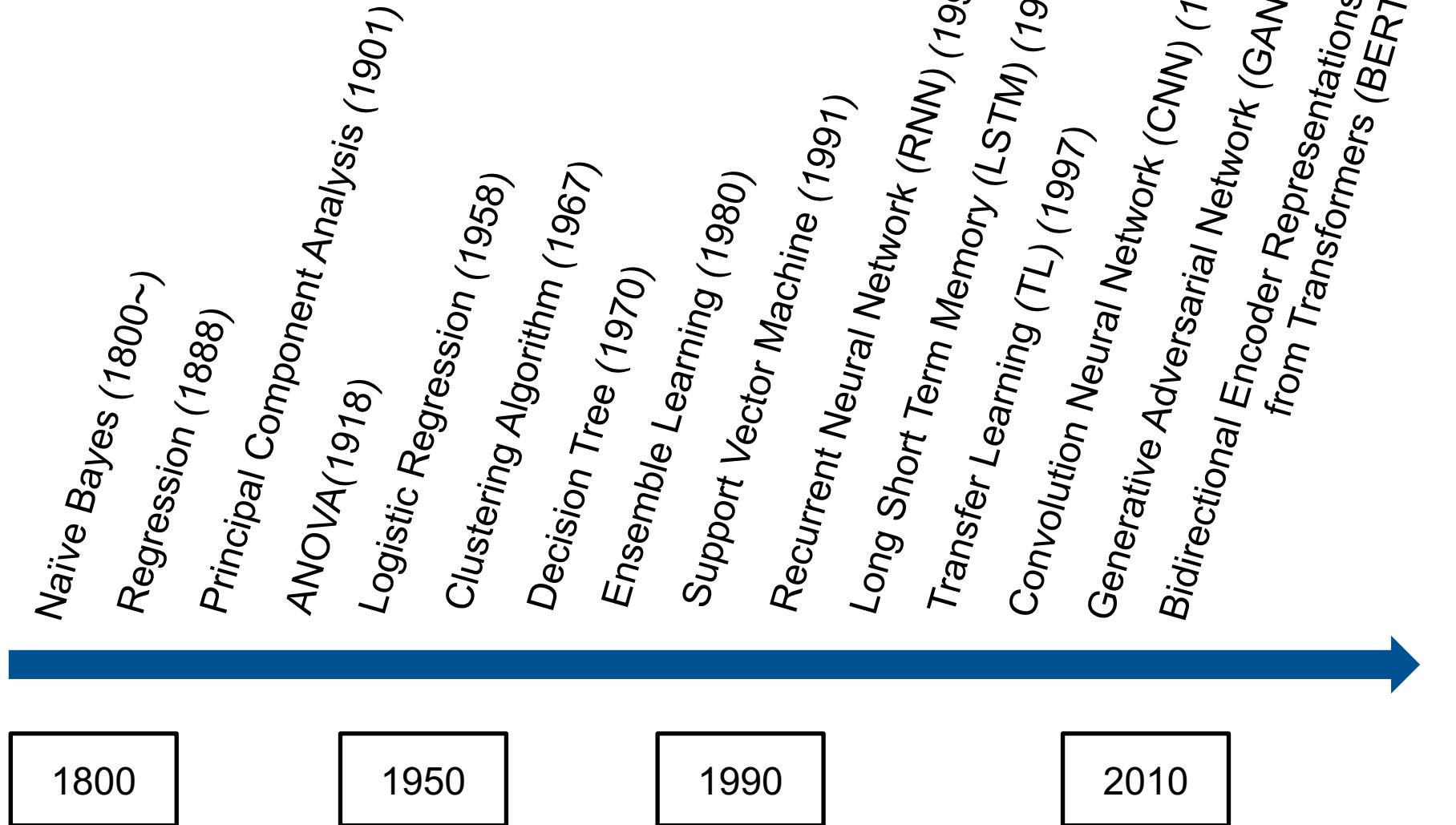


Algorithms

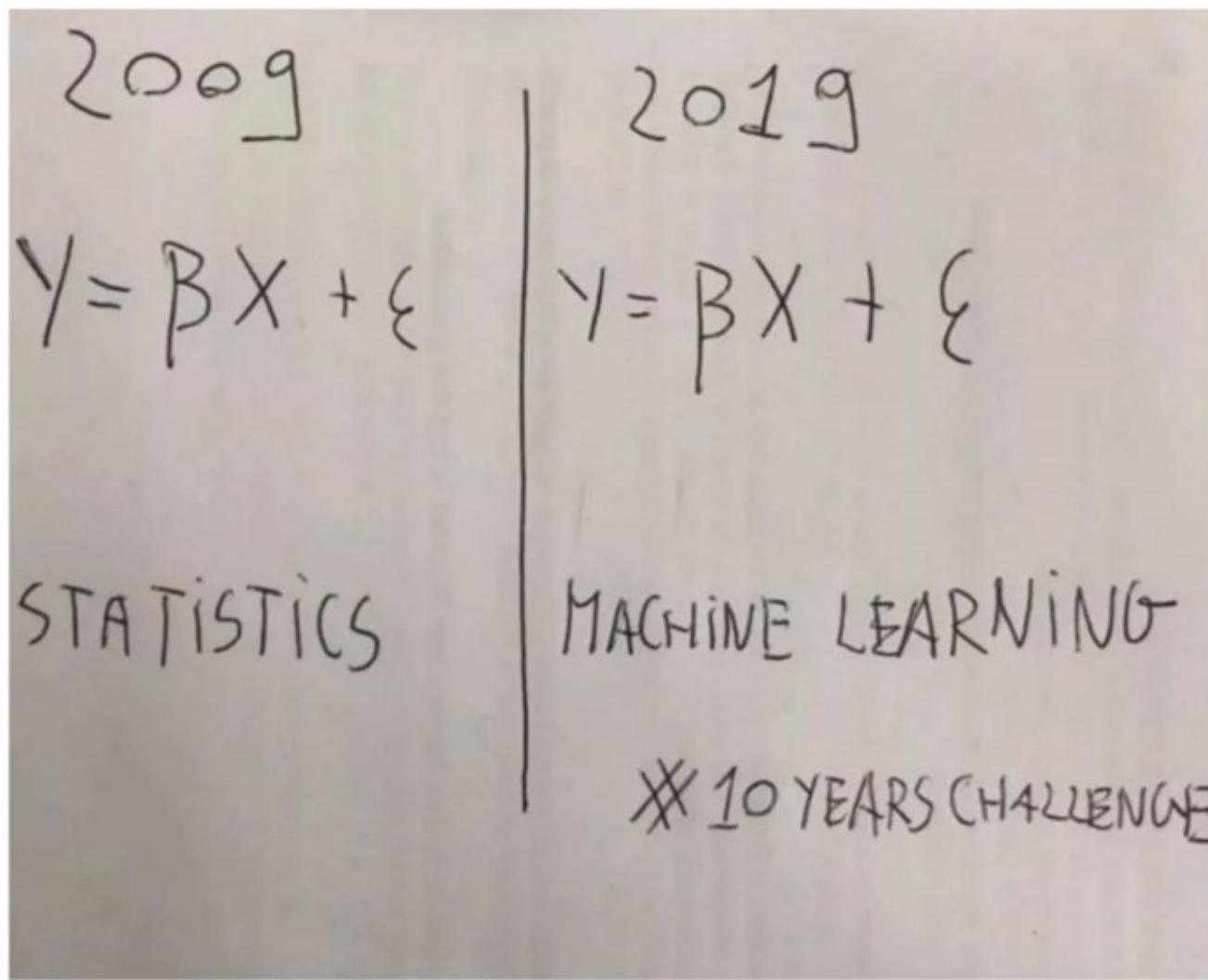
The ecosystem of Digital Transformation



相關技術演進

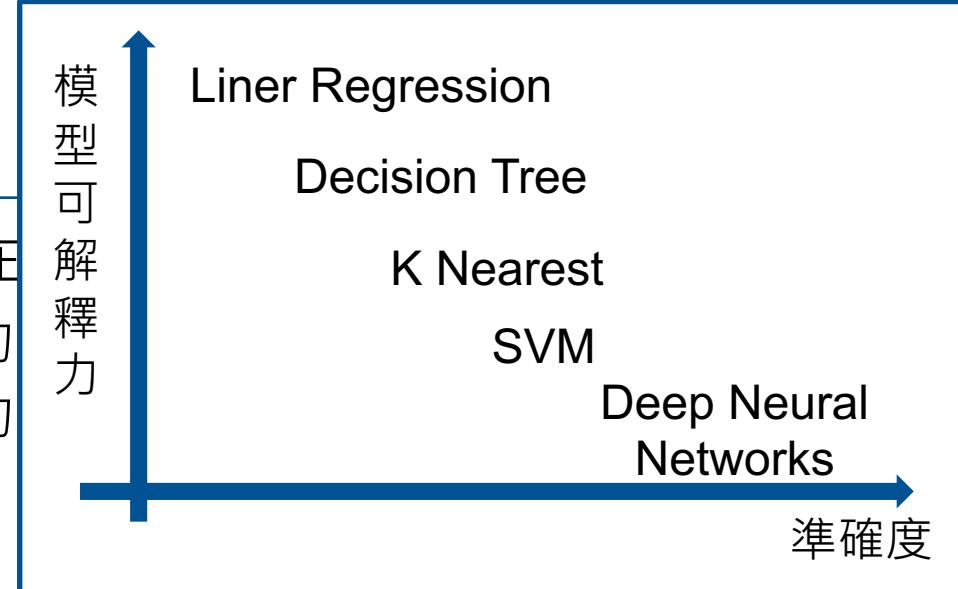


Statistic & Machine Learning



