

Introduction of AI in Medicine

人工智慧之醫療應用簡介

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Introduction of AI

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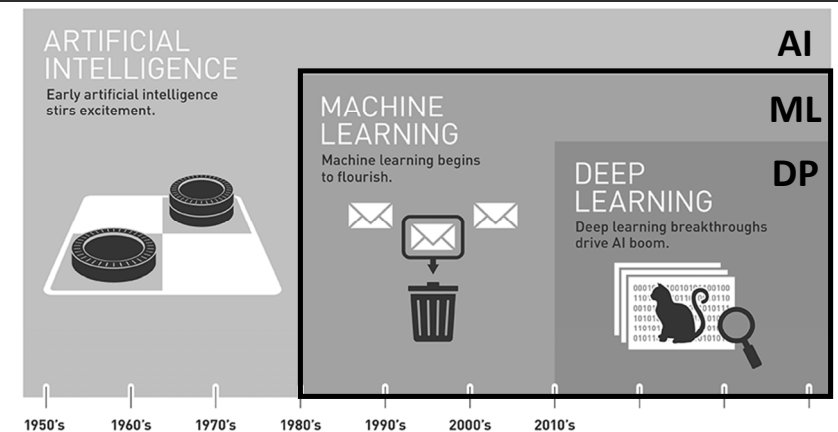
Outline

- Introduction of AI
- Applications of AI in Medicine
- Conclusions & Perspectives

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A.I. and M.L.



Chia-Feng Lu, alvin4016@nycu.edu.tw <https://www.datasciencecentral.com/profiles/blogs/artificial-intelligence-vs-machine-learning-vs-deep-learning>

ML in your daily life...



<http://image-net.org>



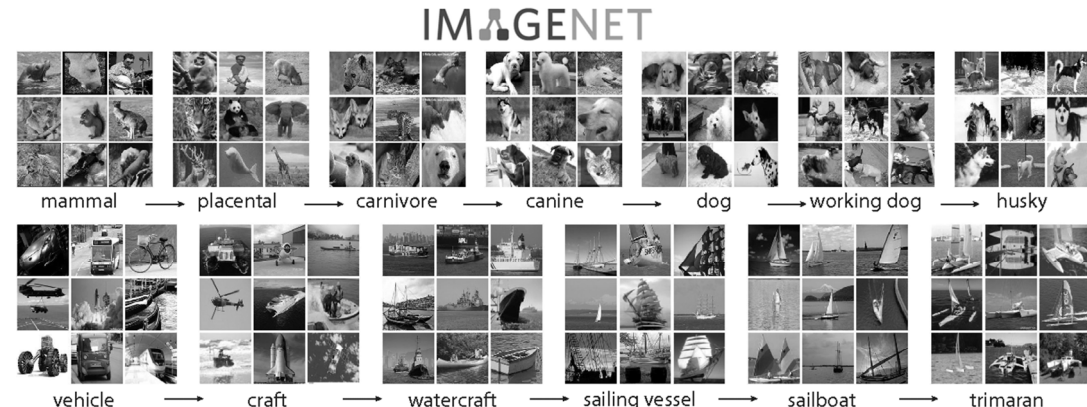
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ML in your daily life...



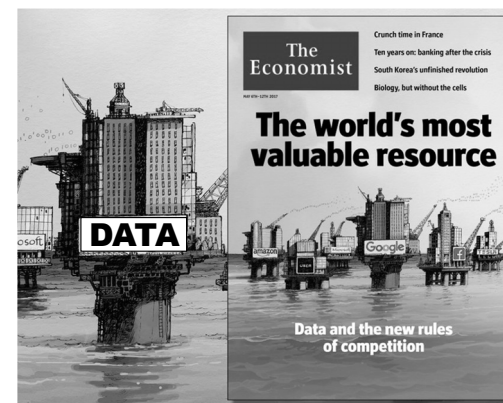
IMAGENET database, 21841 synsets



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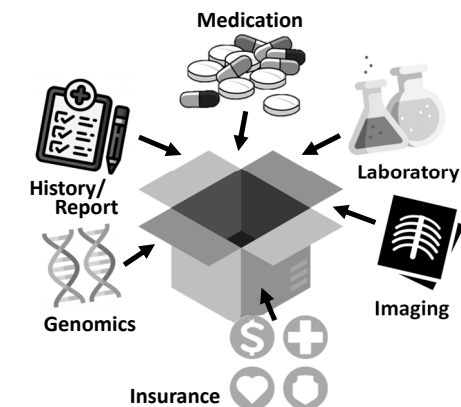
Information/Data Explosion



The Economist, May 2017.

