114學年度醫師工程師組&
電機系丙組專題說明會

時間: 2025年11月28日 中午12:10-13:10

地點: 工程四館116室 (視訊通話連結：https://meet.google.com/pij-gjxd-cwq)

時　間	議程
12:10 – 12:12	開場介紹 (醫學系楊懷哲副系主任、電機系帥宏翰所長)
12:13 – 12:15	專題規劃說明 (帥宏翰老師)
12:15 – 13:10	專題老師介紹 (12:15~12:40陽明校區老師介紹； 12:40~13:05交大校區老師介紹； 13:05~13:10 Q & A)

專題規劃說明

- 電機系丙組與醫師工程師組學生 (鼓勵團隊合作)
- 醫師工程師組學生大二上下學期進行專題研究

  (建議可以多利用寒暑假期間參與研究)

指導老師名單

- 陽明校區: 10位 (臨床醫學、腦科學、生物醫學資訊研究所、公共衛生碩士學位學程)
- 交大校區: 18位 (電機、電子、電控、醫電、光電等研究所)

時間	安排
12:15~12:40	陽明校區老師介紹
12:40~13:10 (每位老師預估4~5分鐘)	交大校區老師介紹 *12:41-12:45* 孫家偉老師 *12:46-12:50* 邱　一老師 *12:51-12:55* 鄭耿璽老師 *12:56-13:00* 李佳燕老師 *13:01-13:05* 廖育德老師（主席代為介紹） *13:05-13:10* Q & A

專題指導老師介紹(陽明校區)

專題指導老師介紹(陽明校區)

- 介紹說明：

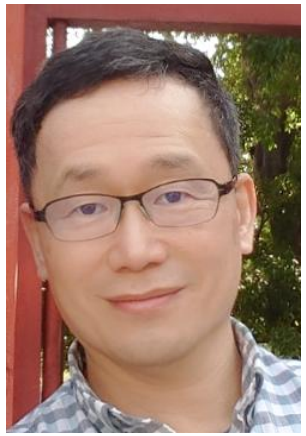
位址	單位	姓名職稱	email	專長領域	教師介紹連結	實驗室介紹連結
陽明校區	國立陽明交通大學 工程醫學學科 主任 醫學院玉山學者	甘致群 教授	edwinkan5@nycu.edu.tw	醫學工程與智慧醫療、 射頻生理感測器 分子界面感測器、無 線射頻辨識定位及物 聯網、奈米CMOS 及 快閃記憶器、 超大型積體電路計算 機輔助設計	https://dmc.nycu.edu.tw/team/	
	醫學院外科學系 北榮神經醫學中心神經外科	楊懷哲 副教授	wade012@gmail.com hcyang3@vghtpe.gov.tw	加馬刀放射手術 腦部立體定位手術 巴金森氏病手術 神經重症加護照顧	https://www.vghtpe.gov.tw/Teacher.action?tid=210	
	醫學院外科學系 北榮神經醫學中心神經外科	李政家 副教授	yfnaughty@gmail.com	難治型癲癇 聚焦超音波 加馬刀放射治療	https://www.vghtpe.gov.tw/Teacher.action?tid=831	
	醫學系神經學科 專任副教授 北榮神經醫學中心腦血管科 主治醫師 臺灣腦中風學會 理事	紀乃方 副教授	naifangchi@gmail.com	腦血管疾病、腦血流 動力學、腦血管超音 波	https://scholar.nycu.edu.tw/zh/persons/nai-fang-chi	
	腦科學研究所	陳麗芬 教授	lfchen@nycu.edu.tw	生醫工程、腦訊號與 影像分析、機器學習/ 深度學習	https://ibs.nycu.edu.tw/?page_id=123	https://bmlab.web.nycu.edu.tw/

專題指導老師介紹(陽明校區)

- 介紹說明：

陽明校區	生物醫學資訊研究所	洪哲倫 教授	clhung@nycu.edu.tw	智慧醫療、深度學習、醫學影像分析、生物資訊計算、高效能計算	https://bmi.nycu.edu.tw/%E6%B4%AA%E5%93%B2%E5%80%AB-che-lun-hung/	
	生物醫學資訊研究所	王禹超 教授	yuchao@nycu.edu.tw	生醫數據分析與人工智慧之臨床應用 轉譯生物資訊 系統生物學		https://yuchao.web.nycu.edu.tw/
	生物醫學資訊研究所	鍾翊方 教授	ifchung@nycu.edu.tw	資料探勘、機器學習、系統生物學 、生物資訊學	https://bmi.nycu.edu.tw/%E9%8D%BE%E7%BF%8A%E6%96%B9-i-fang-chung/	
	公共衛生碩士學位學程	陳翎 助理教授	ling.chen@nycu.edu.tw	醫療大數據分析與產業應用	https://https://ihha.nycu.edu.tw/	
	國立陽明交通大學內科學科教授 北榮教研部實證醫學中心主任	鄭浩民 教授	hmcheng@vghtpe.gov.tw	統合分析、心臟血管血流動力學、心臟血管流行病		

甘致群 教授



醫學院玉山學者
醫學系教授工程醫學學科主任

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電話 ： 0972 961 012
Email ： edwinkan5@nycu.edu.tw

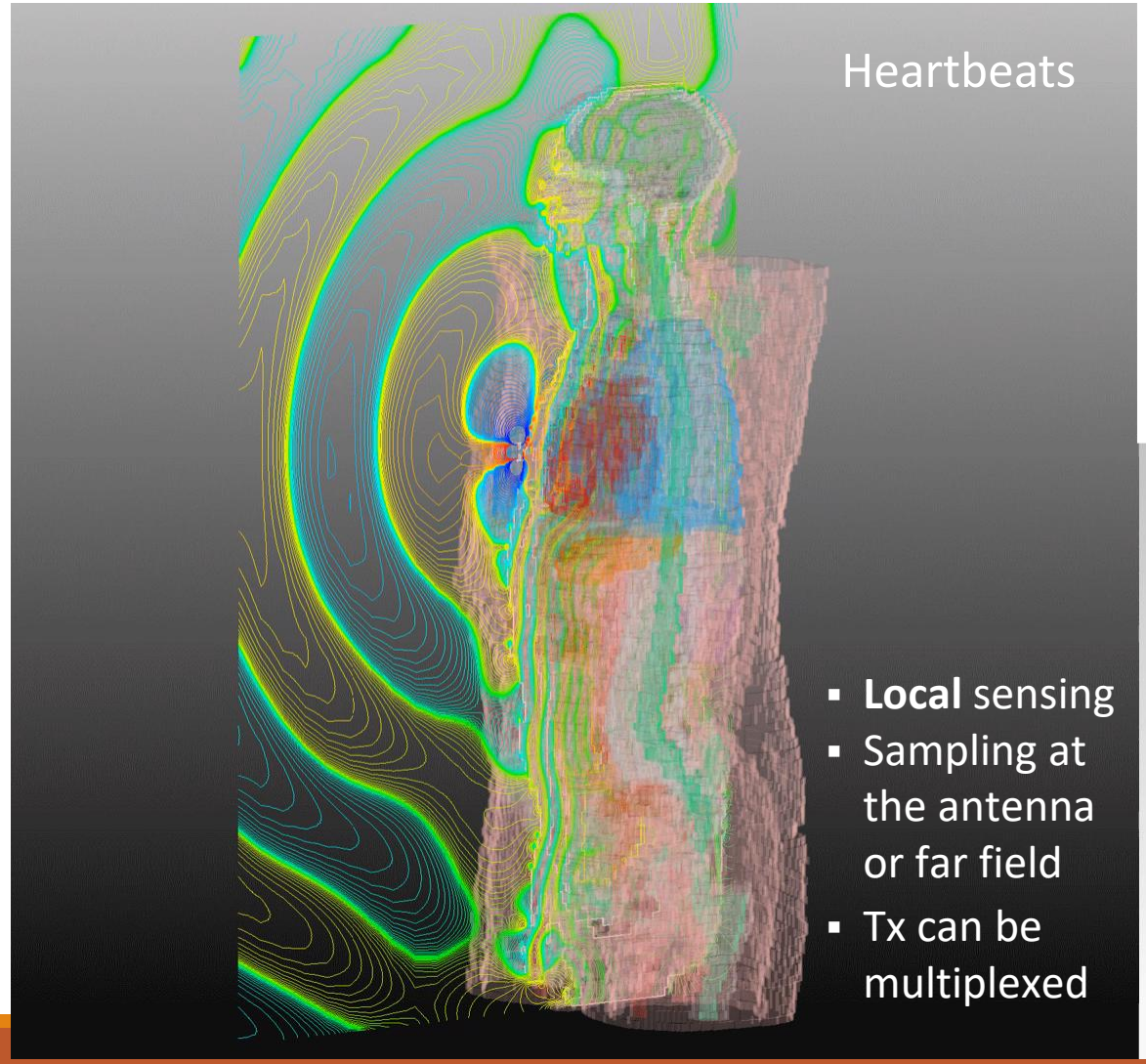
研究領域

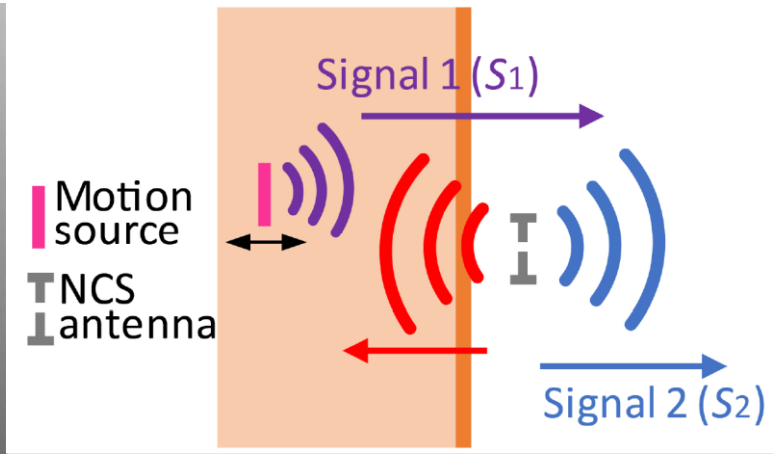
- 醫學工程與智慧醫療
- 射頻生理感測器
- 分子界面感測器
- 無線射頻辨識定位及物聯網
- 奈米CMOS 及快閃記憶器
- 超大型積體電路計算機輔助設計

