



Medical Informatics

醫療資訊科學 實驗室

日期: 2025-11-25

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Outline

► 實驗室的研究方向

A. Medical informatics: 醫療資訊→精準醫療

- 早期偵測
- 貼近臨床需求、研究價值更高

B. Semantic analysis: 語意分析, 情感分析

- 社群媒體如何帶領政治議題的風向
- 不同社群媒體使用者的用字遣詞的特性

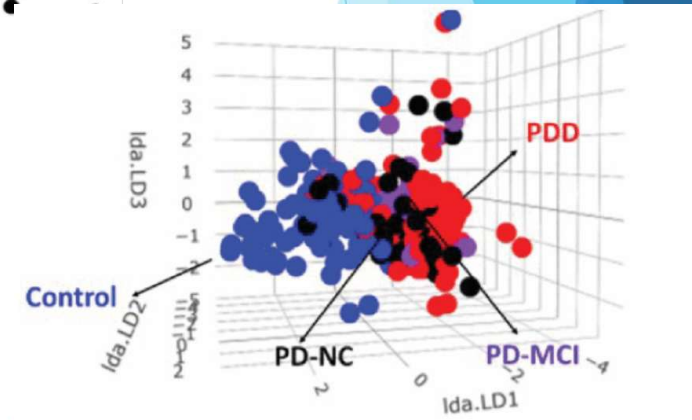
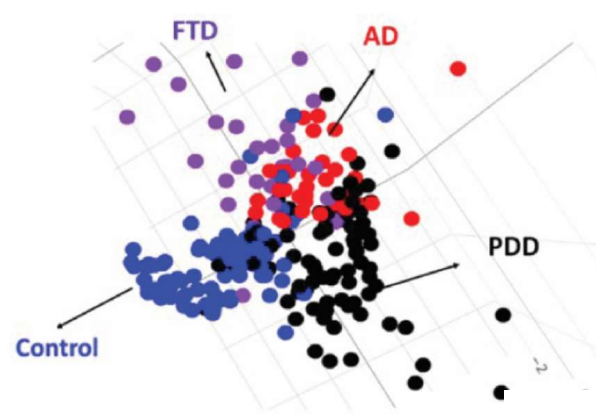
醫療資訊

- ▶ 神經退化性疾病 (Neurodegenerative diseases)
 - ▶ 阿茲海默症 (Alzheimer's disease, AD)
 - ▶ 巴金森氏症 (Parkinson's disease, PD)
- ▶ 眼科疾病
 - ▶ 視網膜色素病變 (Retinitis Pigmentosa, RP)
 - ▶ 老年性黃斑病變 (Age-related macular degeneration, AMD)
- ▶ 心臟驟停 (In-Hospital Cardiac Arrest)
 - ▶ Use vital signs
- ▶ 胎心音的異常偵測
 - ▶ 疫情而未能到醫院蒐集資料，僅以測試資料結案

Neurodegenerative diseases (神經退化性疾病)分類

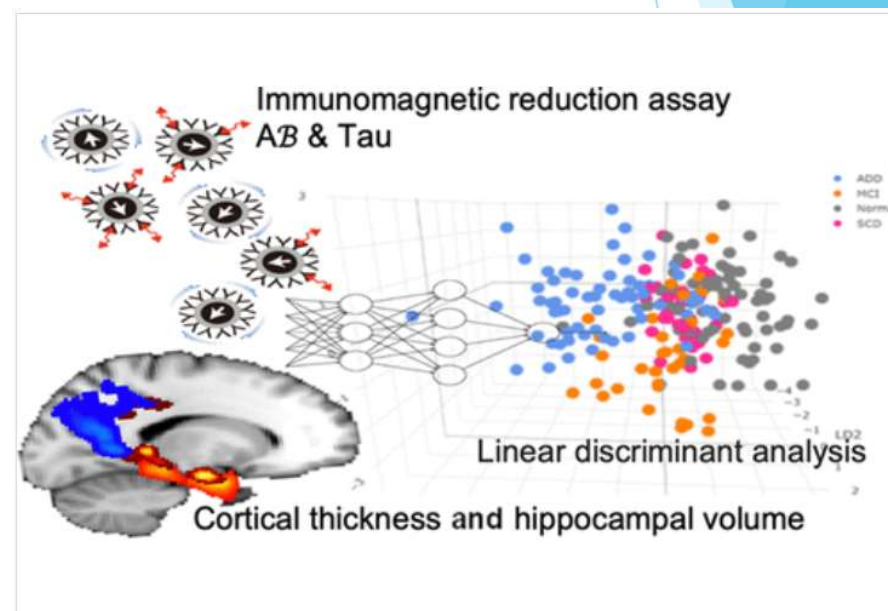
:常見阿茲海默症(AD)、巴金森氏症(PD)

- ▶ Use blood biomarkers (tau, p-Tau181, A β 40, A β 42, and α -synuclein)
- ▶ patients with PD AD, MCI, PDD, PD-MCI, PD-NC, and FTD
- ▶ Control: normal



Neurodegenerative diseases --- Alzheimer's disease (阿茲海默症)