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DIGITAL ERA of HEALTHCARE

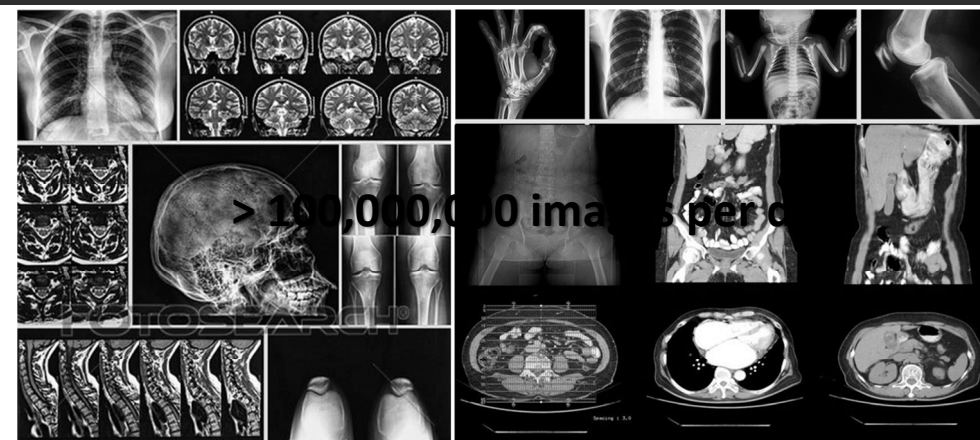


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FDA Speeds Up Artificial Intelligence Approvals January 2019

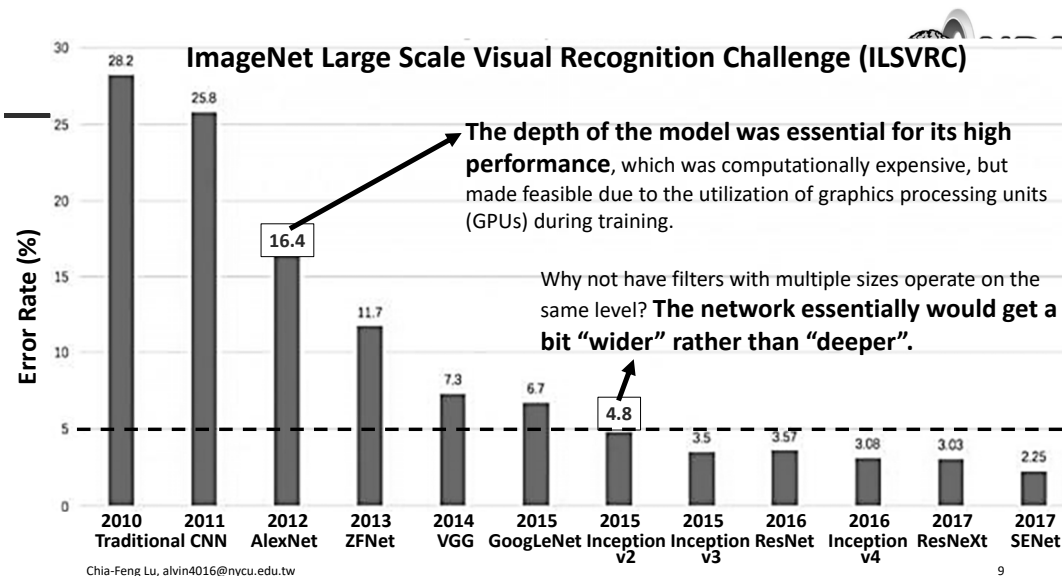
Company	FDA Approval	Indication
Apple	September 2018	Atrial fibrillation detection
Aidoc	August 2018	CT brain bleed diagnosis
iCAD	August 2018	Breast density via mammography
Zebra Medical	July 2018	Coronary calcium scoring
Bay Labs	June 2018	Echocardiogram EF determination
Neural Analytics	May 2018	Device for paramedic stroke diagnosis
IDx	April 2018	Diabetic retinopathy diagnosis
Icometrix	April 2018	MRI brain interpretation
Imagen	March 2018	X-ray wrist fracture diagnosis
Viz.ai	February 2018	CT stroke diagnosis
Arterys	February 2018	Liver and lung cancer (MRI, CT) diagnosis
MaxQ-AI	January 2018	CT brain bleed diagnosis
Alivecor	November 2017	Atrial fibrillation detection via Apple Watch
Arterys	January 2017	MRI heart interpretation