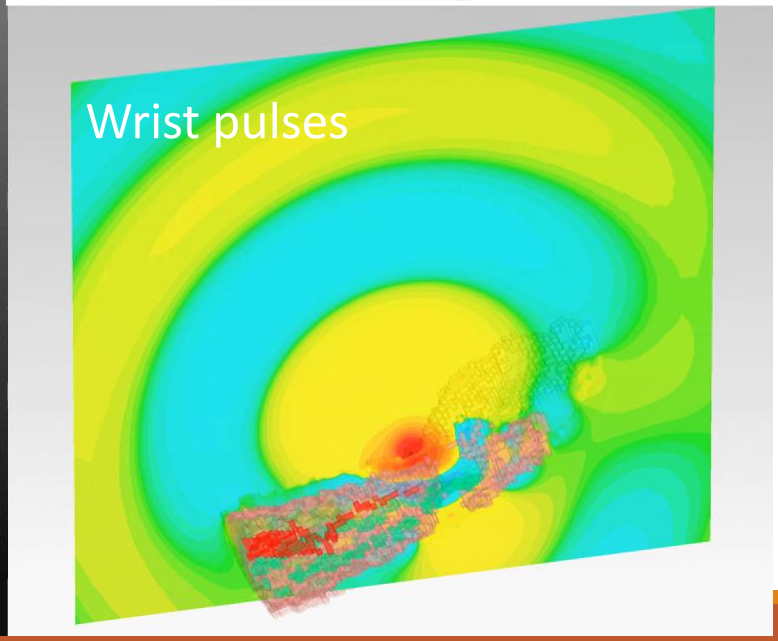
學歷

- 史丹佛大學電機工程系博士後
- 美國伊利諾大學厄巴納-香檳分校電子與計算機工程博士
- 台灣大學電機工程系學士

Wearable Radio Sensing of Internal Organs and Tissues

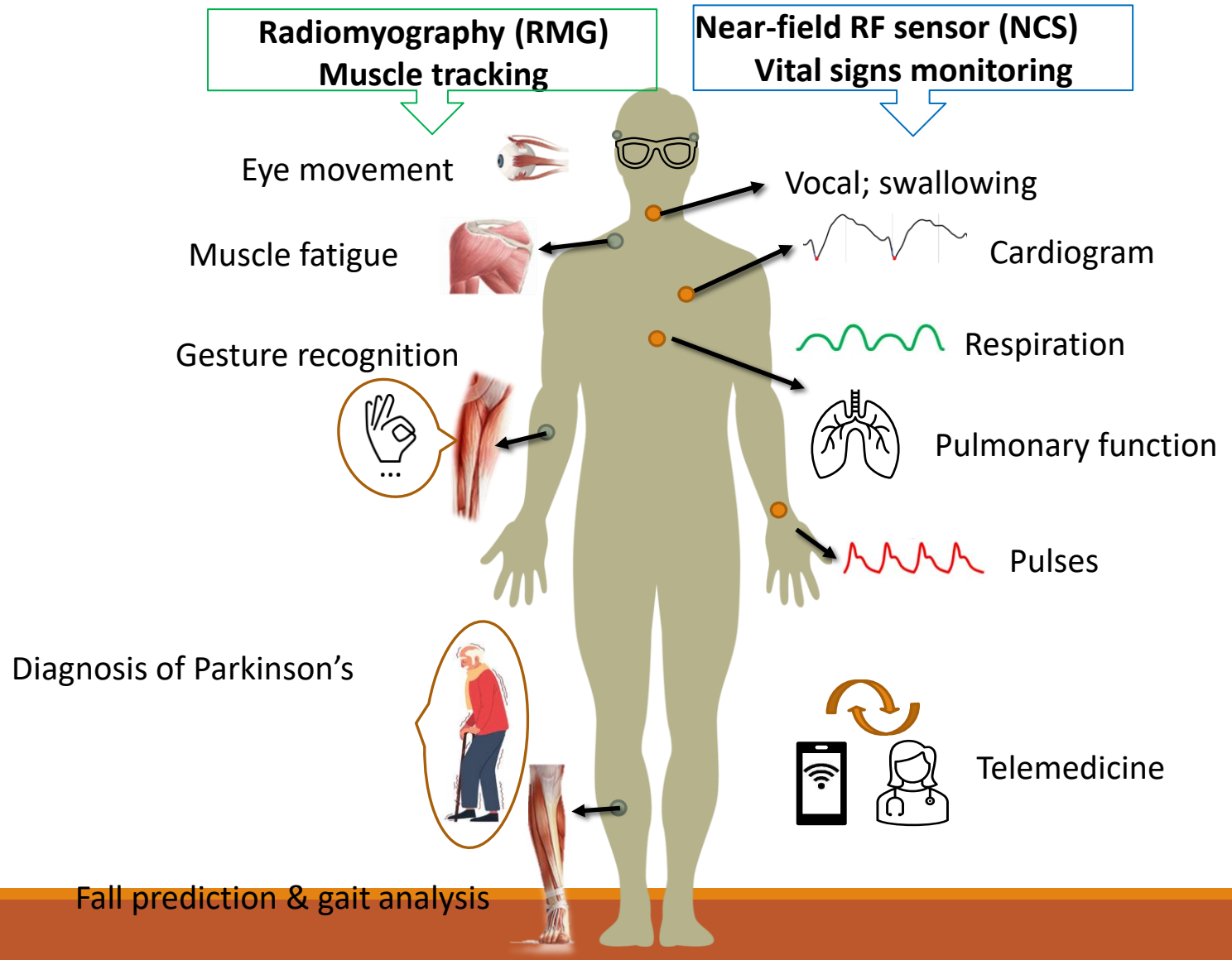




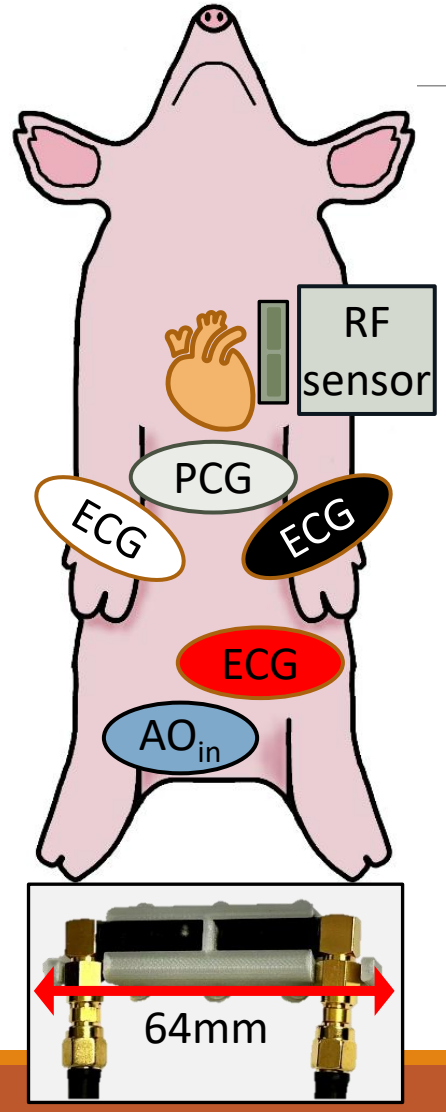


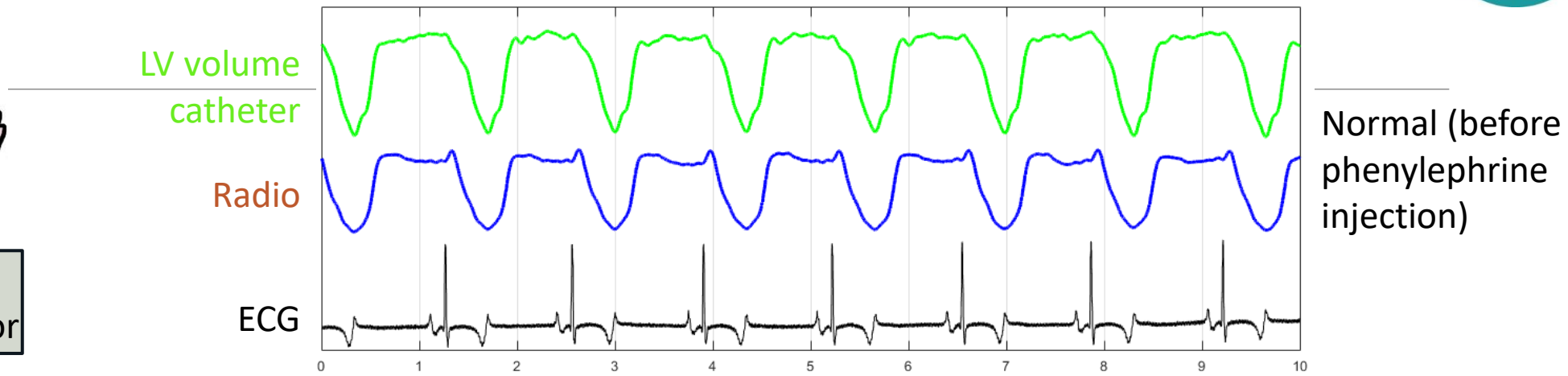
CST Microwave Studio

Possible near-field sensing on human body

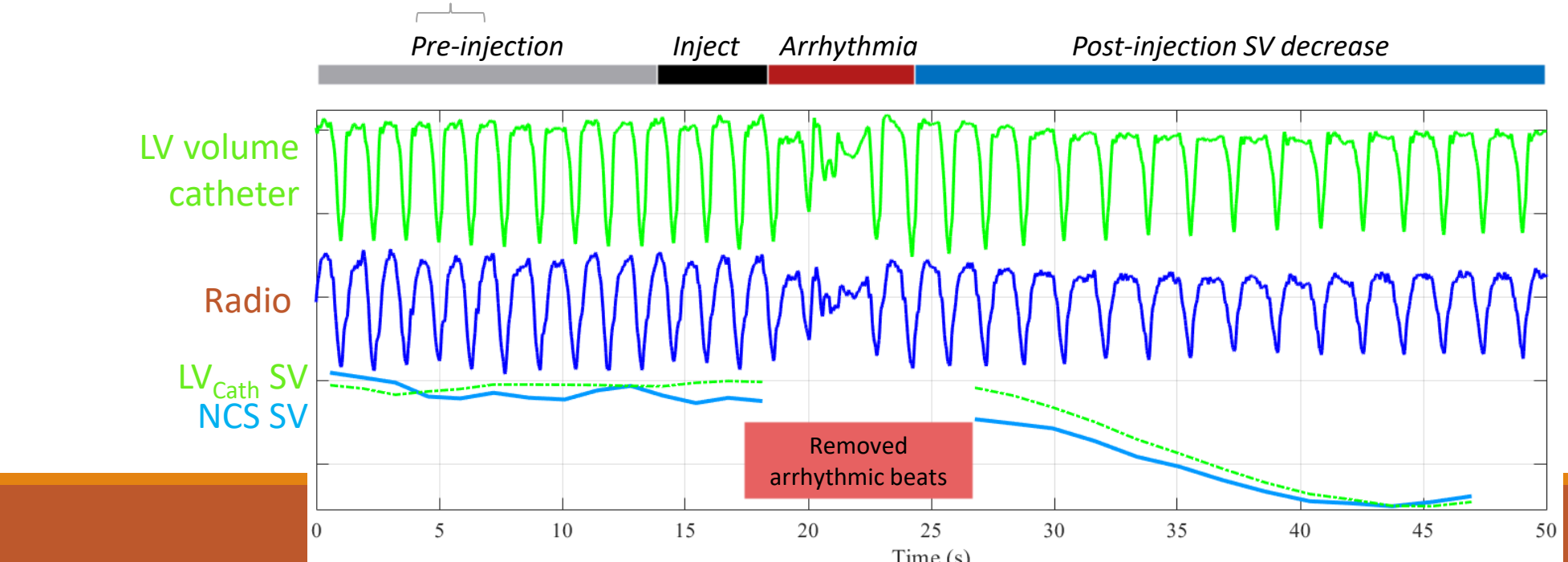


Left Ventricular Volume (LV) Monitoring

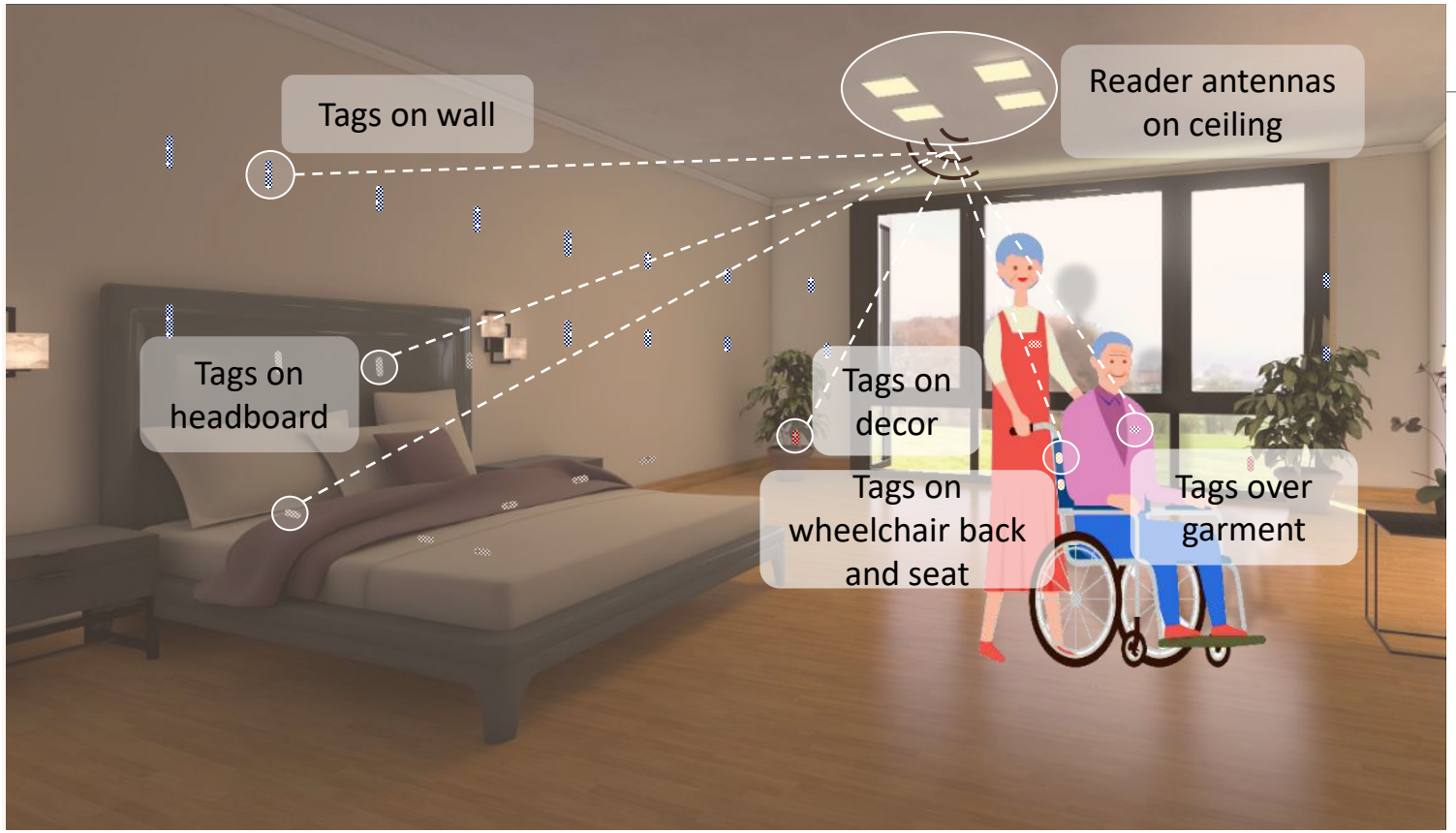




Normal (before phenylephrine injection)



Large number of RFID tags for smart assisted living

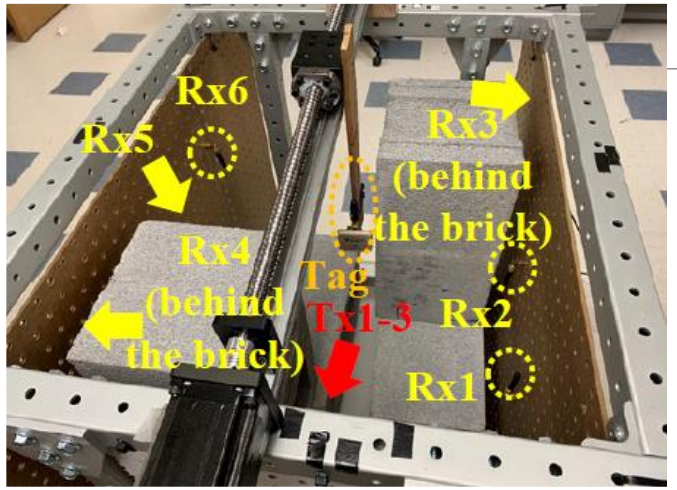


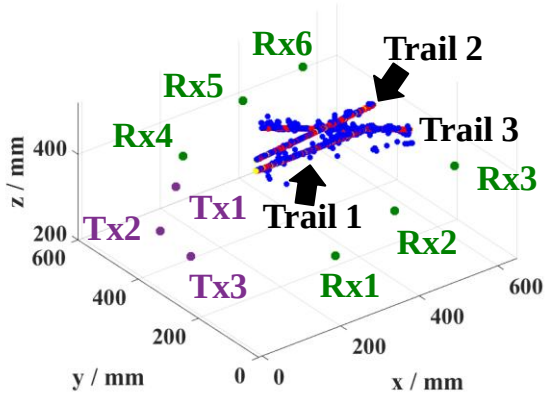
- Tags on occupants: ID, locating and vital signs
