

Introduction of AI in Medicine

人工智慧之醫療應用簡介

盧家鋒 Chia-Feng Lu, Ph.D.

Professor,
Department of Biomedical Imaging and Radiological Sciences,
National Yang Ming Chiao Tung University
alvin4016@nycu.edu.tw

Chia-Feng Lu, alvin4016@nycu.edu.tw

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Outline

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

Introduction of AI

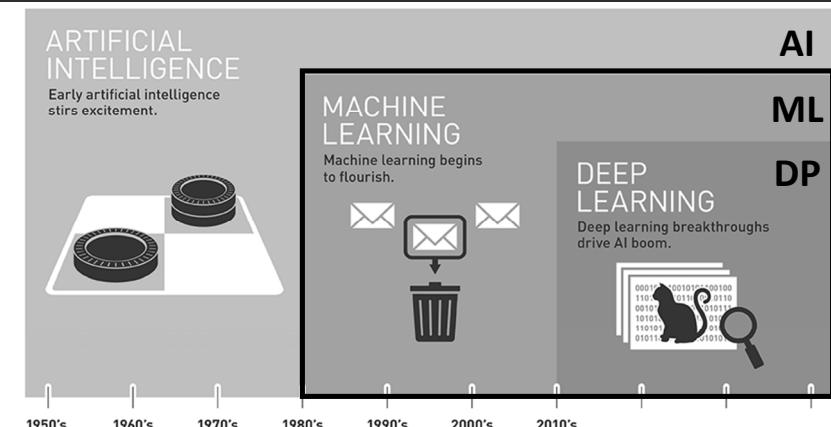
Chia-Feng Lu, alvin4016@nycu.edu.tw

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Chia-Feng Lu, alvin4016@nycu.edu.tw

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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...

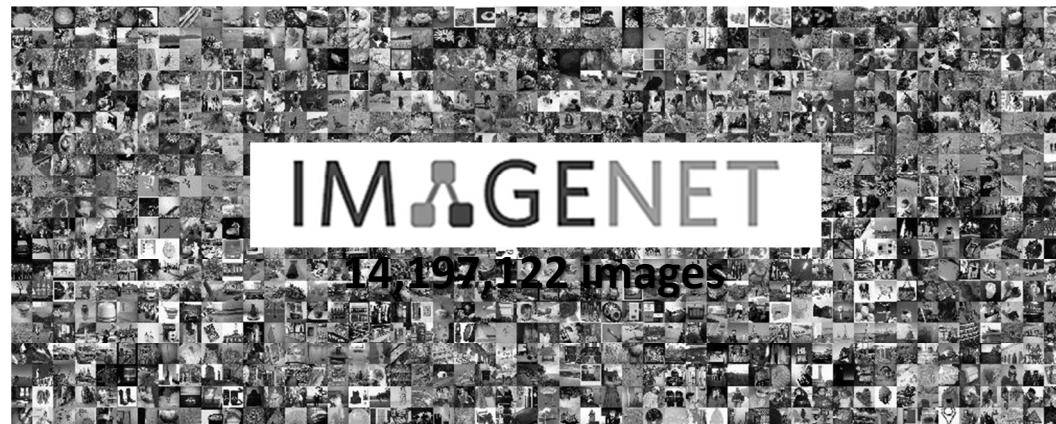
Top left: A photo editing interface showing a portrait of a man with a grid overlay and various crop and filter options.

Top right: A search interface for 'the deep le' showing results like 'the deep learning book' and 'the deep learning revolution'.

Bottom left: A dark-themed interface with a sidebar showing '即时通訊記錄' (Instant messaging history) and '垃圾郵件' (Spam) with 9 notifications.

Bottom center: A dark-themed interface with a search bar '我可以為你做什麼?' (What can I do for you?) and a message input field '傳訊息給 ChatGPT'.

<http://image-net.org>



Chia-Feng Lu, alvin4016@nycu.edu.tw

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ML in your daily life...