Digital Medical Images



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ContaCT / Viz LVO



Sends notifications to a neurovascular specialist that a suspected large vessel occlusion

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ECG App



Determine the presence of atrial fibrillation (AF) or sinus rhythm (SR) on a classifiable waveform.

IDX-DR



Automatically detect more than mild diabetic retinopathy in adults diagnosed with diabetes.

OsteoDetect



Analyze wrist radiographs using machine learning to identify and highlight distal radius fractures.

Applications of AI in Medicine

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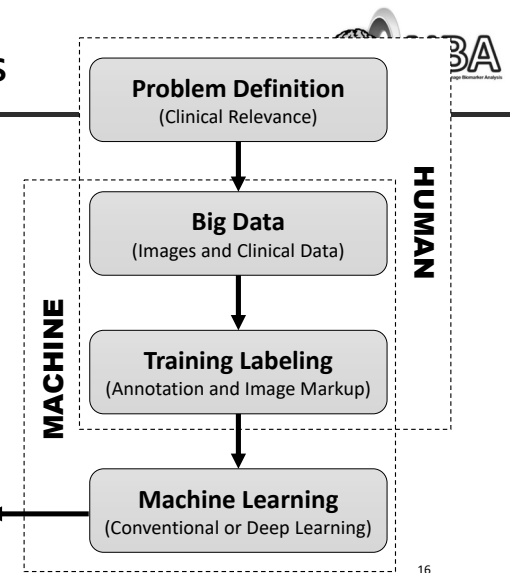
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Elements and Applications

- 影像/資料擷取 Data acquisition
- 病灶偵測 Lesion detection
- 鑑別診斷 Differential diagnosis
- 疾病分級 Disease grading
- 居家醫療 Home-based healthcare
- 基因預測 Genotypes prediction
- 預後預測 Prognosis prediction

Benefit the Clinical Diagnosis & Treatment

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Applications of AI in Medicine



Fields	Application Purpose	Descriptions
Medical Imaging (Radiology)	Detection & segmentation	Identifies tumors, stroke, fractures; auto-segments organs on CT/MRI/X-ray.
Cardiology	Imaging & rhythm analysis	Automates echo measurements, detects arrhythmias, predicts cardiac risk.
Neurology	Brain disease detection	Detects stroke/ICH, quantifies atrophy, supports emergency triage.
Pathology	Cancer screening	Classifies histology slides and grades tumors with high accuracy.
Clinical Decision Support	Prediction & automation	Predicts outcomes, summarizes charts, assists diagnostic decisions.

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Benjamens et al. NPJ digital medicine. 2020, 3(1):1-8. 18

Three Phases of Scaling AI in Healthcare



- To address the routine, repetitive, and largely administrative tasks.
- AI based on imaging in radiology, pathology, and ophthalmology.

- To support the shift from hospital-based to home-based care.
- Remote monitoring, AI-powered alerting systems or virtual assistants, as patients take increasing ownership of their care.

- To improve clinical decision-support tools based on evidence from clinical trials.
- AI as an integral part of the healthcare value chain.

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Transforming healthcare with AI, March 2020, McKinsey & Company.