Machine Learning & Statistic

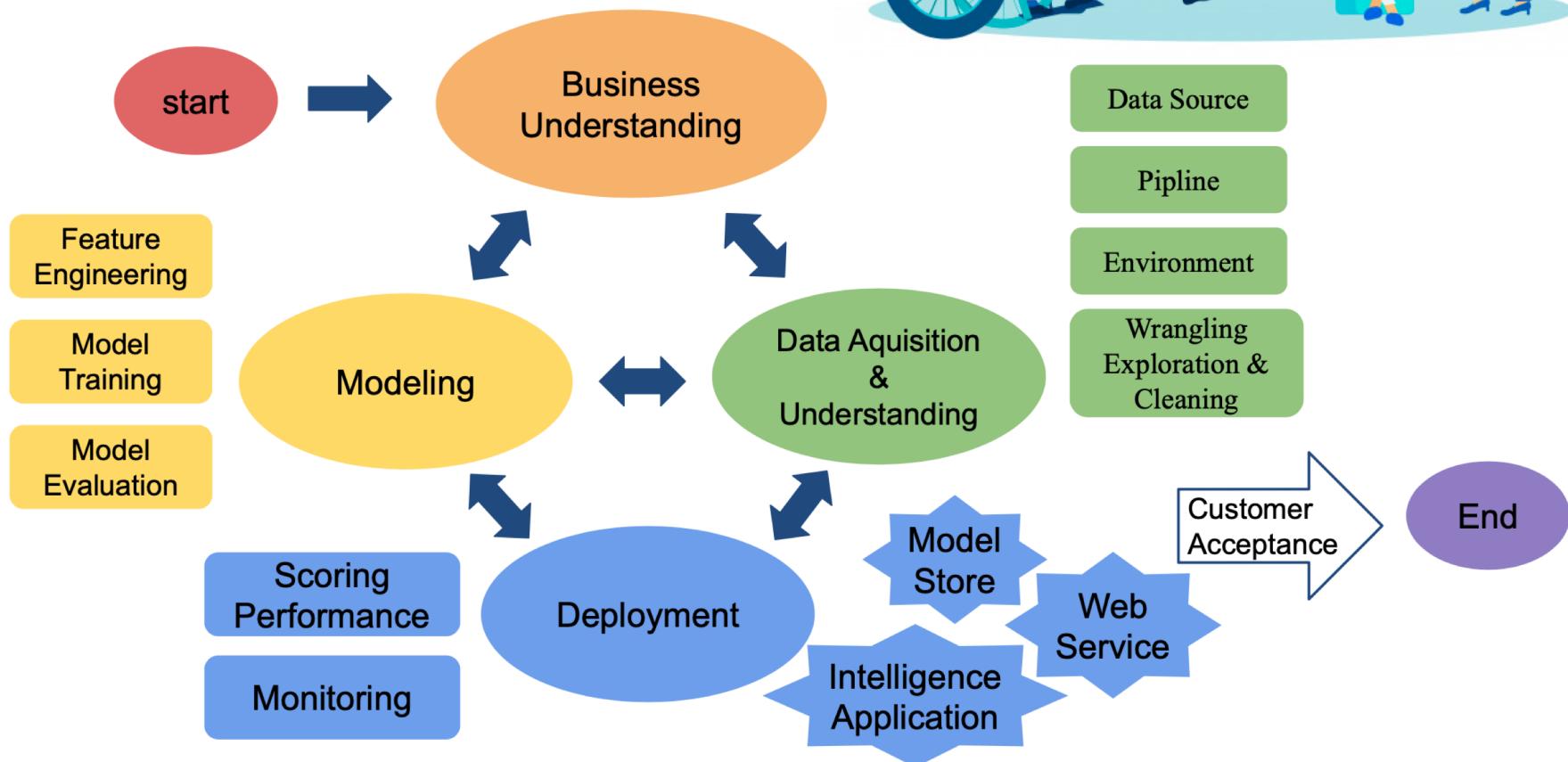
- 機器學習和統計的主要區別在
 - 機器學習模型旨在使最準確的
 - 統計模型是為推斷變數之間的
- 統計和統計建模是不一樣的
 - 統計是對數據的數學研究。除非有數據，否則無法進行統計。
 - 統計模型是數據的模型，主要用於推斷數據中不同內容的關係，或建立能夠預測未來值的模型(Regression)。
- 機器學習通常會**犧牲可解釋性**以獲得強大的預測能力。
 - 從線性迴歸到神經網絡，儘管解釋性變差，但是預測能力卻大幅提高。
 - 機器學習的**理論**來源於數學和統計學
 - 機器學習**演算法**基於優化理論(Self Learning)、矩陣代數和微積分
 - 機器學習的**實現**來源於電腦科學和工程學概念，比如核映射、特徵散列等。
(e.g. kernel tricks, feature hashing)