- Tags on furniture: Covert and backup vital-sign monitoring
- Tags on essential items: 6 “W” logistics
- Tags on doors and windows for security
- Ambient tags for device-free occupants (fail-safe): number; location; posture

Use case of IoT in assisted living:
Passive RFID tags on occupants, furniture, items and ambient

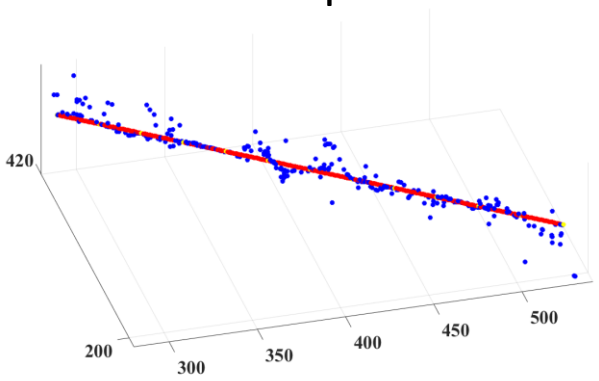
P. Sharma, *IEEE Sensors*, 2021

3D localization experiments with spatial diversity



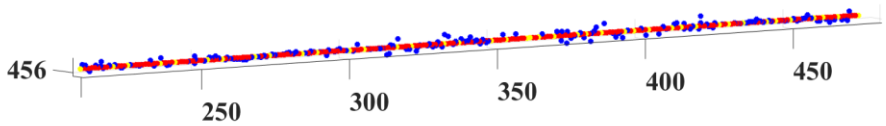


Setup

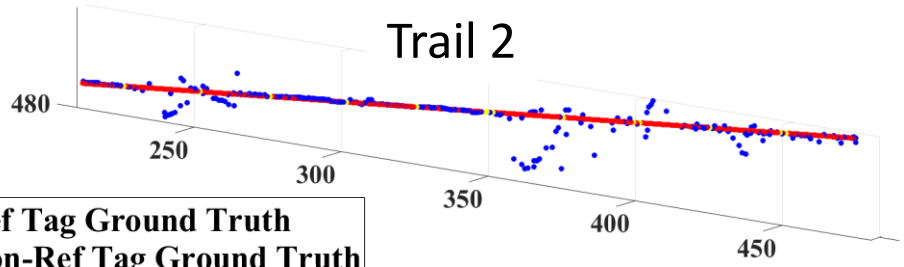


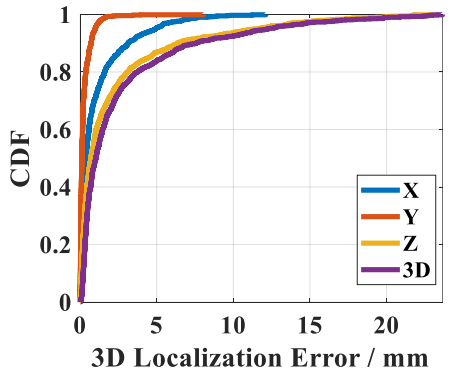
Trail 3

Trail 1

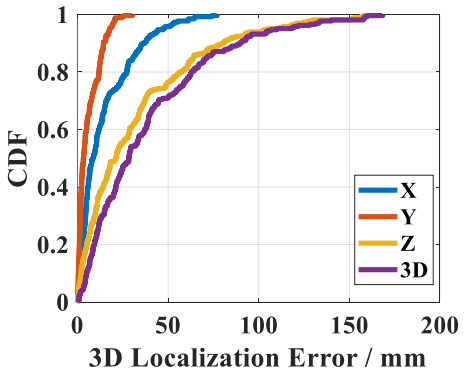


Trail 2





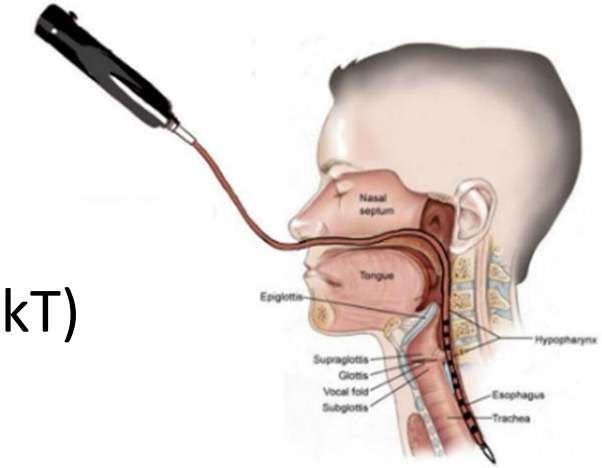
3D localization error
Phase from near-field