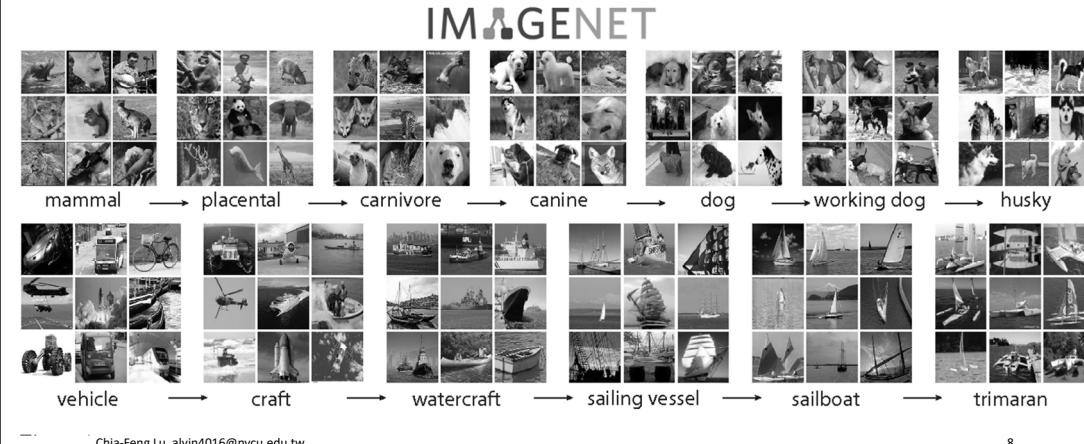
Top right: A search interface for 'ChatGPT' showing a query for '韓國首爾四天三夜的精選行程建議' (Korean Seoul 4 days 3 nights recommended itinerary).

Bottom right: A screenshot of a research paper abstract titled 'KR 首爾 4 天 3 夜行' (KR Seoul 4 days 3 nights trip) with a speaker icon indicating it's a recorded presentation.

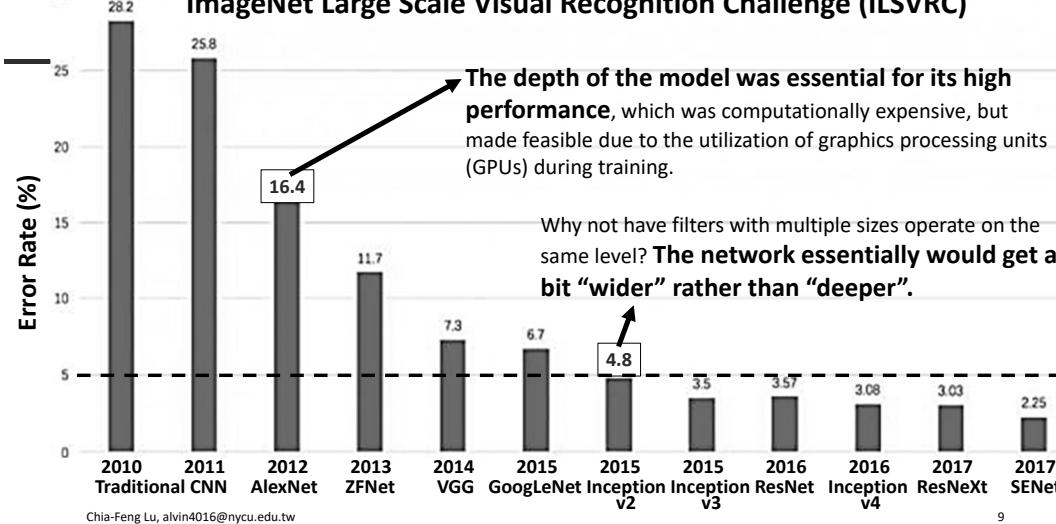
Bottom right: A collage of logos for AI models: GAMMA, NotebookLM, Gemini, Suno, and SORA 2 BY OPENAI.