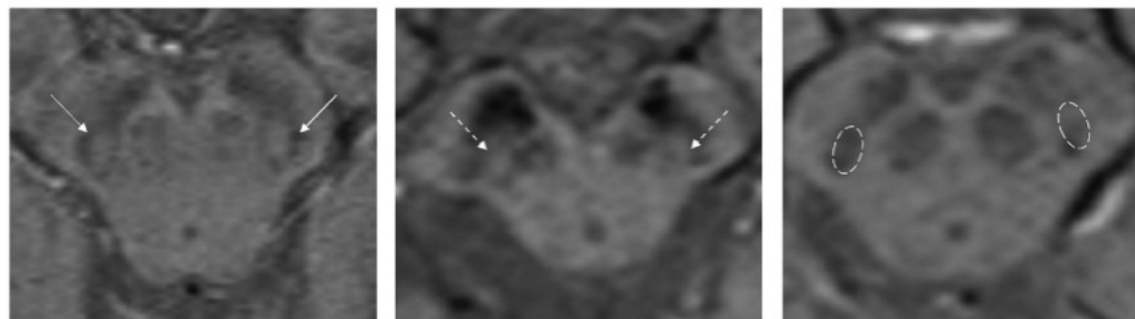
- ▶ 18 brain-image
- ▶ 3 plasma biomarker
 - ▶ $A\beta_{1-42}$, $A\beta_{1-40}$, and tau protein



Chiu, Shu-i; Fan, Ling-Yun; Lin, Chin-Hsien; Chen, Ta-Fu; Lim, Wee Shin; Jang, Jyh-Shing; Chiu, Ming-Jang, Machine-learning-based classification of subjective cognitive decline, mild cognitive impairment, and Alzheimer's dementia using neuroimage and plasma biomarkers, *ACS Chemical Neuroscience*. 2022.

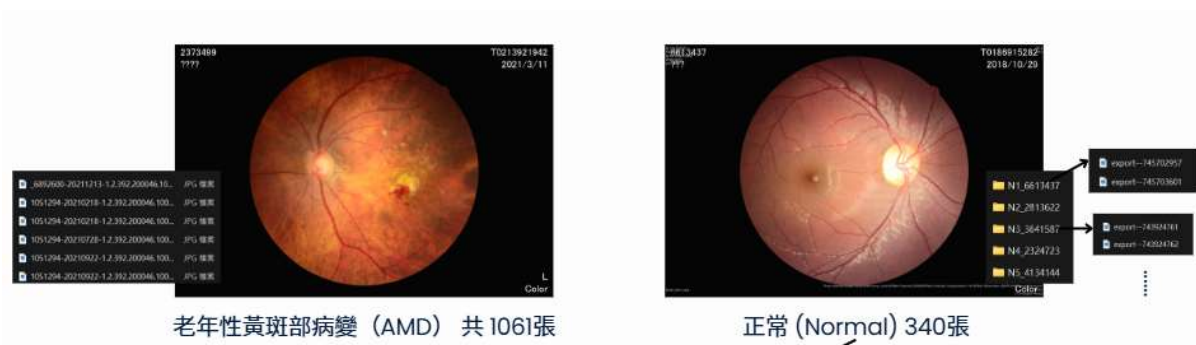
Neurodegenerative diseases--- Parkinson's disease (巴金森氏症)

- ▶ 黑質 nigrosome-1 影像
 - ▶ 俗稱燕子的尾巴 (黑質細胞退化)

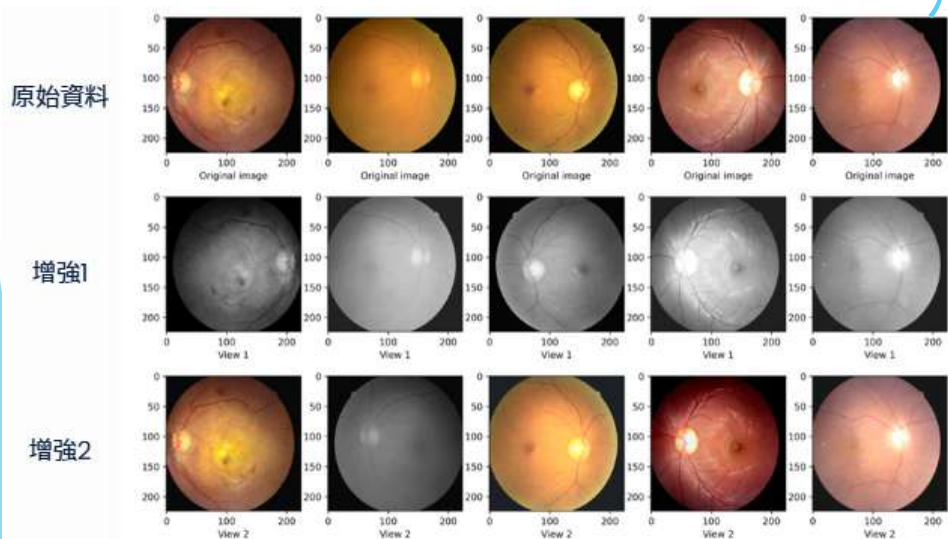


腦部電腦斷層
影像

Yung-Tsai Chu, Chin-Feng Yu, Sung-Pin Fan, Ta-Fu Chen, Ming-Jang Chiu, Jyh-Shing Roger Jang, Shu-I Chiu*, Chin-Hsien Lin*, Substantia nigra nigrosome-1 imaging correlates with the severity of motor symptoms in Parkinson's disease, *Journal of the Neurological Sciences*, Vol. 451, 2023.