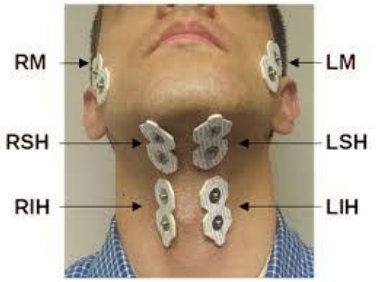


3D localization error
Linear phase-distance

My current research projects at NYCU

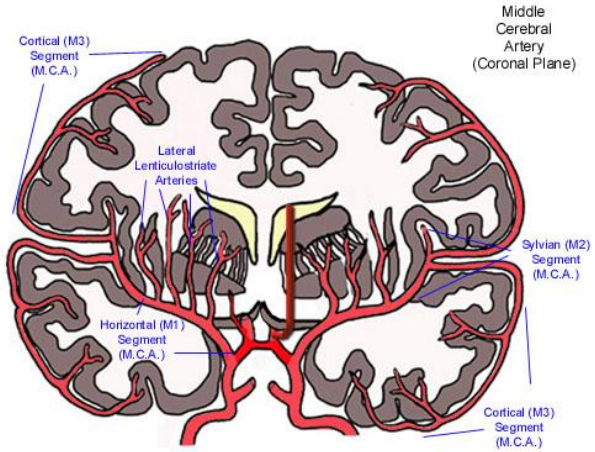
- Non-invasive dysphagia monitoring
- Muscle fatigue by RMG, EMG and EEG
- Fundamental limits of low-voltage switching (< 3kT)





What I hope to do additionally

- Brain arterial pulses
- Balance and fall recovery
- Cardiovascular dynamics
- Measurables in Chinese medicine
- Humanoids in geriatric care
- Indoor precision 3D locating
- IC realization of the wearable sensors



Falling warning/risk, gait

楊懷哲 副教授

現職:

國立陽明交通大學醫學系副系主任兼外科學科專任副教授

臺北榮民總醫院神經醫學中心一般神經外科主任

學經歷:

2001 台北醫學大學醫學系

2008 台北榮民總醫院神經外科專科訓練

2009 美國匹茲堡大學功能性神經外科與加馬刀放射手術臨床研究員

2010 加拿大多倫多大學深部腦電極刺激手術臨床研究員

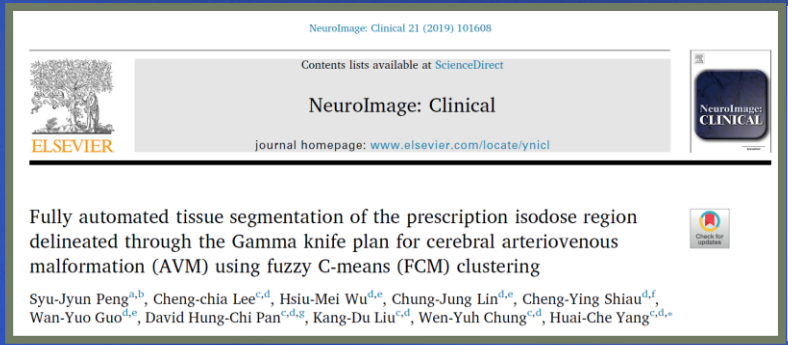
2021 國立陽明交通大學腦科學研究所博士

研究領域

•主要研究興趣領域為結合Ai人工智慧的影像分析與自動判讀方式，來客觀迅速評估放射手術與放射線治療對於各類不同腦部疾病包括腦血管動靜脈血管畸形 (cerebral AVM)、動靜脈廔管 (Dural AVF)、轉移性腦瘤 (Brain metastases)、腦膜瘤 (Meningioma) 與聽神經瘤 (Acoustic neuroma)等，所產生之長期治療成效分析預測與併發症相關性研究與預防

電　話: 02-55704213 #24213
Email : wade012@gmail.com

AI application in Brain lesion detection and Gamma-Knife Radiosurgery outcome prediction



NeuroImage: Clinical 21 (2019) 101608

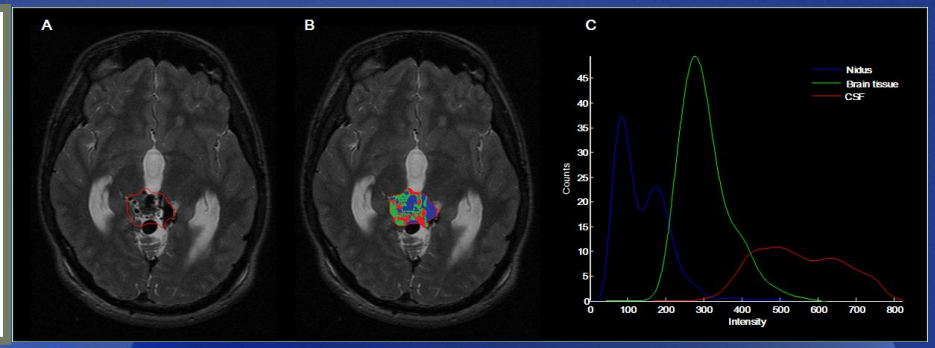
Contents lists available at ScienceDirect

NeuroImage: Clinical

journal homepage: www.elsevier.com/locate/ynicl

Fully automated tissue segmentation of the prescription isodose region delineated through the Gamma knife plan for cerebral arteriovenous malformation (AVM) using fuzzy C-means (FCM) clustering

Syu-Jyun Peng[a,b], Cheng-chia Lee[c,d], Hsiu-Mei Wu[d,e], Chung-Jung Lin[d,e], Cheng-Ying Shiau[d,f], Wan-Yuo Guo[d,e], David Hung-Chi Pan[c,d,g], Kang-Du Liu[c,d], Wen-Yuh Chung[c,d], Huai-Che Yang[c,d,*]



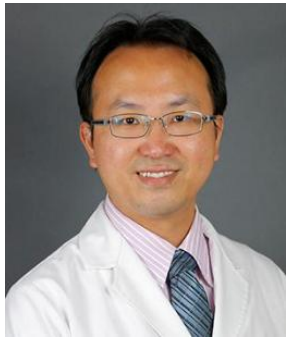
Artificial Intelligence Auto Segmentation Application for Evaluate the Risk of Radiosurgery for Cerebral Arterio-Venous Malformation (ASAP- AVM)

李政家

Deep Mets: Auto detection and AI Generation of radiology report for brain metastases in brain MRI

nycu

李政家 副教授



職稱:國立陽明交通大學醫學院外科學系部定副教授
北榮神經醫學中心神經外科主治醫師
學經歷:國立陽明交通大學腦科學研究所博士
國立陽明交通大學醫學系醫學士
美國維及尼亞大學神經外科臨床研究員
Email :yfnaughty@gmail.com
個人網頁:https://www.vghtpe.gov.tw/Teacher.action?tid=831

研究領域

- 難治型癲癇
- 聚焦超音波
- 加馬刀放射治療

正在進行之研究方向

- 加馬刀跨國性研究
- 藥物難治型癲癇、巴金森氏症、顫抖症
- 影像與人工智慧的結合應用

合作夥伴

紀乃方 副教授

現職:國立陽明交通大學 醫學系神經學科 專任副教授
北榮神經醫學中心腦血管科 主治醫師

學經歷:
國立陽明大學醫學系醫學士
臺灣腦中風學會 理事
臺北醫學大學 雙和醫院中風中心主任
美國耶魯大學研究員

辦公室: 北榮神經醫學中心16樓 room 456
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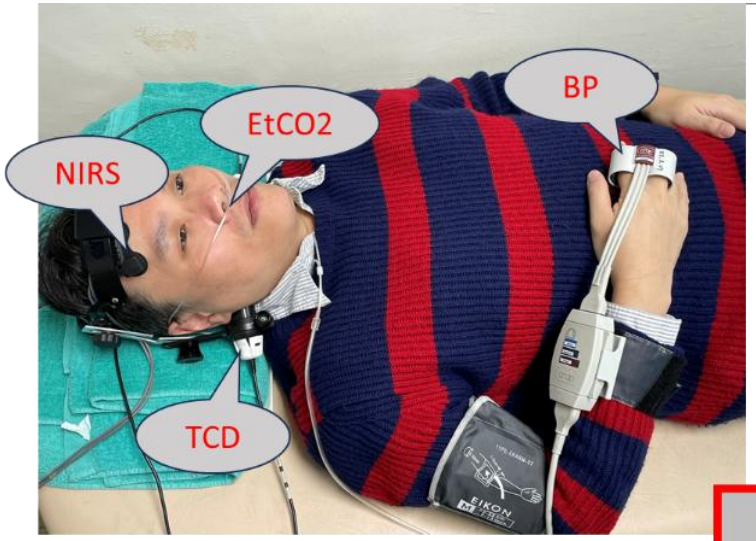
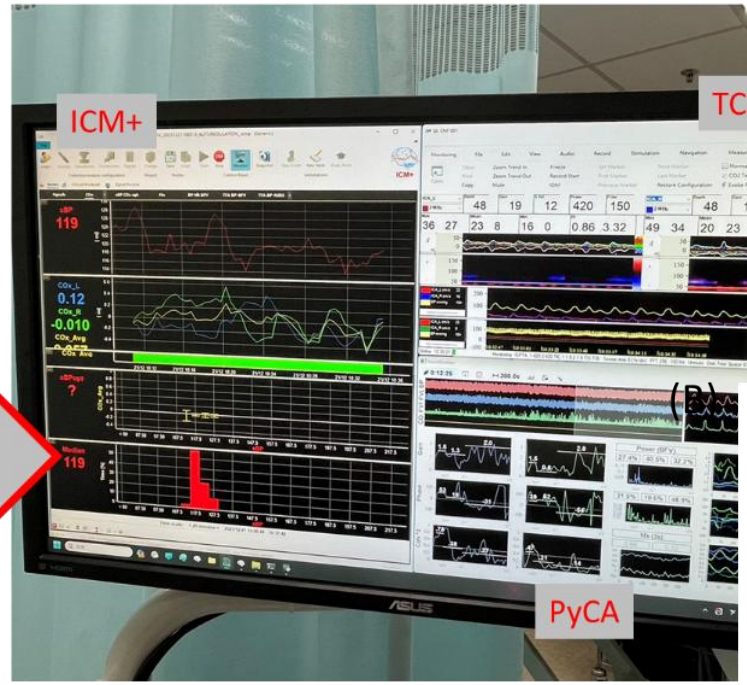
Email :naifangchi@gmail.com
個人網頁: https://scholar.nycu.edu.tw/zh/persons/nai-fang-chi