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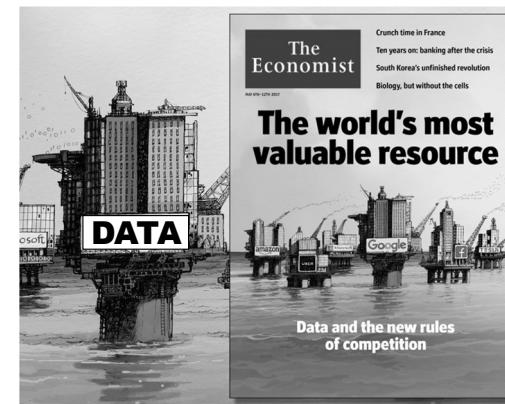
IMAGENET database, 21841 synsets



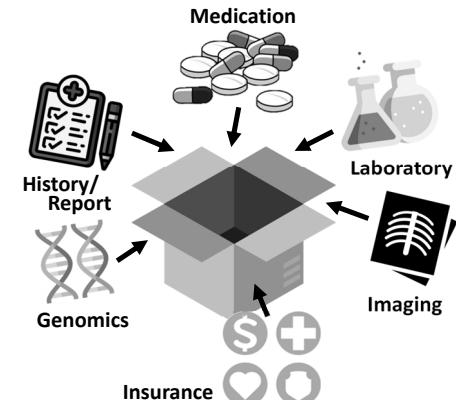
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Information/Data Explosion



DIGITAL ERA of HEALTHCARE

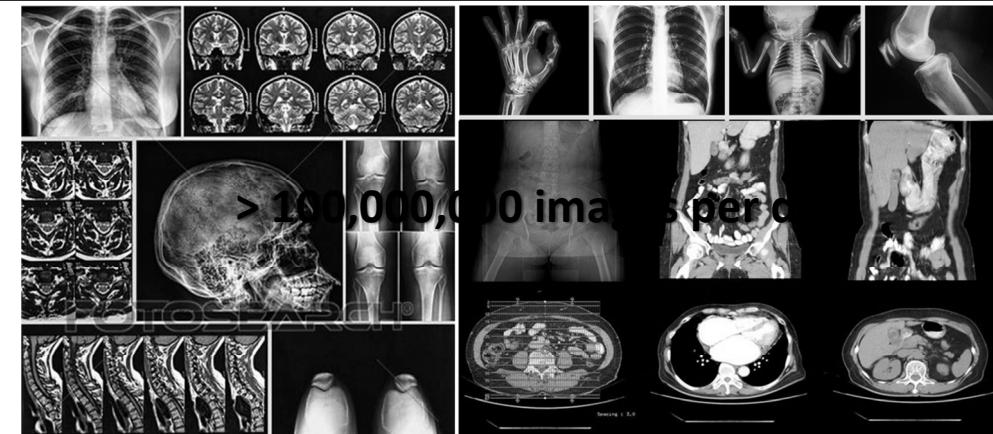


FDA Speeds Up Artificial Intelligence Approvals January 2019



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



Chia-Feng Lu, alvin4016@nycu.edu.tw

ContaCT / Viz LVO



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

Chia-Feng Lu, alvin4016@nycu.edu.tw

ECG App



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

Chia-Feng Lu, alvin4016@nycu.edu.tw

IDX-DR



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

Chia-Feng Lu, alvin4016@nycu.edu.tw

OsteoDetect



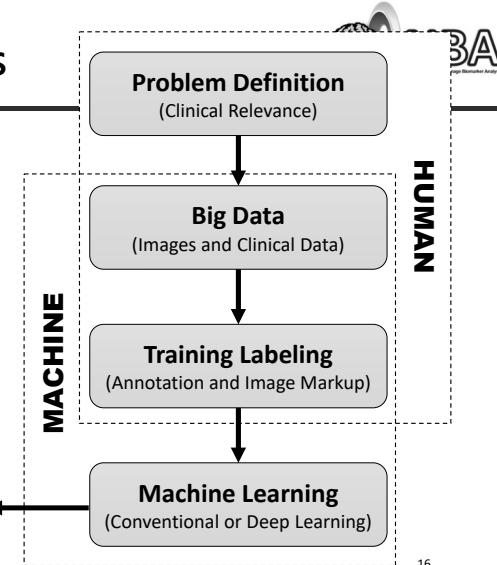
Analyze wrist radiographs using machine learning to identify and highlight distal radius fractures.