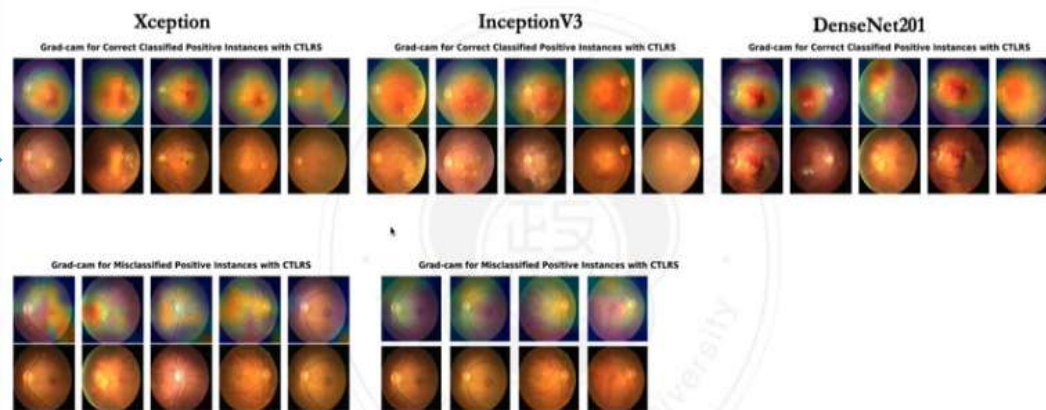
眼科：AMD(老年性黃斑部病變)



資料增強的三個方法 Flip, Color Jittering, Color Drop 每次增強機率 [0.5,0.8,0.2]