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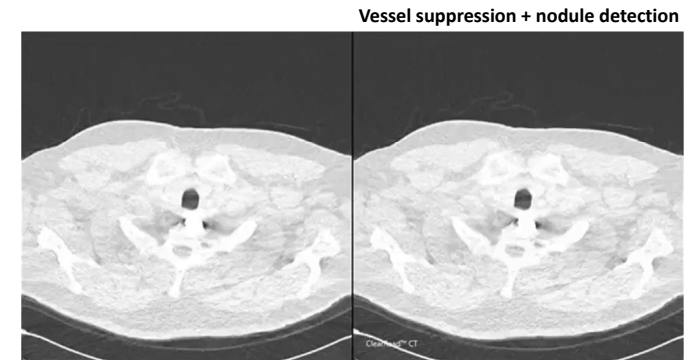
Lesion detection – Chest Images



Riverain
TECHNOLOGIES



ClearRead CT is Riverain's transformative, concurrent read AI product built off of the patent pending ClearRead CT | Vessel Suppress software. ClearRead CT provides a vessel suppressed CT series while automatically detecting and measuring critical properties of solid, sub-solid and ground glass nodules.



FDA approved for nodule detection, 2016

<https://youtu.be/e4KUmpUUIHg>

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Real-time Multi-Person 2D Pose Estimation Using Part Affinity Fields

Zhe Cao, Tomas Simon, Shih-En Wei, Yaser Sheikh
Carnegie Mellon University

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Real-time Multi-Person 2D Pose Estimation Using Part Affinity Fields

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動作偵測、居家復健
評量、球員動作分析



<https://www.youtube.com/watch?v=pW6nZXeWIGM>

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Time Is Brain

Human nervous tissue is rapidly lost as emergent evaluation and therapy are required.

Non-urgent

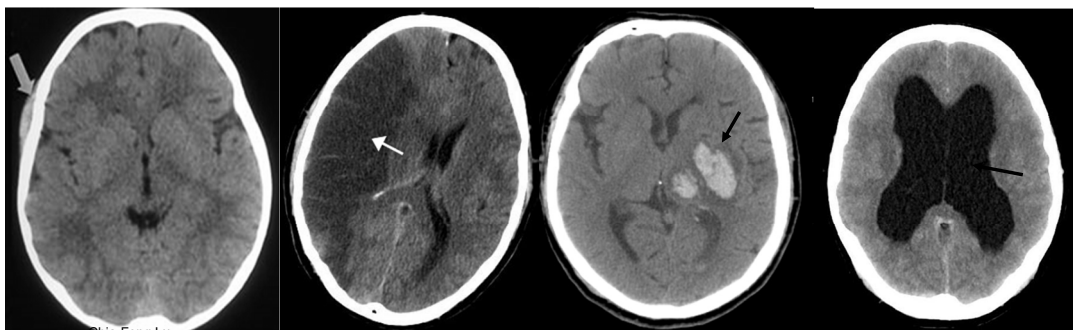
hematoma

stroke

Urgent

hemorrhage

hydrocephalus



Chia-Feng Lu, <https://www.nature.com/articles/1337-1341>

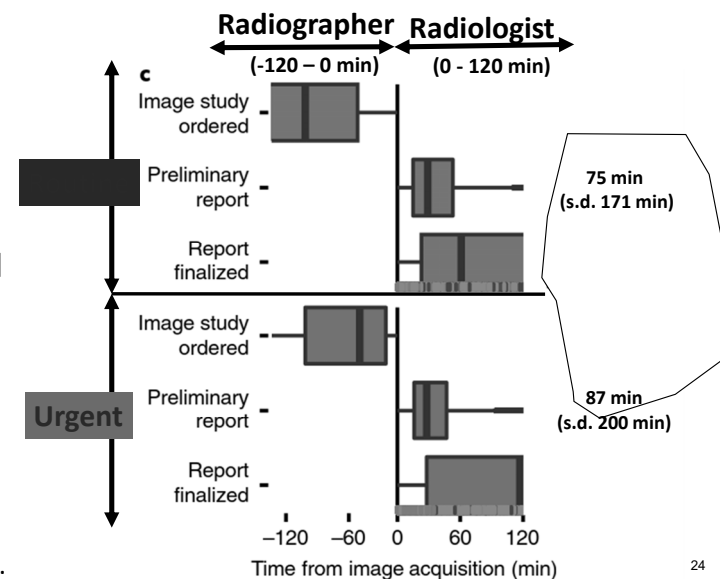
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Current CT Head Workflow

Mount Sinai Hospital
(96303 reports)

Order priority Image order to interpretation latency
 Routine <45 min
 Urgent 45 min-4 h
 >4 h

Nat Med. 2018 Sep;24(9):1337-1341.