一名數據科學家。

- 工作的主要內容是和感測器數據打交道。
- 如果試圖證明感測器能夠對某種刺激（如氣體濃度）做出反應，那麼將使用統計模型來確定信號響應是否具有統計顯著性。
- 嘗試理解這種關係，並測試其可重複性Repeatability，以便能夠準確地描述感測器的響應，並根據這些數據做出推斷。
- 還可能測試，響應是否是線性的？響應是否歸因於氣體濃度而不是感測器中的隨機雜訊等等。
- 機器學習演算法的評估使用測試集來驗證其準確性。然而，對於統計模型，透過信賴區間、顯著性檢驗和其他檢驗對迴歸參數進行分析，可以用來評估模型的合法性。

Data Analytics Lifecycle



旅遊推薦系統

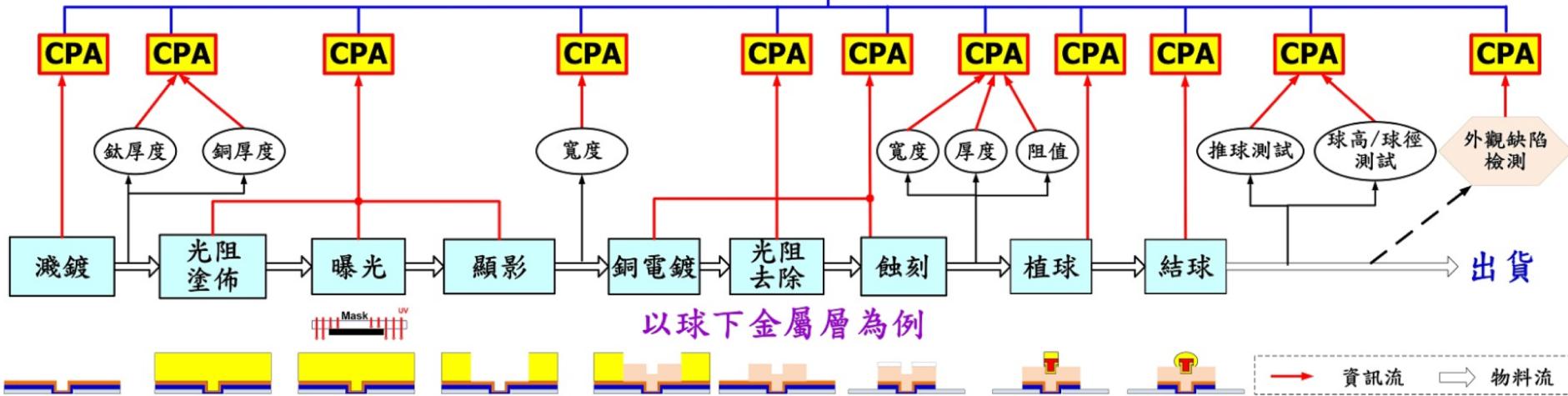


製造業流程

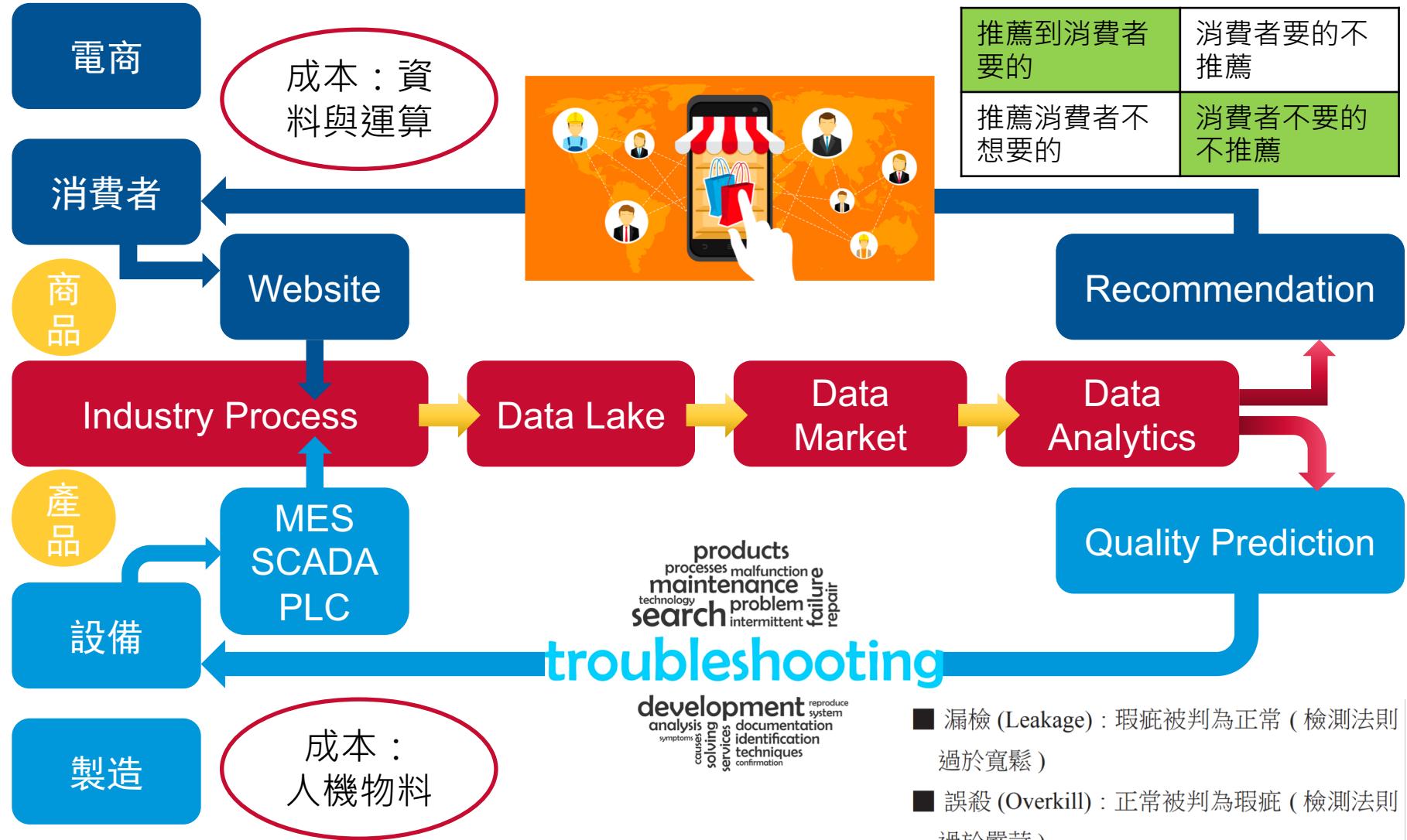
PLC, OPC Server, Sensor, etc.

Data Lake

CPA：虛實代理人(Cyber-Physical Agent)，即製造業所需之物聯網元件。



Industry Process is Important for Data Analytics



How to do AI application? Topic ! Team !!