Chia-Feng Lu, alvin4016@nycu.edu.tw

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

Chia-Feng Lu, alvin4016@nycu.edu.tw



NBA
NeuroImage Biomarker Analysis

HUMAN

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Applications of AI in Medicine

Chia-Feng Lu, alvin4016@nycu.edu.tw

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.

Chia-Feng Lu, alvin4016@nycu.edu.tw

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

Chia-Feng Lu, alvin4016@nycu.edu.tw

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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.

Chia-Feng Lu, alvin4016@nycu.edu.tw

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

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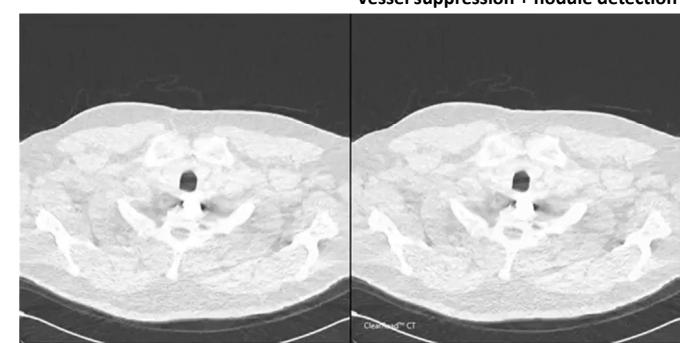
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Lesion detection – Chest Images

Riverain
TECHNOLOGIES

 **ClearRead CT**
Clinical AI

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>

Chia-Feng Lu, alvin4016@nycu.edu.tw

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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

Chia-Feng Lu, alvin4016@nycu.edu.tw

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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



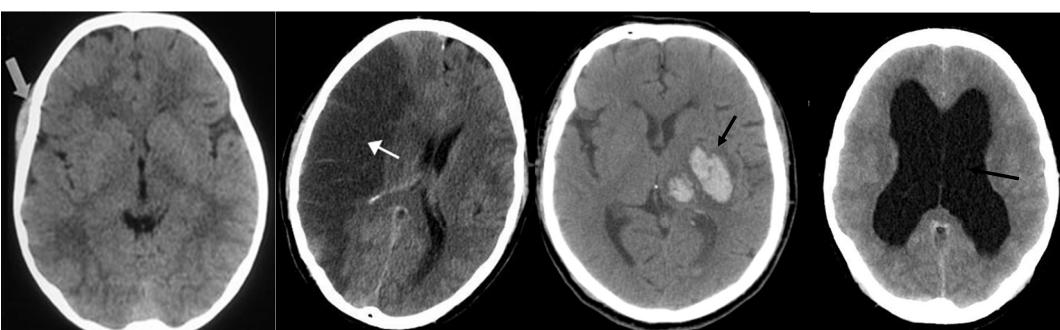
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Time Is Brain

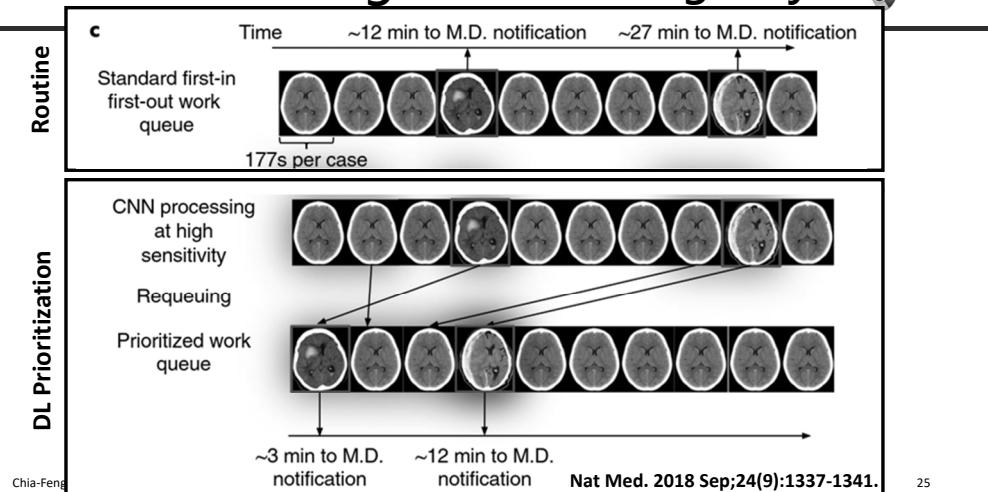
Human nervous tissue is rapidly lost as emergent evaluation and therapy are required.