研究領域

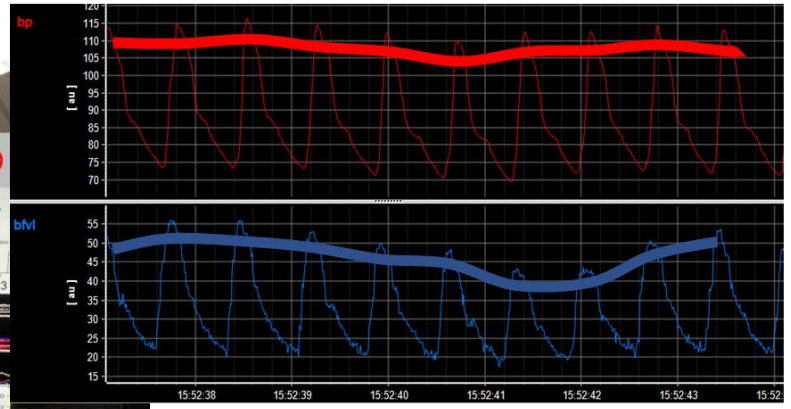
- 腦血管疾病
- 腦血流動力學
- 腦血管超音波

腦血流自動調節
血壓/腦血流超音波/近紅外腦血流光譜分析

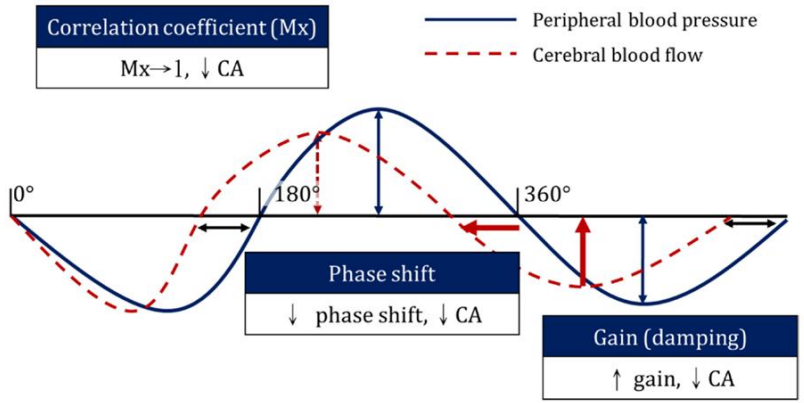




(A)



(B)



陳麗芬 教授

國立陽明交通大學 腦科學研究所 專任教授

國立陽明交通大學 醫學系工程醫學學科 合聘教授

國立陽明交通大學 智慧健康照護跨域學程 醫學系負責人

網頁介紹: https://bmlab.web.nycu.edu.tw

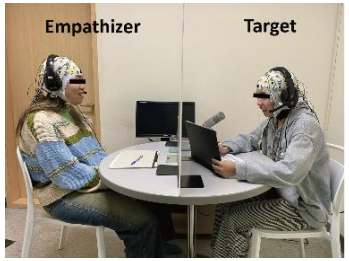
Tel: (02) 2826-7384

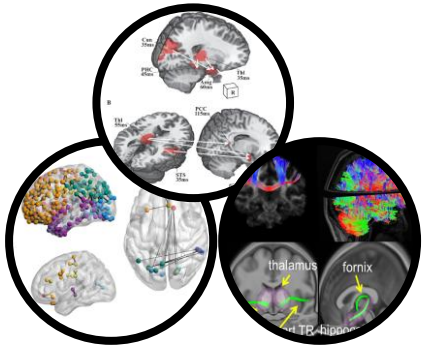
Fax: (02) 2827-3123

E-mail : lfchen@nycu.edu.tw

研究專長

- 生醫工程
- 腦訊號與影像分析
- 機器學習/深度學習





正在進行之研究方向如下：

1. 運用多模態生物特徵與雙人腦電波探討同理情緒對話之神經機轉
2. 以AI技術發展rTMS運用於難治型憂鬱症之個人化精準醫療 (振興醫院合作案)
3. 自殺評估：建置以多型態神經影像為基礎之自殺傾向與自殺意念評估系統(北榮合作案)
4. 開發深度學習融合模型，以建置結合繪畫多模態行為與神經生理特徵之情緒狀態評估平台(北榮合作案)：兒童 MRI 模擬實驗室建置、數位繪圖版多模態系統建置

腦造影實驗室近期研究工具與技術開發

EEG Hyper-scanning
雙人腦電波擬真實實驗

Audio-only

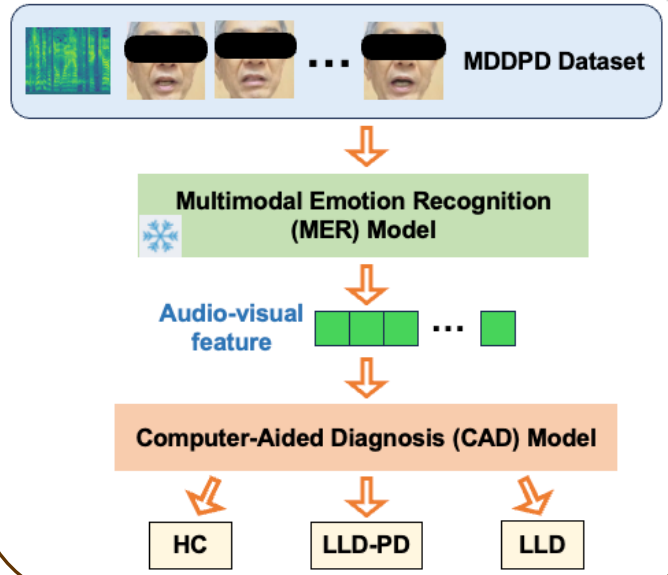
Audio-visual

Conversation

結合多模態資料之深度學習模型開發

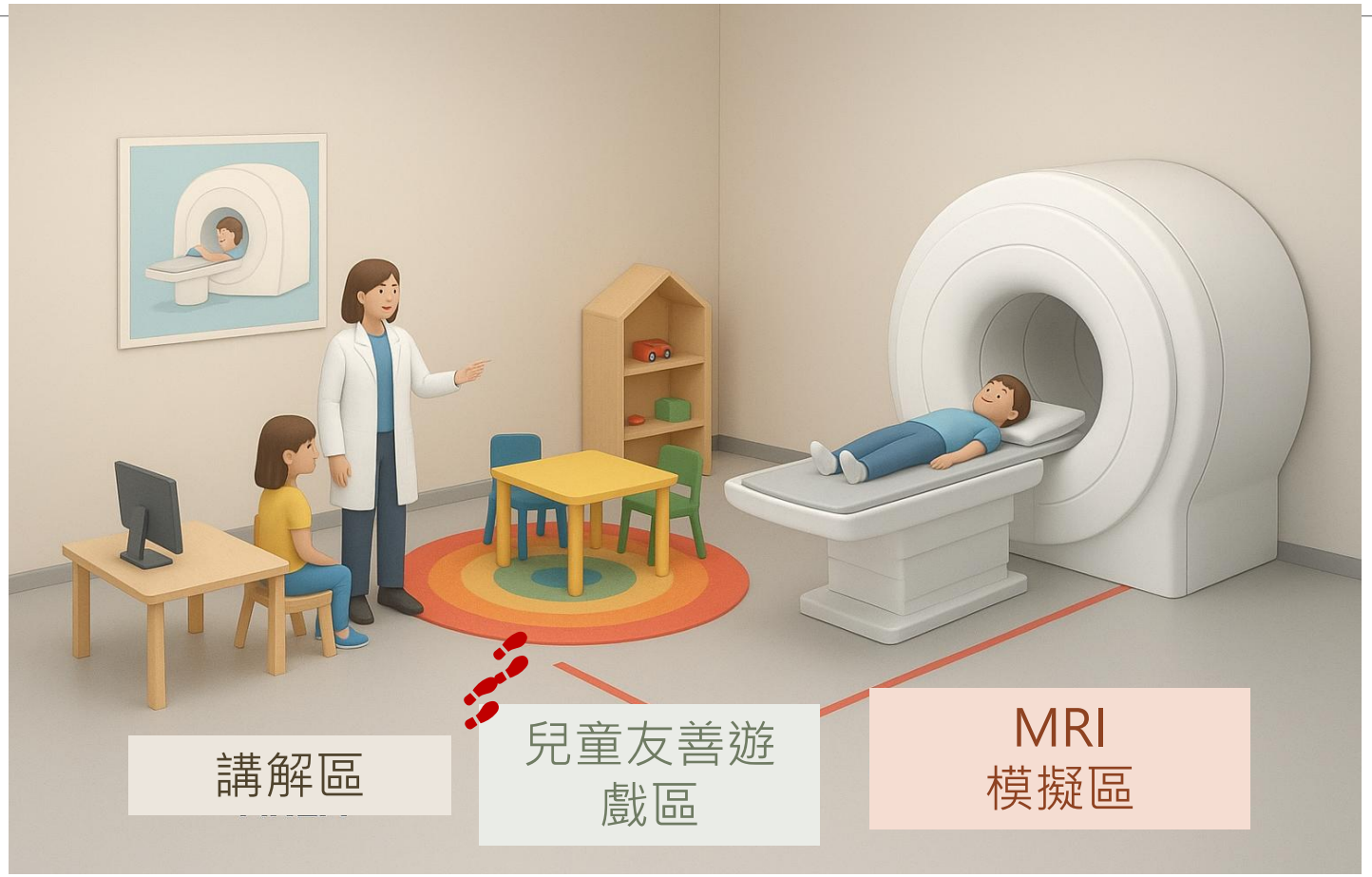
臨床問診錄影

語音　　動態人臉表情



腦造影實驗室近期研究工具與技術開發

兒童 MRI 模擬器（北榮兒童外科合作案）



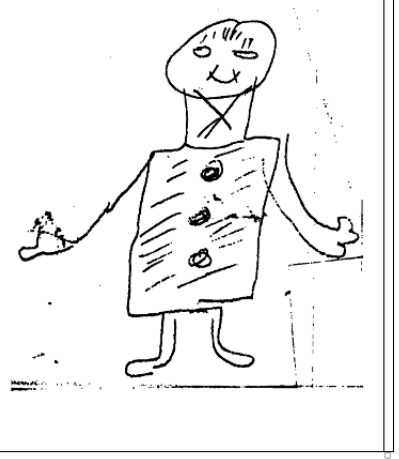
腦造影實驗室近期研究工具與技術開發

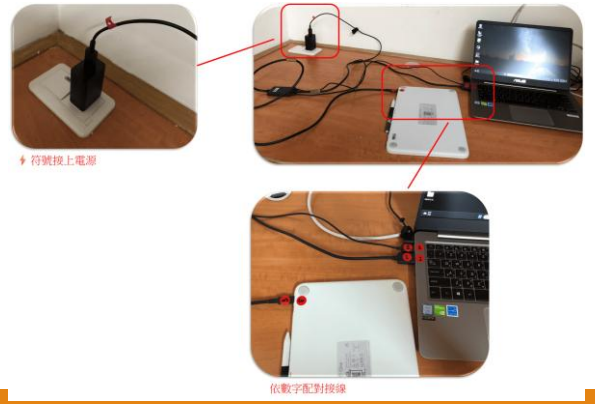
開發評估心智狀態之多模態數位繪畫系統（北榮精神科合作案）

(表) 畫人測驗評分標準(4)。

變數	圖形指標	圖形指標描述
A	彌補性防禦	不穩定、模糊的羽狀線條，多次侵蝕
B	衝動控制障礙	長脖子
C	“有機性”指標	部分之間缺乏整合/對稱性
D	“精神病性”指標	異常/比例失調的品質
E	憂鬱	小型或空洞的人物
F	否認與投射	空洞的眼睛，缺失的耳朵
G	解離性跡象	身體部分的融合
H	明顯的攻擊性	長而尖銳的手指和牙齒
K	自殺風險的特定指標	頸部、前臂或其他身體部位的割傷線條