CTLRS Grad-Cam

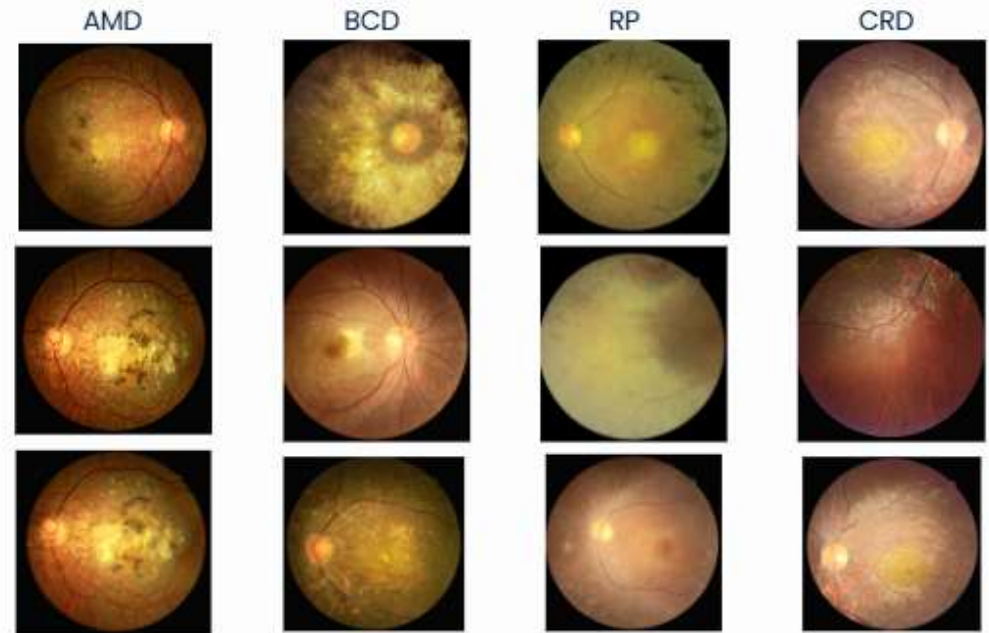


Source: 游勤對, 碩士論文, 2022

Doing --- (a)視網膜退化疾病模型

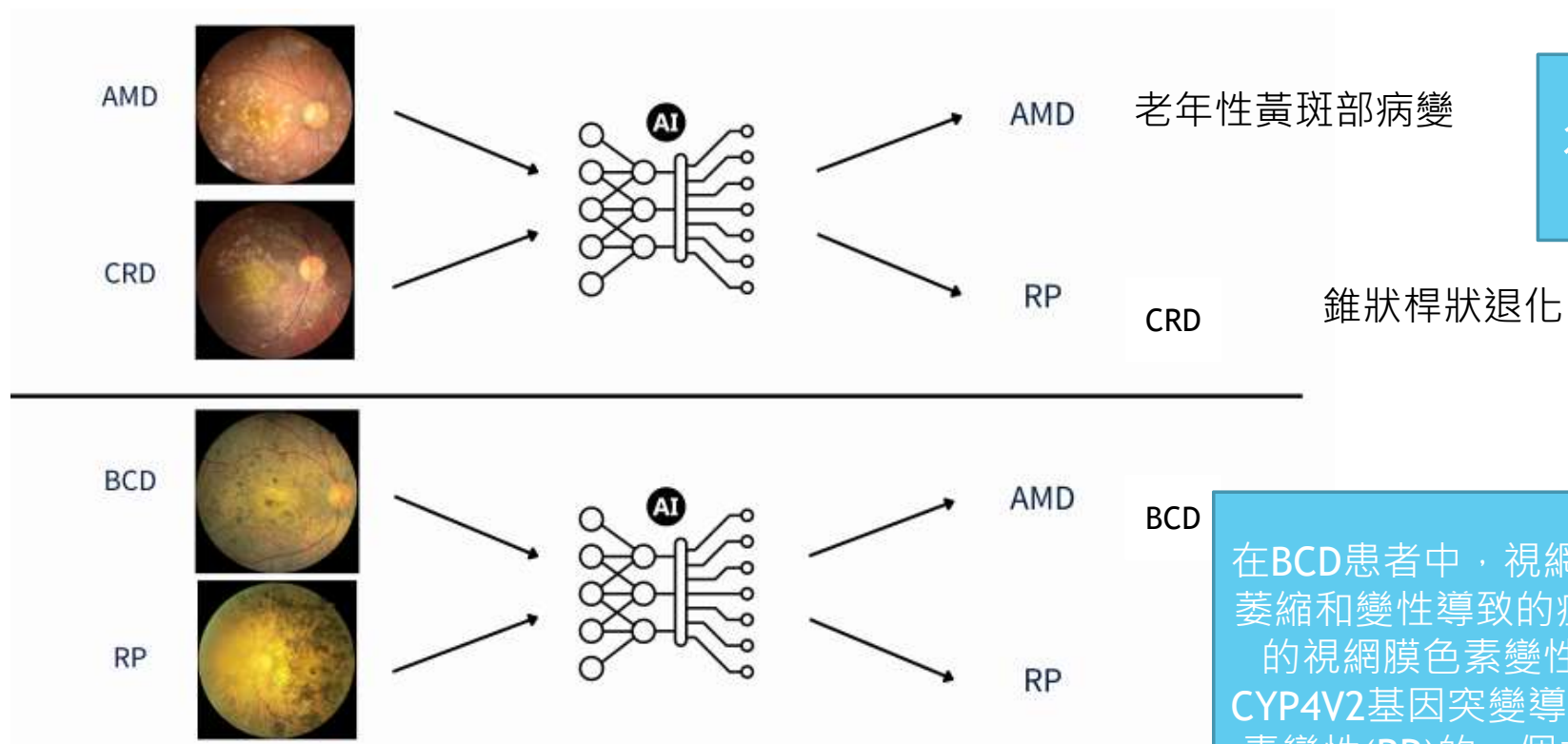
- ▶ 老年性黃斑部病變 (Age-Related Macular Degeneration, AMD):老化
- ▶ 結晶性視網膜失養症(Bietti Crystalline Dystrophy, BCD):基因缺陷
- ▶ 視網膜色素病變(Retinitis Pigmentosa, RP):基因突變
- ▶ 錐狀桿狀退化(Cone-rod dystrophy, CRD):遺傳性眼疾

Comparison



資料來源:臺大醫院眼科

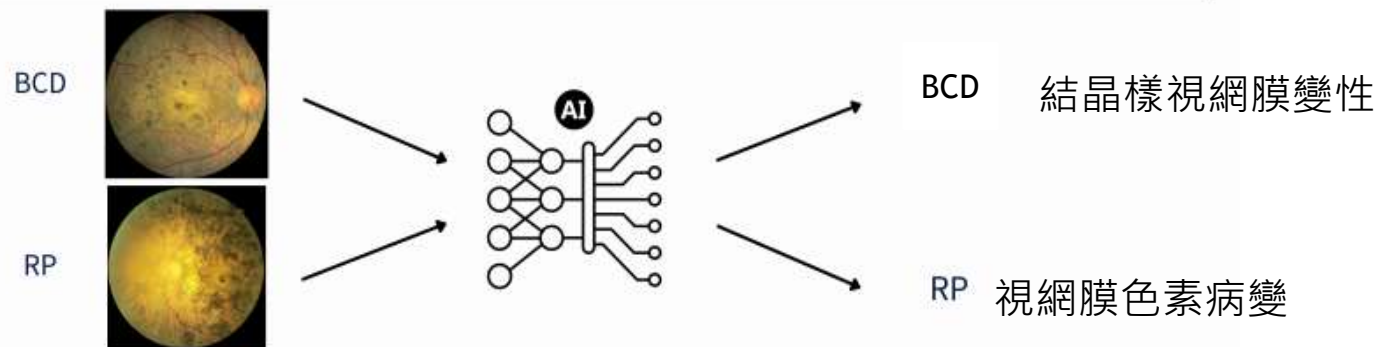
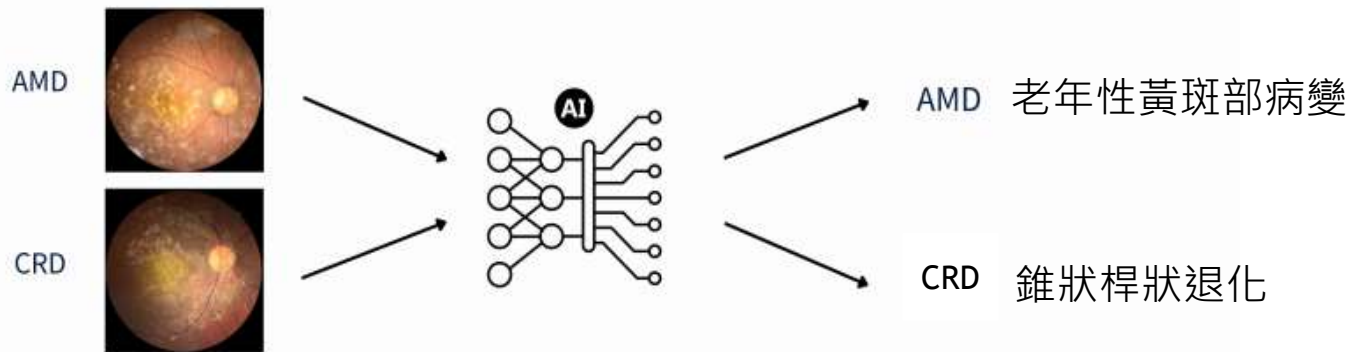
Binary Image Classification