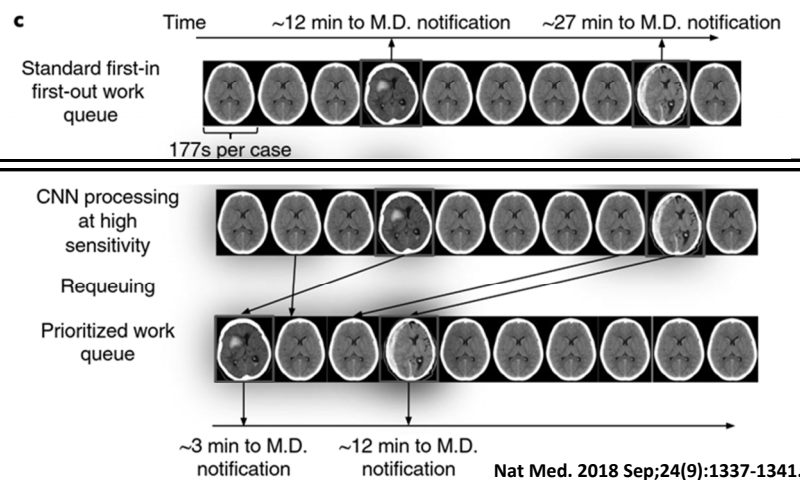
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Differential Diagnosis – Emergency



Routine

DL Prioritization



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SPECIAL REPORT | AI IN MEDICINE

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Benefits, Limits, and Risks of GPT-4 as an AI Chatbot for Medicine

Authors: Peter Lee, Ph.D. ¹, Sebastien Bubeck, Ph.D., and Joseph Petro, M.S., M.Eng. Author Info & Affiliations

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The uses of artificial intelligence (AI) in medicine have been growing in many areas, including in the analysis of medical images,¹ the detection of drug interactions,² the identification of high-risk patients,³ and the coding of medical notes.⁴ Several such uses of AI are the topics of the “AI in Medicine” review article series that debuts in this issue of the *Journal*. Here we describe another type of AI, the medical AI chatbot.



Conclusions & Perspectives

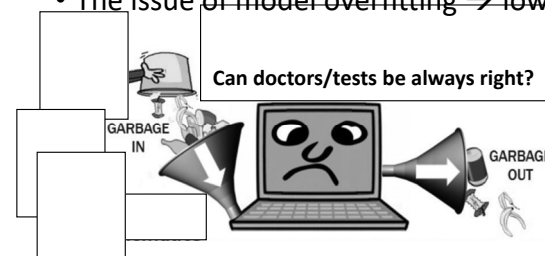
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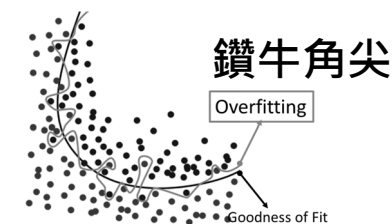
Challenges of ML/DL



- Identification of Key question → requirement of domain knowledge
- Sufficient and diverse dataset → multi-center/international collaboration
- The correctness of data annotation → garbage in garbage out.
- The issue of model overfitting → low generalization.



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How IBM Watson Overpromised and Underdelivered on AI Health Care

2 Apr 2019 | 15:00 GMT

After its triumph on *Jeopardy!*, IBM's AI seemed poised to revolutionize medicine. Doctors are still waiting



Headquarter of IBM Watson in Manhattan

2015 年 4 月，IBM 成立了獨立的 Watson Health 部門；到 2016 年，Watson 大約花費了 40 億美元（約新台幣 1200 億元）收購了 4 家醫療數據公司，包括 Explorys、Phytel 和 Merge Healthcare。醫療這塊大蛋糕似乎是人工智慧時代，IBM 亟待轉型的一步大棋。

而僅僅成立三年後，這一昔日的明星部門就被傳出裁員 50% 至 70%，一場「AI+ 醫療的泡沫破滅」，引起了整個產業的一片嘩然。

Only 5/50 partnerships successfully produced applications.