(圖) 畫人測驗圖例。





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研究領域：

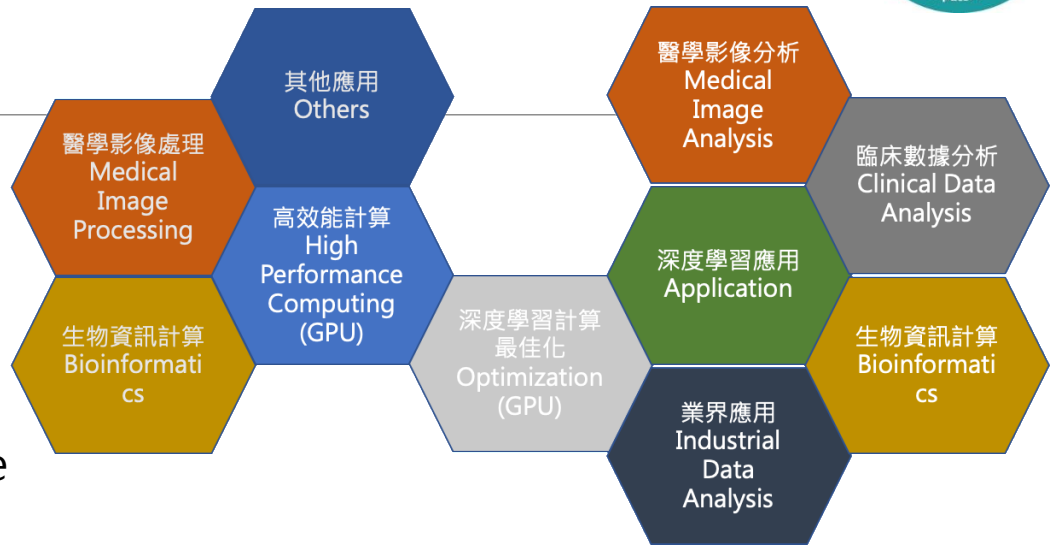
- 智慧醫療(Smart Medicine)
- 深度學習(Deep Learning)
- 醫學影像分析(Medical Image Analysis)
- 生物資訊計算(Bioinformatics Computing)
- 高效能計算(High Performance Computing)

目前研究方向：

- OCT影像辨識視網膜病變
- X光影像辨識骨折
- MRI/CT影像辨識肝癌
- 超音波辨識/預測心臟衰竭
- 臨床影像辨識皮膚疾病
- 表情影像辨識憂鬱症
- 平行計算加速醫學影像計算
- 平行計算加速生物計算

合作夥伴:

洪哲倫博士 (國立清華大學資訊工程博士)
國立陽明交通大學生物醫學資訊所教授
巴黎薩克雷大學高效能計算實驗室合聘教授
靜宜大學資訊傳播學系合聘教授
麗臺科技研發顧問
工研院資通所深度學習優化技術顧問
華廣生技血糖儀研發顧問



- 執行超過數十項科技部與業界產學計畫
- 法國、英國、波蘭合作研究計畫
- 發表100餘篇學術論文
- 美國專利-Method and manager physical machine for virtual machine consolidation (US8745234B2)
- 台灣專利-皮膚癌影像辨識(新型第M635542號)
- 台灣專利-皮膚疾病影像判讀方法及皮膚疾病影像判讀系統(發明第I874826號)
- 台灣專利-智慧病歷品質評比系統及方法(發明第I8814234號)

- 研發NoCode AI平台（麗臺科技）
- 研發電路板瑕疵檢測系統 （南亞電）
- 研發OCT影像黃斑部病變辨識系統（台中榮總TFDA）
- 研發膚質影像辨識系統（108年科技部亮點產業計畫）
- 研發機械加工紋路辨識系統 (科技部計畫）
- 研發連續性血糖儀 （華廣生技）
- 研發影像為主的跌倒偵測系統 (台中榮總）
- 研發疲勞駕駛偵測系統 （由田科技）
- 心臟衰竭預測（馬偕醫院）
- 整合嵌入式AI晶片與先進CNC控制器之系統設計與研發（114年國科會計畫）
- 整合邊緣運算模組於生成式AI智慧製造系統研發（114年國科會計畫）
- SkyMars 機聯網 (PMC)
- 研發食物影像辨識系統 （無敵科技）
- 研發道路號誌影像辨識系統（自駕車-工研院合作）

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Image Processing and Analysis
Data Analysis
Machine Learning and Deep Learning
Large Language Models

Publications:
Image Descriptions for Visually Impaired Individuals to Locate Restroom Facilities, Cheng-Si He ,Nan-Kai Lo, Yu-Huan Chien and Siao-Si Lin

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Medical Image Processing and Analysis
Deep Learning
Large Language Models

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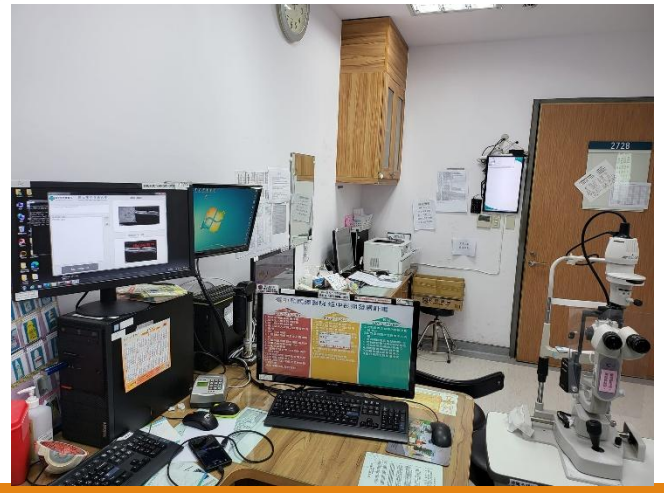
Image Processing and Analysis
Machine Learning and Deep Learning
Large Language Models

醫療應用(1)

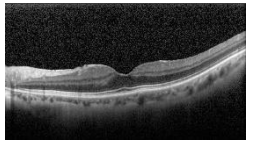
病歷品質評分系統-使用NLP技術透過收集的病歷訓練評分模型
可以針對不同科別不同醫院，建立不同的評分規則。

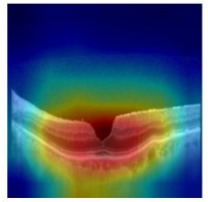
皮膚癌辨識系統

使用深度學習技術辨識五種不同的皮膚癌病變，辨識準確度超越醫師。
已經獲得專利。

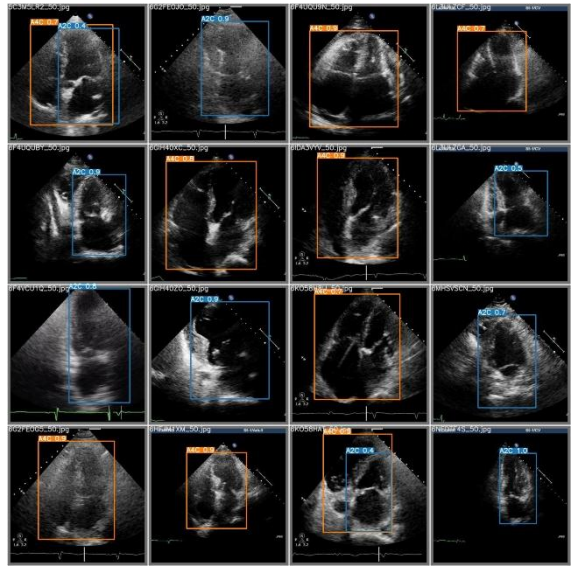


黃斑部病變辨識系統-使用深度學習技術辨黃斑部病變，辨識準確度超越醫師。



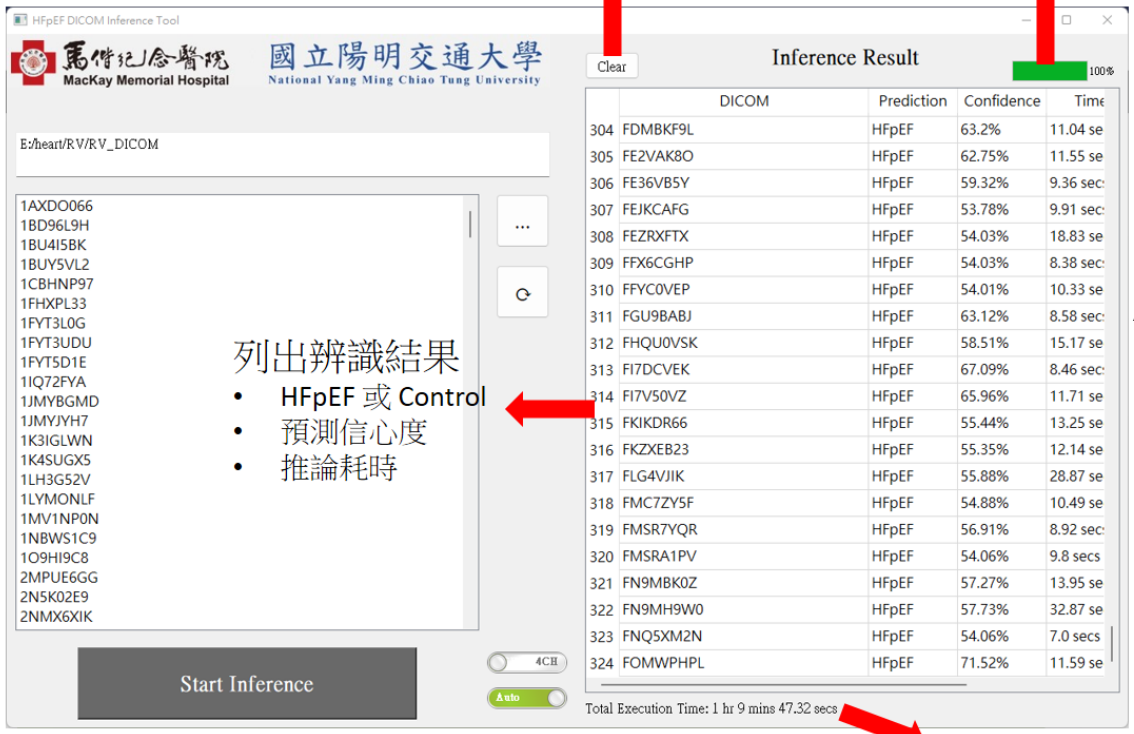


醫療應用(2)