後天 vs 先天

在BCD患者中，視網膜色素上皮(RPE)的萎縮和變性導致的症狀類似於其他形式的視網膜色素變性(RP)。BCD是由於CYP4V2基因突變導致。BCD是視網膜色素變性(RP)的一個主要類型，BCD患者往往也被一般性地診斷為RP

Doing: 解決臨床的痛點



後天 vs 先天

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Doing ---
(b)巴金森氏症早期偵測模型

**Elderly people will make up
22% of population by 2050**

全球人口高齡化



In 1990, UN designated Oct. 1 as
International Day of Older Persons



WORLD POPULATION

7.8 BILLION

By 2050, population
aged 65 and
over will

**EXCEED
1.5 BILLION**



Currently, **one
out of every**

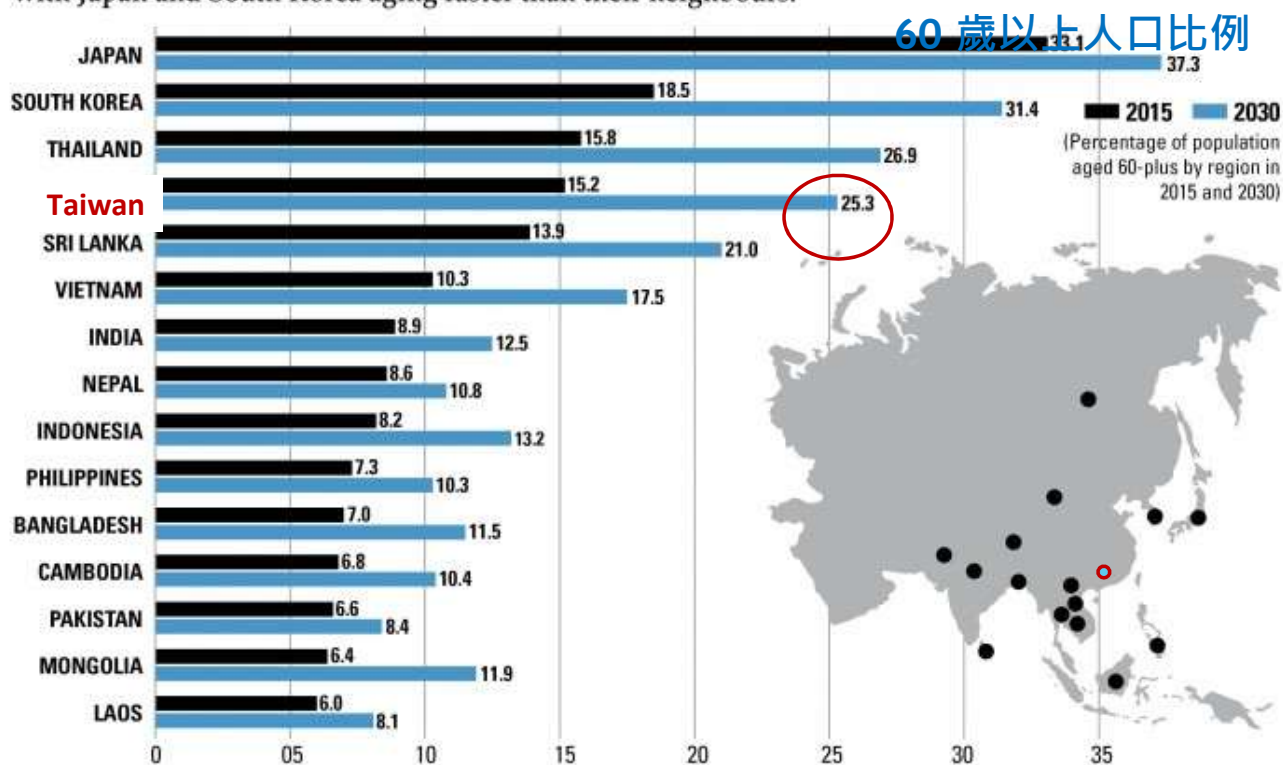


台灣已提前進入超高齡老化社會

人口結構變化 2030-2055

How Asia's Population is Ageing, 2015-2030 Scenario

The proportion of people aged 60 and over is projected to grow in all Asian countries with Japan and South Korea aging faster than their neighbours.