<https://www.ahajournals.org/doi/abs/10.1161/01.str.0000196957.55928.ab>

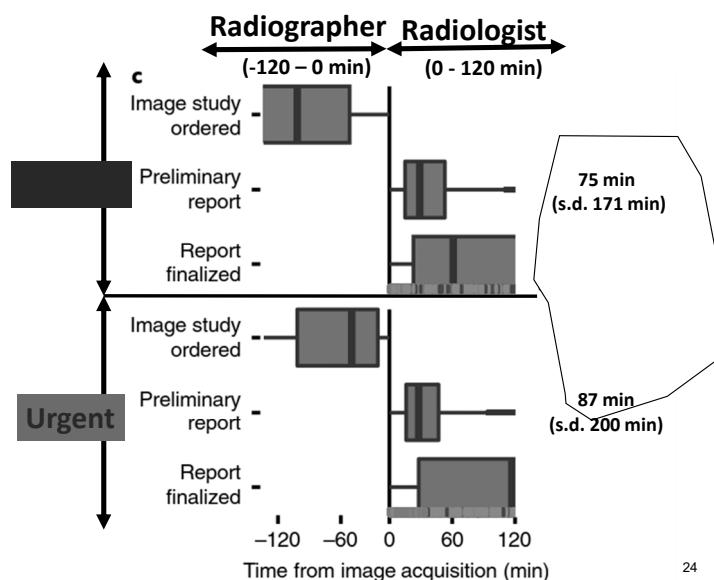
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Differential Diagnosis – Emergency



Current CT Head Workflow

Mount Sinai Hospital (96303 reports)



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

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CURRENT ISSUE ▾ SPECIALTIES ▾ TOPICS ▾

SPECIAL REPORT | AI IN MEDICINE

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

Authors: Peter Lee, Ph.D. , 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

Chia-Feng Lu, alvin4016@nycu.edu.tw

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How IBM Watson Overpromised and Underdelivered on AI Health Care

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

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+ 醫療的泡沫破裂」，引起了整個產業的一片譁然。

Only 5/50 partnerships successfully produced applications.

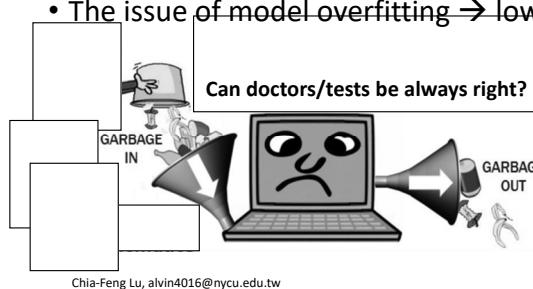


Chia-Feng Lu, alvin4016@nycu.edu.tw

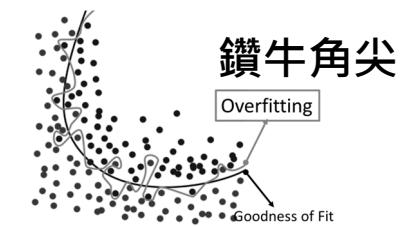
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Challenges of ML/DL

- 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.