清空已顯示結果

運行進度條

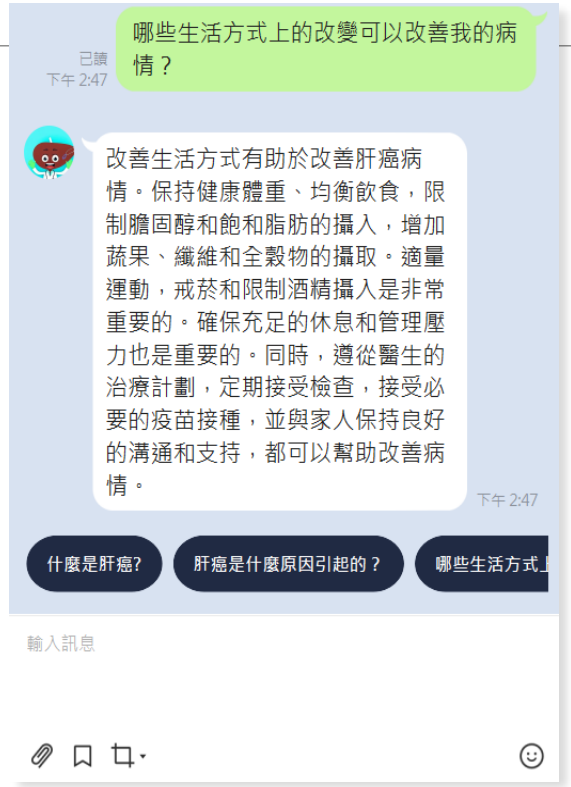


顯示總執行時間

心臟衰竭預測系統

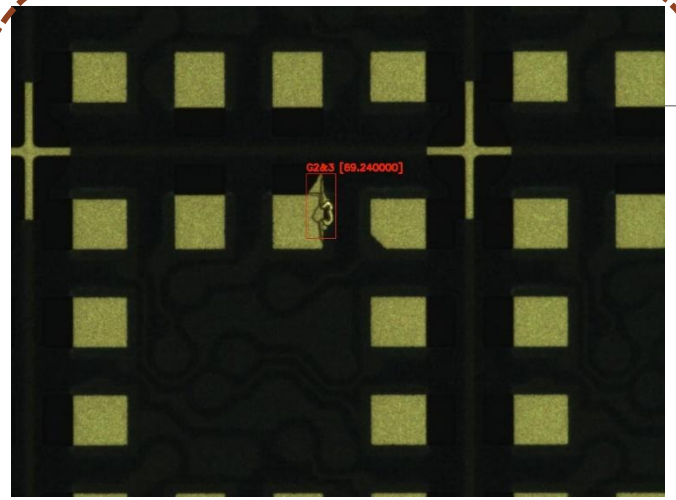
透過心臟超音波影像，進行心臟收縮舒張進行AI預測，預測結果顯示在介面上。
AI推論運算由Intel的AI晶片進行心臟超音波影像處理。

醫療應用(3)

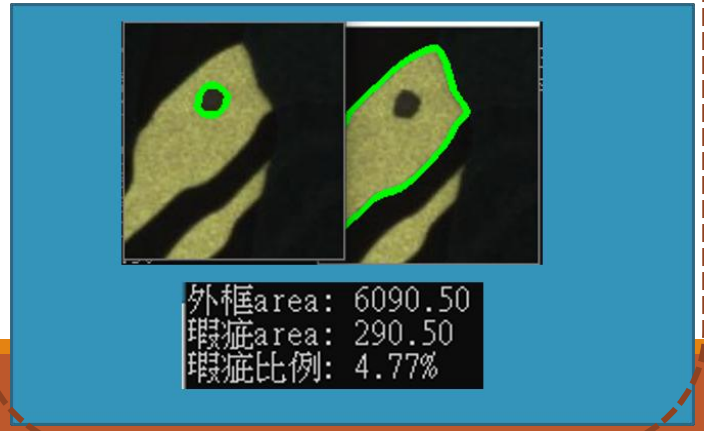


肝癌保健聊天機器人研究計畫：
透過LLM模型，訓練肝癌保健相關資料，
建立Q&A模型

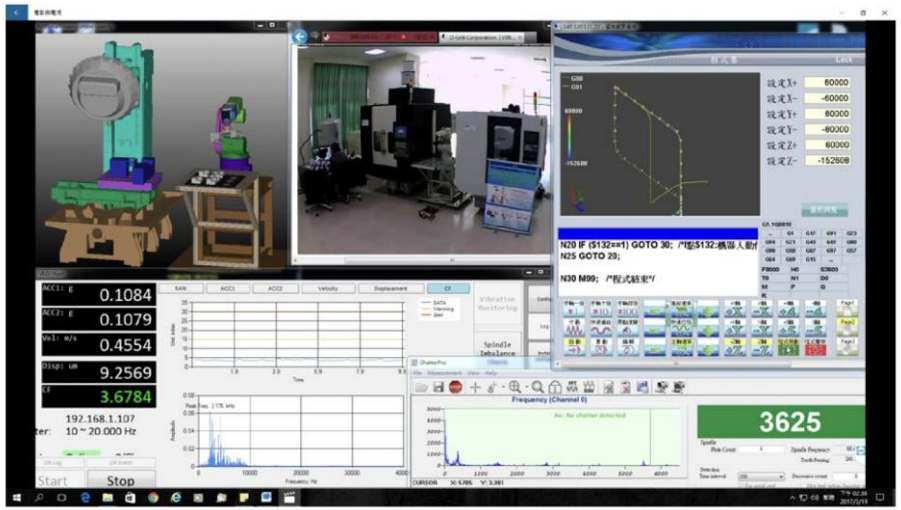
工業應用(1)



南亞電路板公司產學合作計畫：
電路板瑕疵檢測，透過機邊電腦的AI模型辨識，瑕疵面積計算



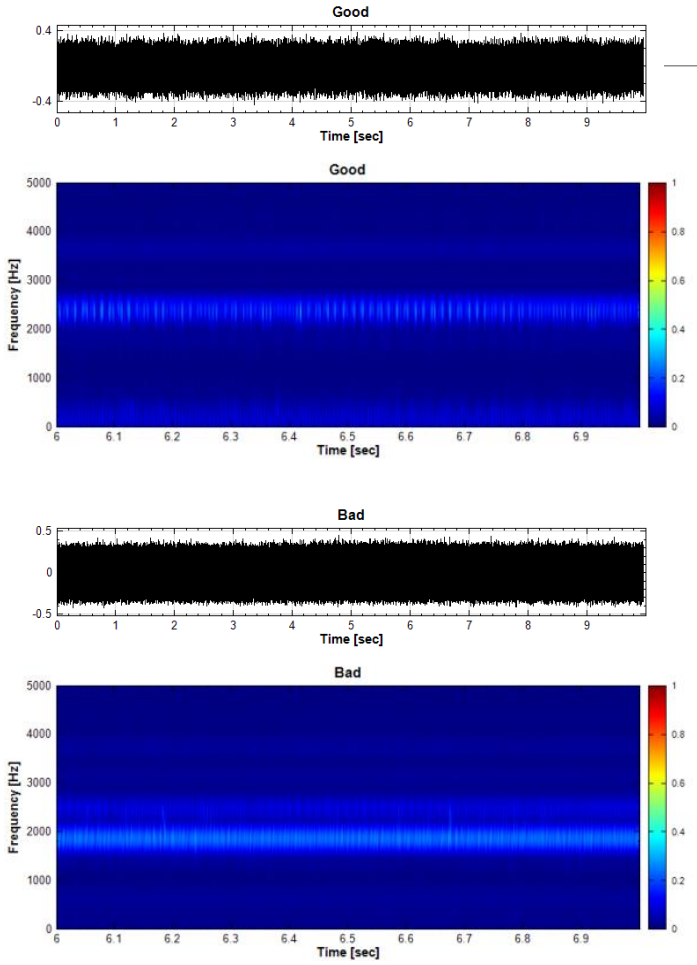
國科會計畫：
刀具磨耗辨識，透過機邊電腦經由影像進行監測刀具磨耗狀態。



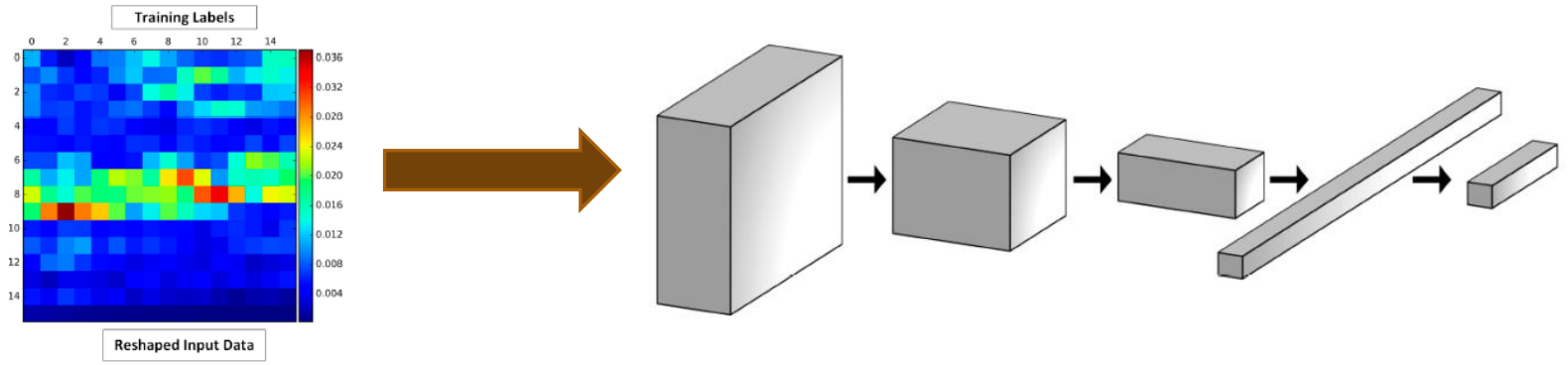
國科會計畫：
機邊電腦擷取加工機具數據進行遠端監測

工業應用(2)