Compiled by: ANN/DataLEADS

Source: Global Age Index, 2015

<https://www.thejakartapost.com/news/2018/02/14/how-asias-population-is-ageing-2015-2030-scenario.html>

感謝林靜嫻醫師提供

非傳染性慢性疾病是已開發國家最重要的死因

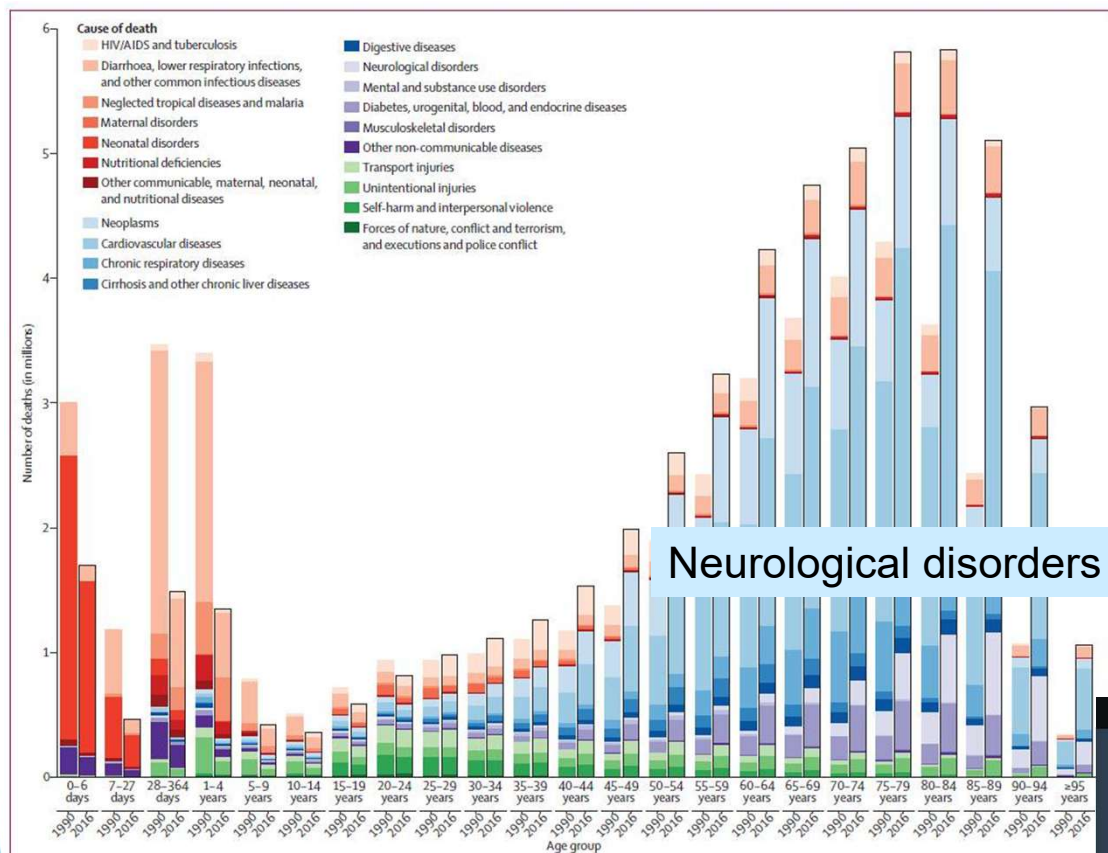


Figure 3: Global composition of number of deaths by Level 2 causes for 23 GBD age groups, both sexes combined, 1990 versus 2016
Composition of Level 2 causes of death globally for males and females combined, by age group, showing difference in composition between 1990 and 2016. Number of total deaths due to Level 2 causes is indicated by height of bar; causes are colour-coded to highlight the relative number of total deaths due to a specific cause.

已開發國家早死 (premature death)死因72%為非傳染性慢性疾病

The 5 major categories of non-communicable diseases (NCDs)