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Uncertainty
為未來而學，
順應潮流積累能力

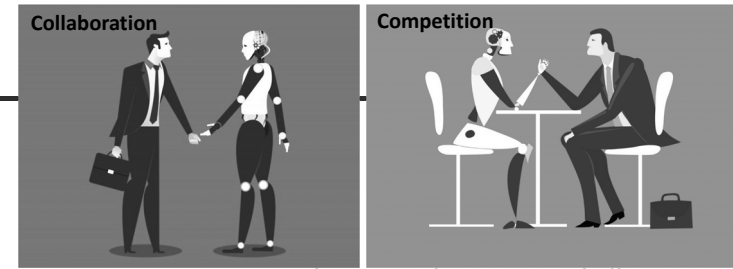
LOSER
後知後覺

WINNER
先發制人

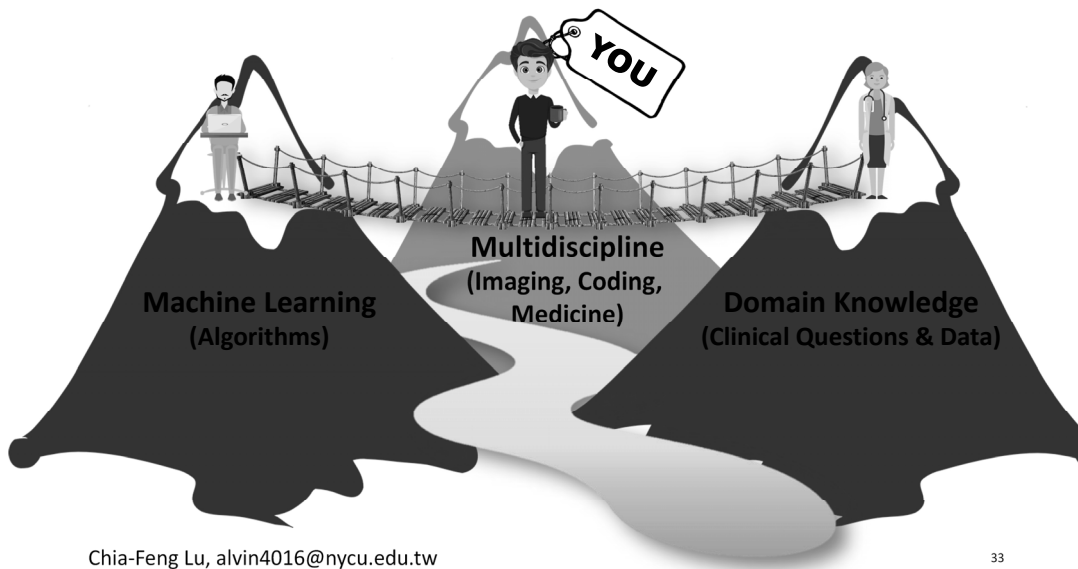
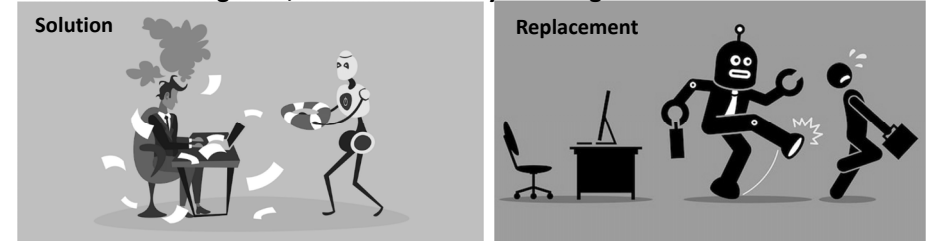


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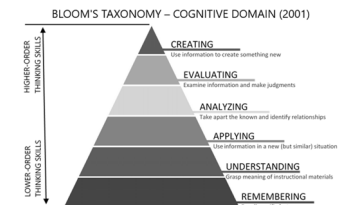
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Together, We Solve Century Challenges.



"**Thinkers** with AI capabilities will dominate those who use AI without **critical thinking** skills, while those who resist AI will be left behind."



**AI is learning all the time,
how about you?**

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