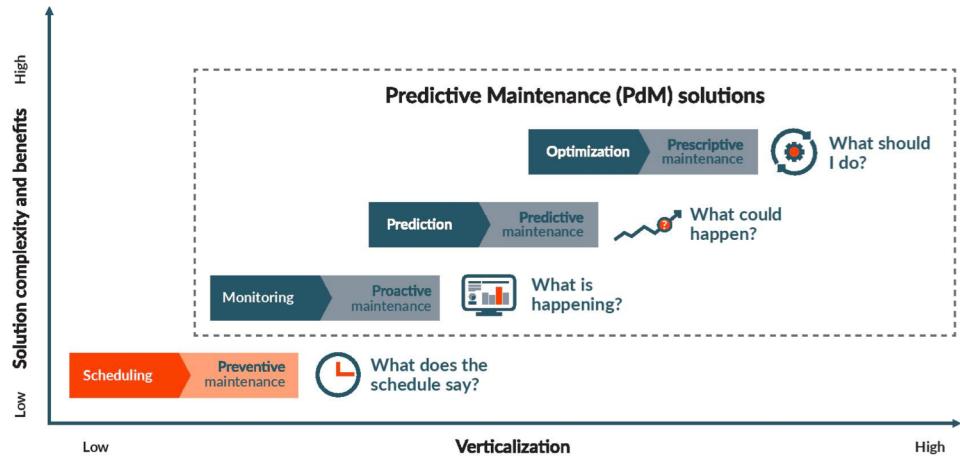
- 產業利用性
 - 再現性

Predictive Maintenance

- 技術新穎性
- 進步性

Machine Learning

Preventive to Prognosis



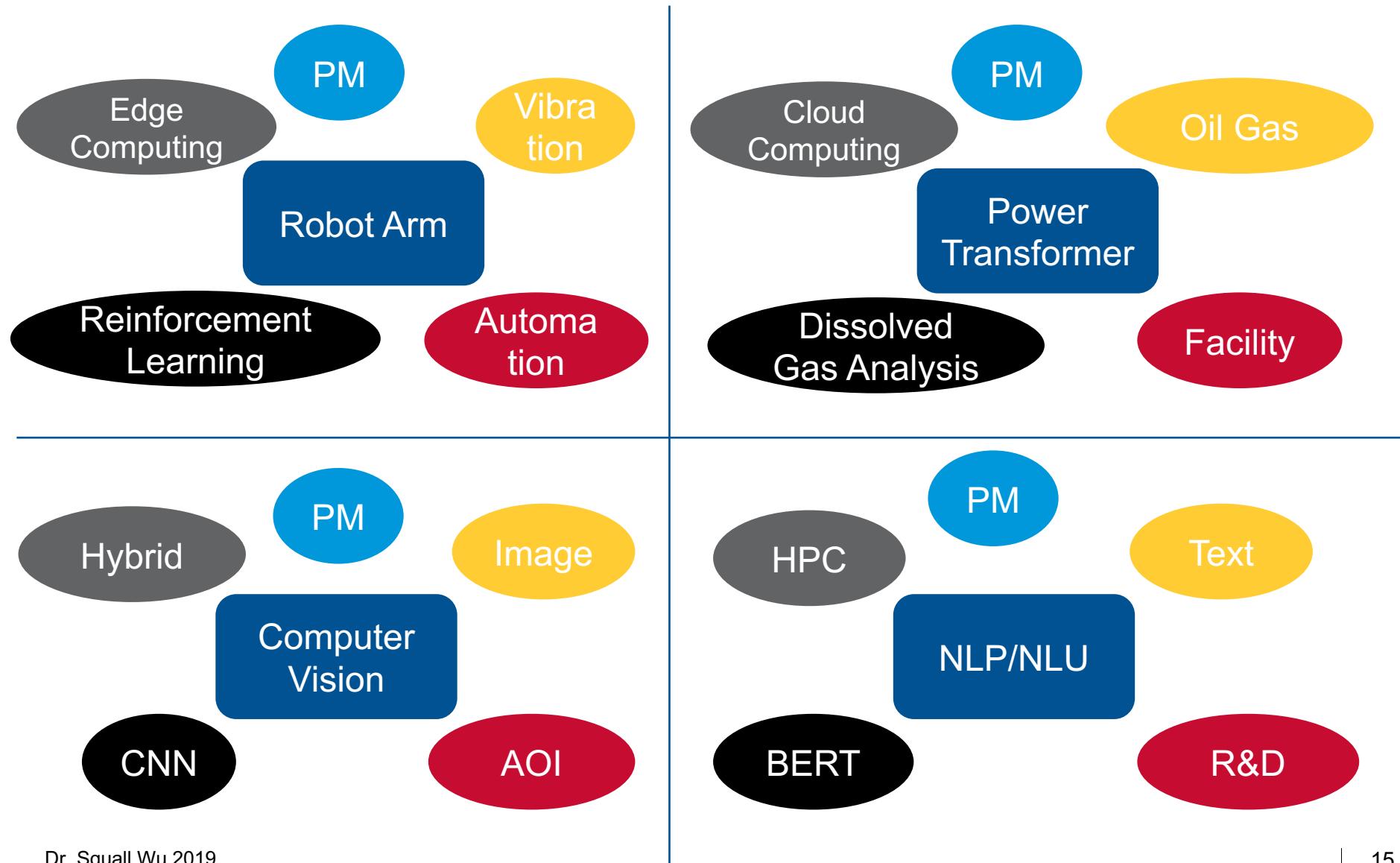
- AI Scientist

- Software engineer
- Data engineering
- Hardware
- Bridger
- Domain expert

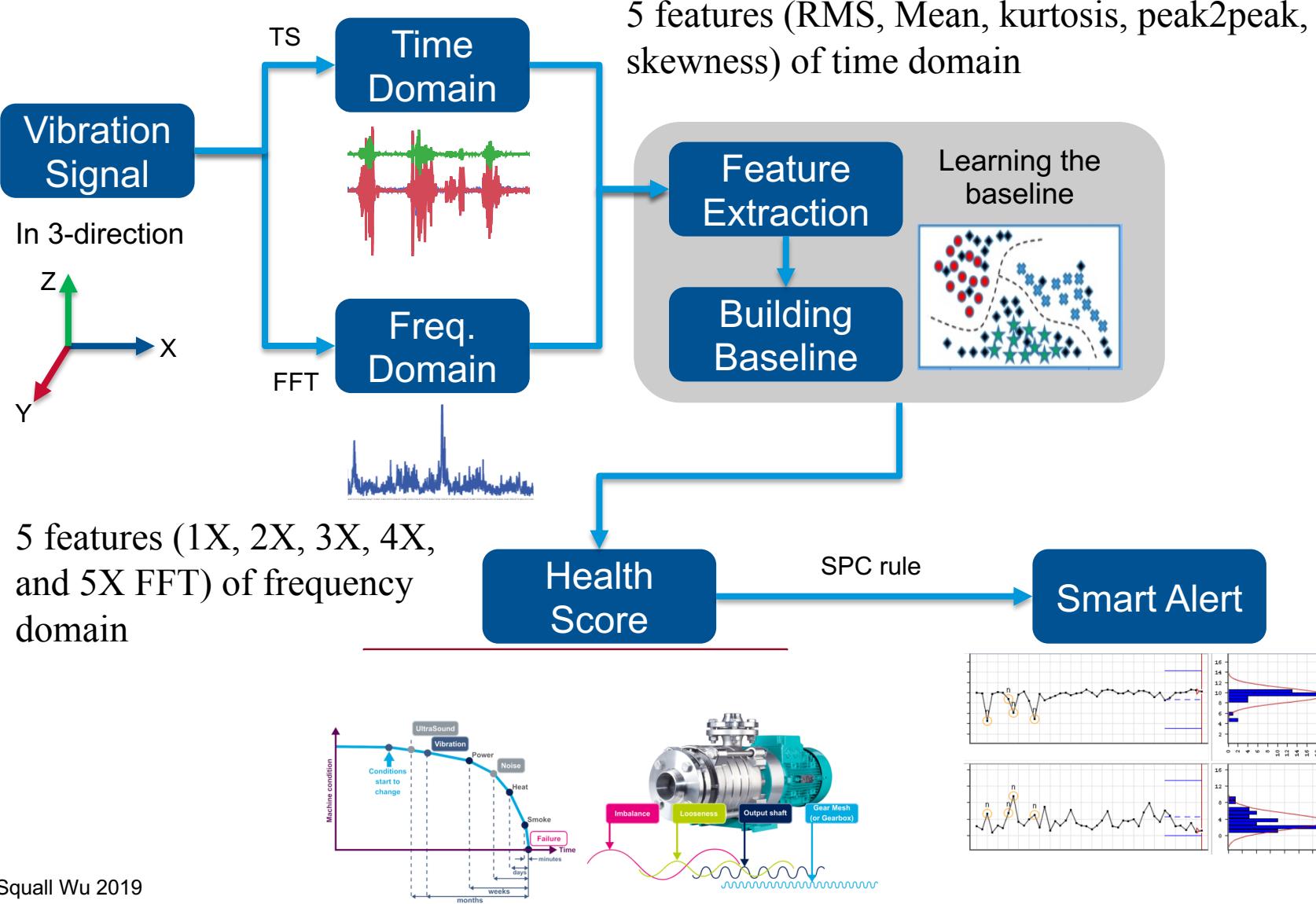