Cardiovascular Diseases



Diabetes



Chronic Respiratory Diseases

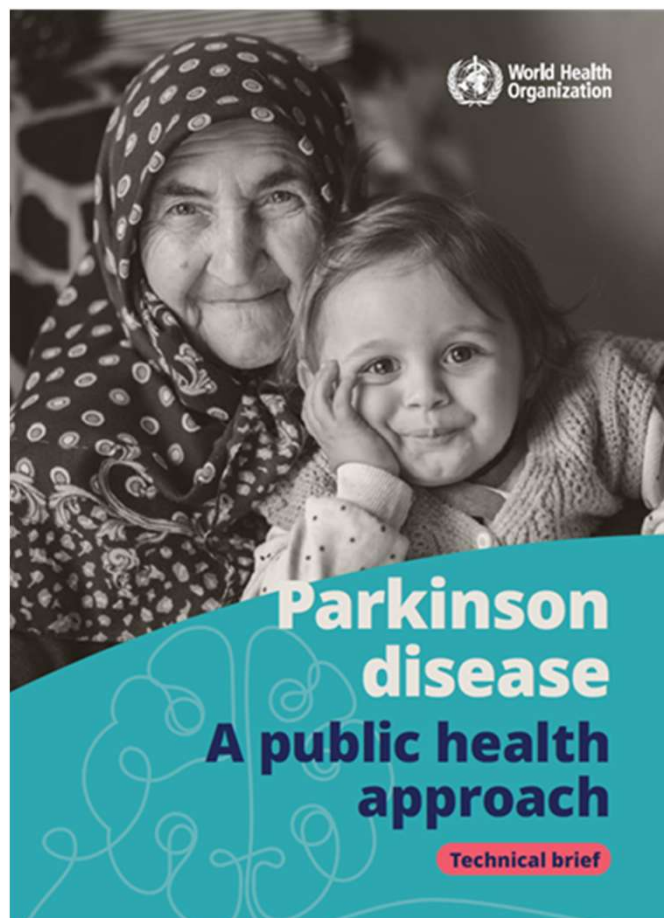


Cancer



Neurological disorders

感謝林靜嫻醫師提供



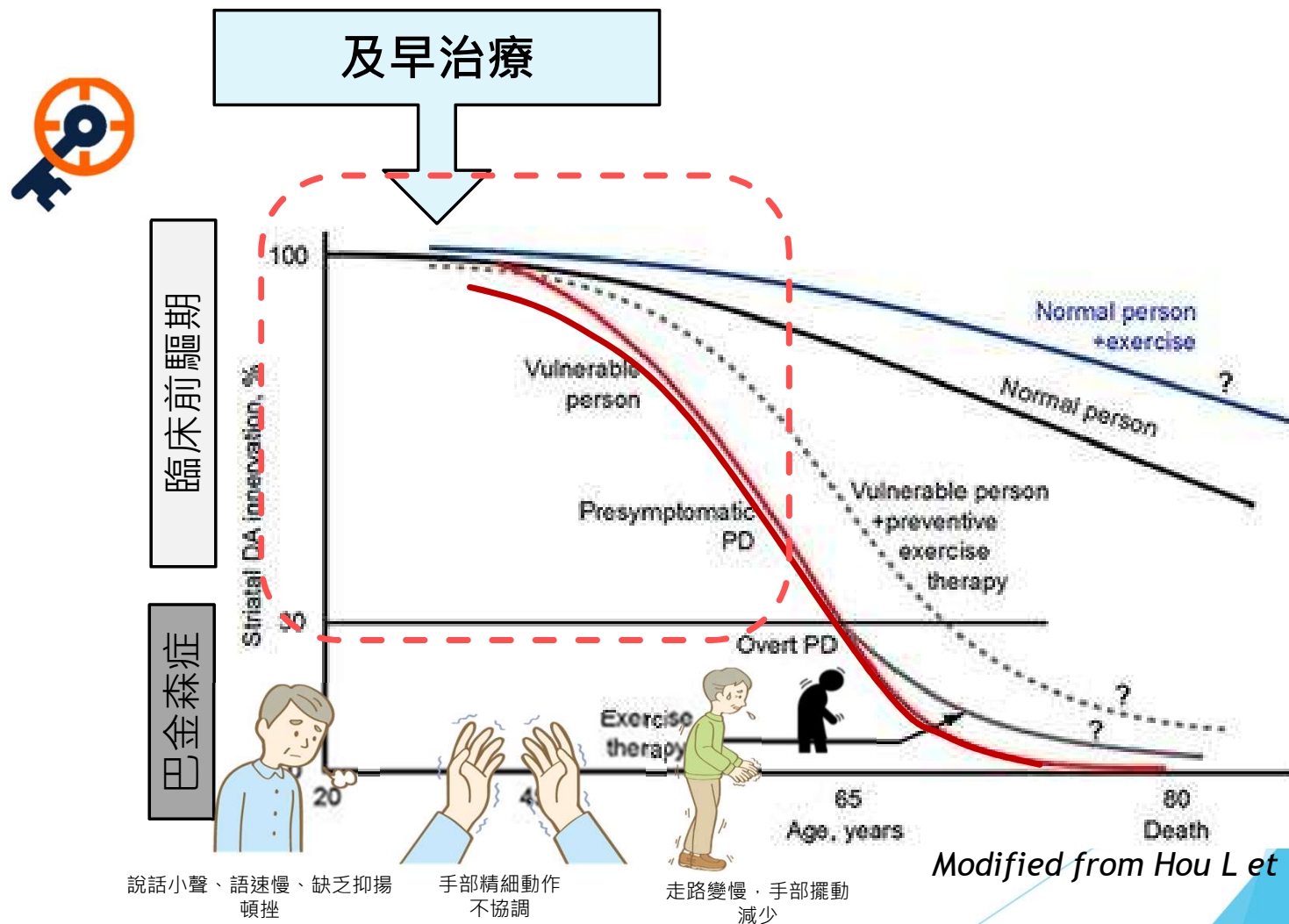
The global impact of Parkinson's disease (PD) is increasing faster than for any other neurological disorder

A doubling of PD prevalence over the past 25 years, with over 5.8 million disability-adjusted life years in 2019 - an increase of 81% since 2000

Parkinson disease: a public health approach. Technical brief. Geneva: World Health Organization; 2022.