Chia-Feng Lu, alvin4016@nycu.edu.tw



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Uncertainty
為未來而學，
順應潮流積累能力



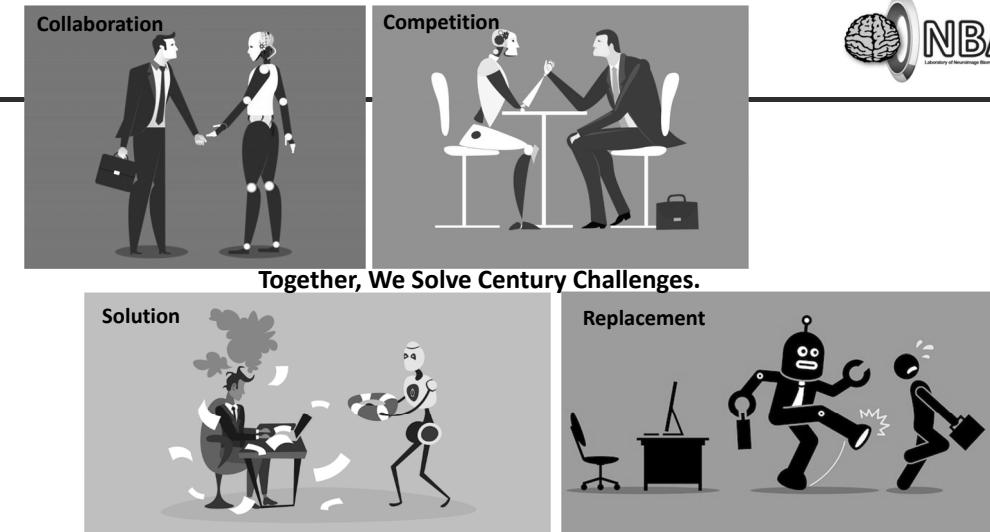
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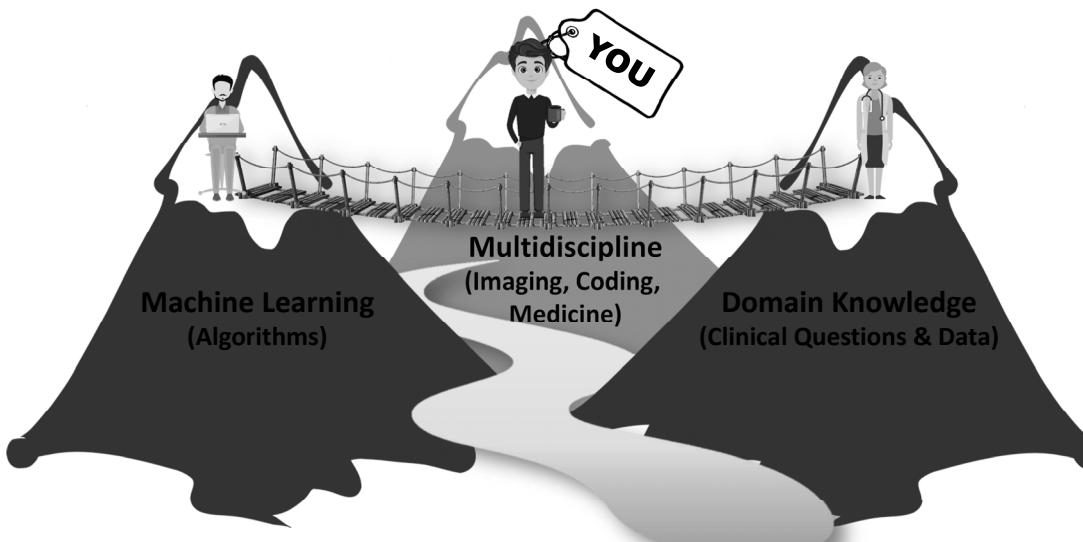
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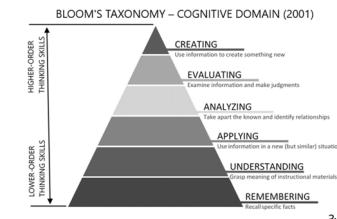


Chia-Feng Lu, alvin4016@nycu.edu.tw

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

Chia-Feng Lu, alvin4016@nycu.edu.tw



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

Chia-Feng Lu, alvin4016@nycu.edu.tw