Project Manager
Data Source
Domain Expert
Data Analytics
Software & IT

How to build an AI solution team !!!

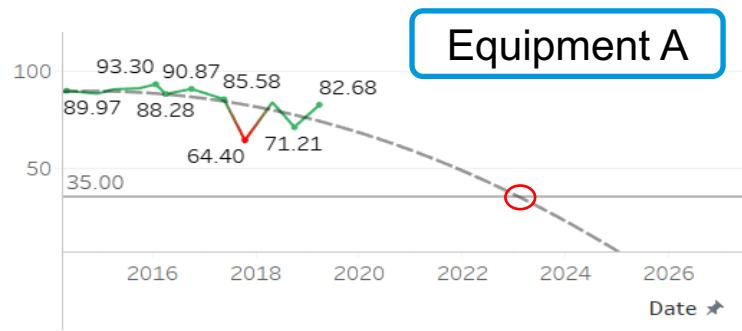


Data Analysis Processing

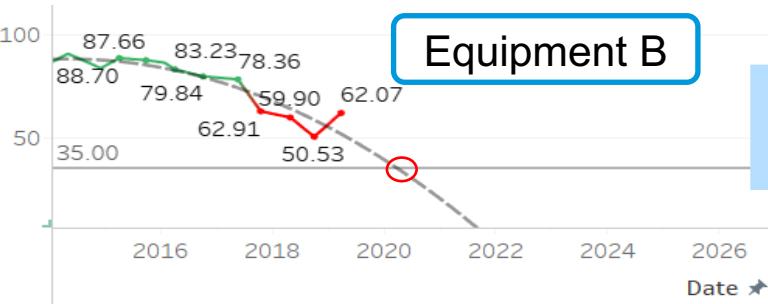


Using the health score and the model, the critical event can be predicted for predictive maintenance.