感謝林靜嫻醫師提供

臨床痛點：臨床前驅期的黃金時間



感謝林靜嫻醫師提供

核心特徵 (1/3): 語音分析

Voice Analysis

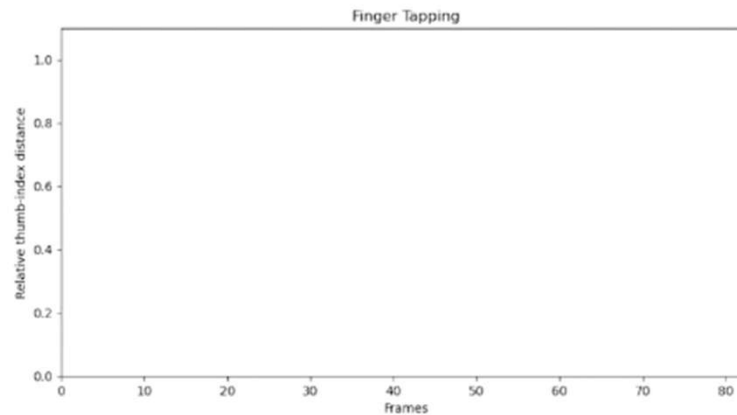
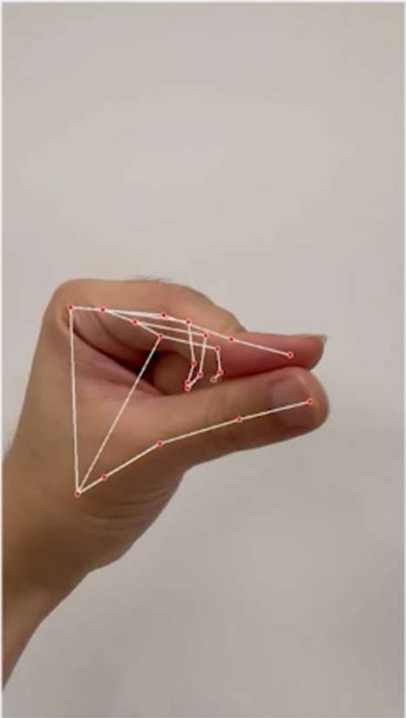


Key Voice Features:

- 1. Reading Time:** Duration taken to read the paragraph
- 2. Phonetic Score:** Assessment of pronunciation accuracy
- 3. Pause Percentage:** Proportion of pauses during reading
- 4. Voice Volume Variance:** Variability in the loudness of the voice
- 5. Average Pitch:** Mean pitch of the voice signal
- 6. Pitch Variance:** Variability in the pitch of the voice

核心特徵 (2/3): 手部動作

Finger Tapping Analysis



Key Finger Tapping Features:

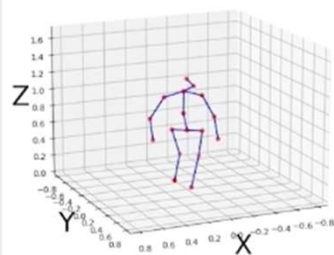
- 1.Finger Tapping Duration:**
Measures the time it takes for the index finger to touch the thumb
- 2.Finger Tapping Duration Change:**
Observes the variation in the duration of the index-to-thumb touches
- 3.Finger Tapping Distance:**
Calculates the distance between the index finger and thumb
- 4. Finger Tapping Frequency:**
Calculates the frequency of finger tapping

核心特徵 (3/3): 1分鐘步態分析

Walking Gait Analysis



3D Pose Estimation



Key Gait Features:

1. Walking Duration:

Measures the total time taken to walk a certain distance

2. Step Length:

Calculates the distance covered in one step

3. Turning Duration:

Records the time taken to complete a turn

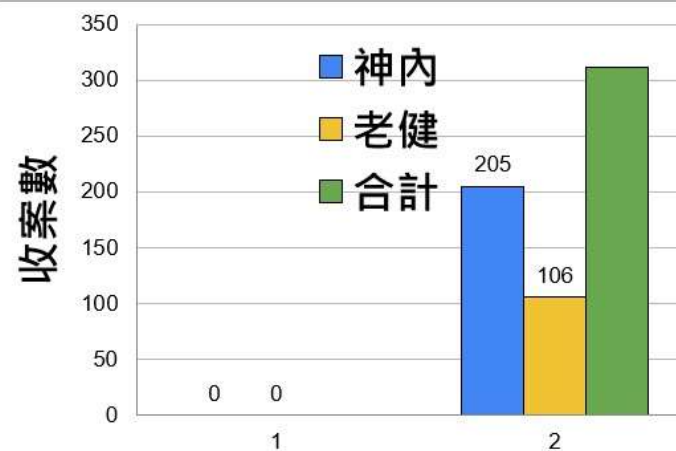
4. Percentage of Foot on Ground:

Analyzes how long each foot stays in contact with the ground

(b)巴金森氏症早期偵測模型(第二期)

- ▶ 透過手機或平板APP進行收案
- ▶ 收集病人資訊
 - ▶ 語音
 - ▶ Free speech (碩一生)
 - ▶ 手部動作
 - ▶ 手部畫圓書寫 (碩二生正在進行)
 - ▶ 步態
 - ▶ 相關量表
 - ▶ 問卷
- ▶ 建構Multimodal model

門診收案	神內	老健	合計
2025/07/25	205	106	311



截至 2025/07/25

Semantic analysis

▶ Facebook

- ▶ 總統大選期間政治貼文的情感分析
- ▶ 疫情期間的議題
 - ▶ 校正回歸
 - ▶ text
 - ▶ text+Emojis
 - ▶ Sarcasm detection
 - ▶ 疫苗、抑鬱症 (已畢業的同學)

▶ Threads

- ▶ “罷免”、“關稅”、“問AI”... (傳播領域老師合作)

Doing---

- ▶ **Multimodal analysis:** 文字結合圖片...
- ▶ **Threads 情感分析**
 - ▶ 以”罷免”議題為主，以**7/26**前兩周探討社群媒體的情感
- ▶ **Threads 與Facebook的用字遣詞的探討**

	筆數	說明
Positive	10,596	支持罷免
Negative	4,326	反對罷免
Neutral	2,286	無明顯立場或無關內容
Total	17,208	



Q & A