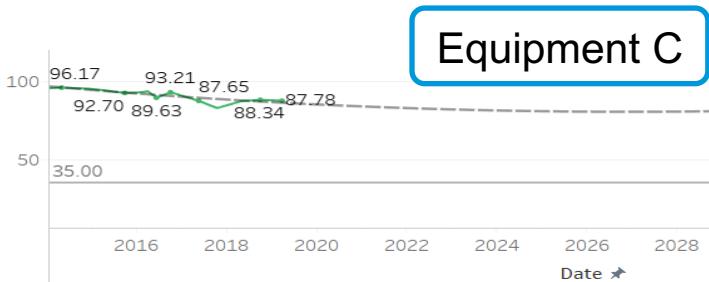
- The critical time of the **good** to **poor** status can be calculated and the result is able to provide decision support.



Health score will lower than 35 after 2023.



Should be maintained before 2021.



There will be no immediate problems in recent years.

Smart Manufacturing Suggestion

- A great tool in the wrong hands is a waste.



- Provide solution not just only data analytics
- From Auto Process to Auto Modeling
- Data Quality to Model Quality
 - Model evaluation : Overkill & Leakage
- Standard data preprocess tool
 - Such as : Text labeling

Key	Value
wikiPageID	4848272
Born	1946
Political party	Republican
Spouse	Melania Knauss
Parents	Fred Trump, Mary Anne MacLeod
Residence	White House

Named Entity Recognition

AI Patent Application



EPO：
人工智能與機器學習
專利審查指南已生效



圖片來源：Pixabay

Guidelines for Examination

Table of Contents - Guidelines for Examination

Part G – Patentability < >

Chapter II – Inventions < >

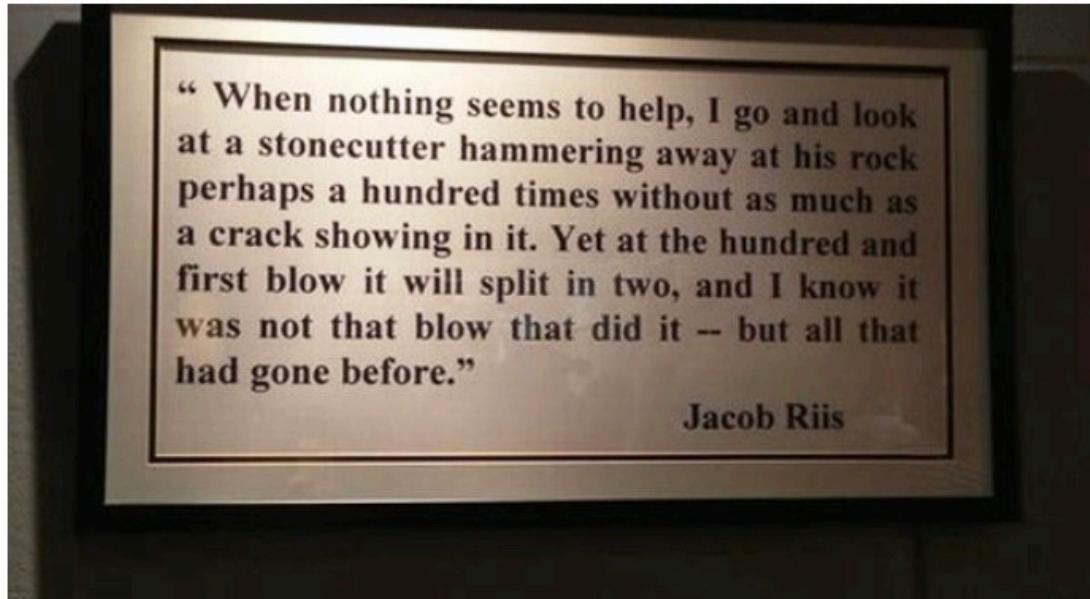
3. List of exclusions < >

3.3 Mathematical methods < >

3.3.1 Artificial intelligence and machine learning >

- 人工智能和機器學習是根據計算模型和演算法來進行分類、聚類、回歸和降維等進行操作，例如神經網絡，遺傳演算法，支援向量機， k 均值，核回歸和判別分析。這些計算模型和演算法本身俱有抽象的數學性質，而不管它們是否可以基於訓練數據“訓練”。
- 反之，AI或機器學習之專利申請案，倘若能界定出利用該AI或機器學習技術所能實現之特定技術目的(或所能解決之技術課題)，或者倘若能界定出該AI技術所應用之特定技術領域，即可通過技術性特徵之審查。

Digital Transformation & Artificial Intelligence



「當一切努力看似無用，我會去看石匠敲打石頭。可能敲了一百下，石頭上連一條裂縫都沒有，但就在第一百零一下，石頭斷裂為兩半。然後我了解到，把石頭劈成兩半的不是最後那一下，而是先前的每一次敲擊。」