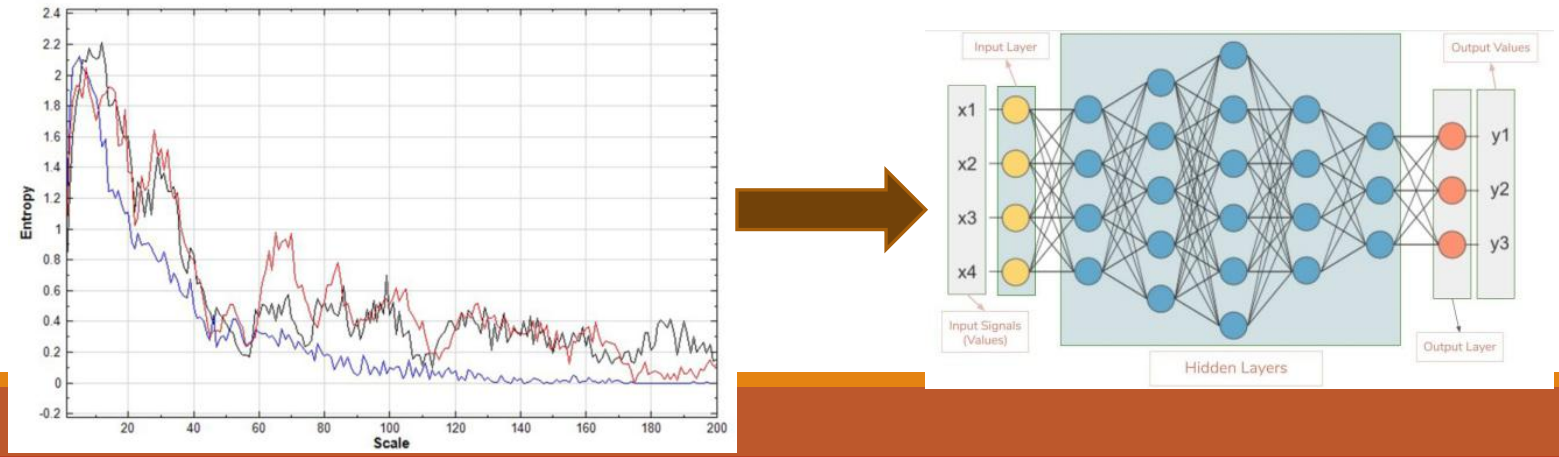
資策會產學合作計畫：
馬達保養預測（偵測馬達異音，預測是否需要保養維修）



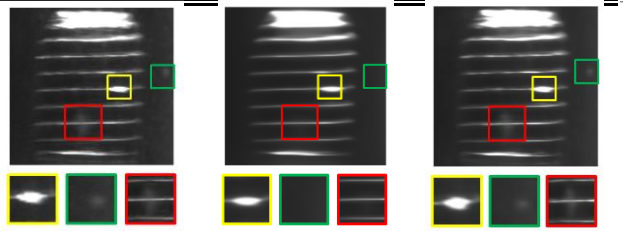
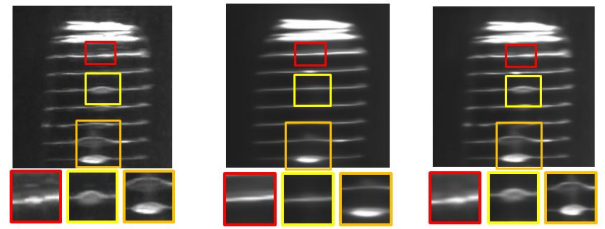
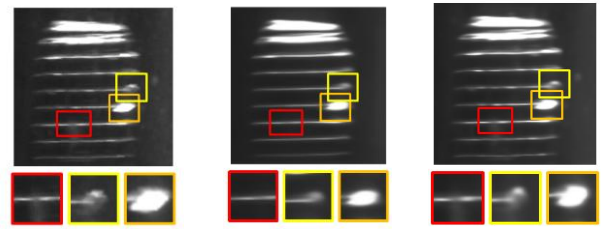
Through time-frequency analysis, the sound signal or vibration signal is converted into a time-frequency map, then will be compressed and classified by convolutional neural network.



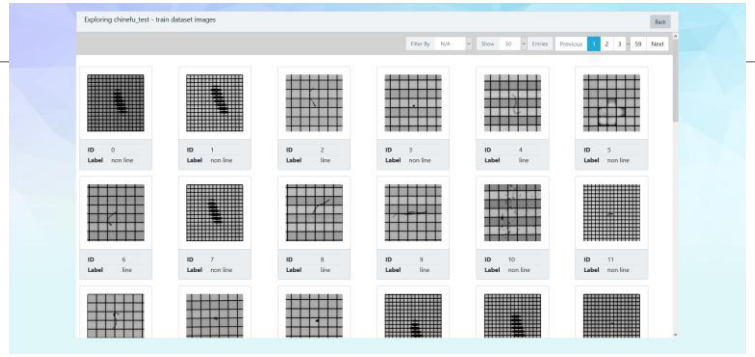
The feature is extracted with MSE the classification is predicted with simple neural network

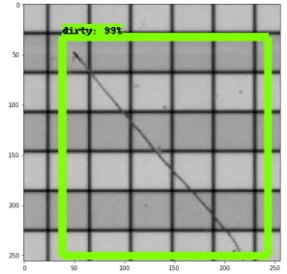


工業應用(3)

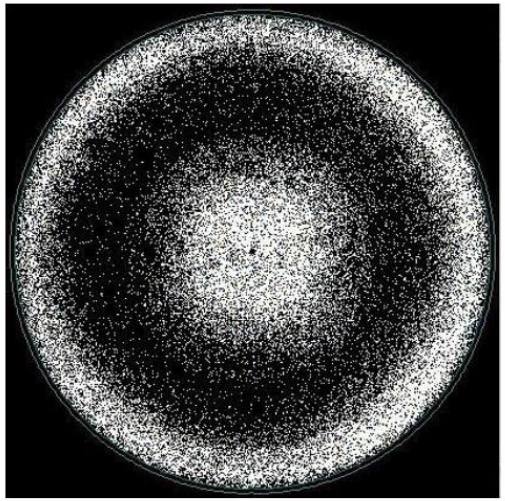
Sample No.	Original	DAE	BAE
1			
2			
3			

研究計畫：
螺絲瑕疵檢測，檢測螺絲表面紋路瑕疵



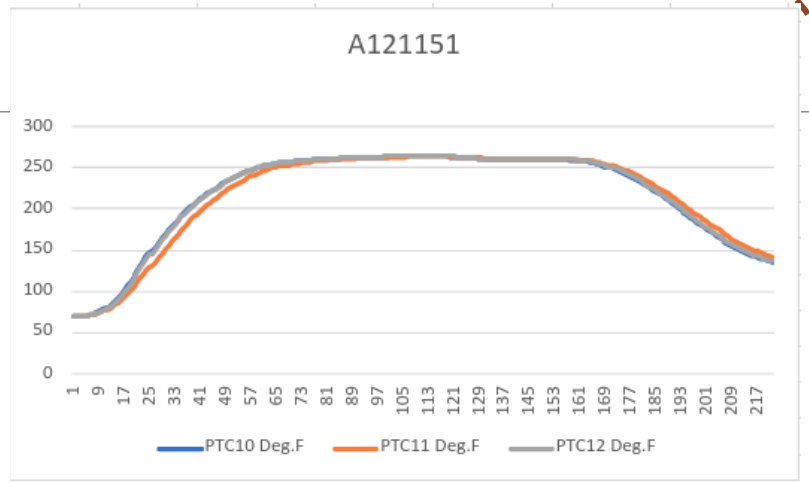


華凌光電產學合作計畫：
辨識LED面板瑕疵

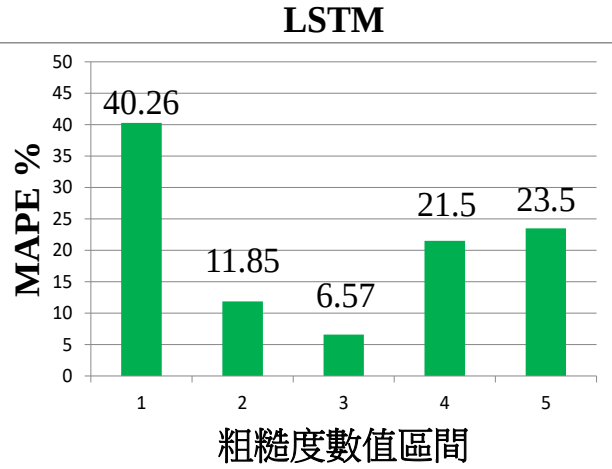


中國砂輪產學合作計畫：
預測再生晶圓重工率

工業應用(4)



智慧製造大數據競賽計畫：
漢翔工業熱壓爐溫度曲線預測，
預測溫度曲線升溫趨勢



智慧製造大數據競賽計畫：
工研院表面粗糙度預測，透過主軸電流、主軸轉速等數值，預測加工後，工件的表面粗糙度

目前研究合作

CT影像-肝癌辨識（北榮、中榮、義大）

皮膚相關疾病影像辨識（中榮）

OCT影像視網膜黃斑部病變辨識（中榮、Duke University）

臉部情緒憂鬱症辨識（長庚、Ulster University）

心臟數位孿生系統（馬偕）

裸骨骨折中後裸損傷預測（中榮）

研究方向

人工智慧、醫學影像、醫療資訊、可信任AI、高效能計算

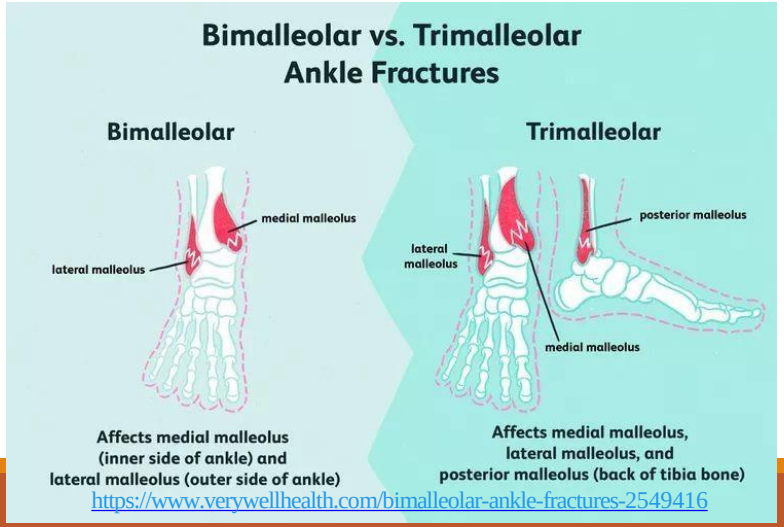
GPT智慧病歷

Deep Learning for Ankle Fracture Classification on X-ray image: Focus on Bimalleolar and Trimalleolar Fractures

輸入經過預處理的腳踝的正面與側面X光影像。

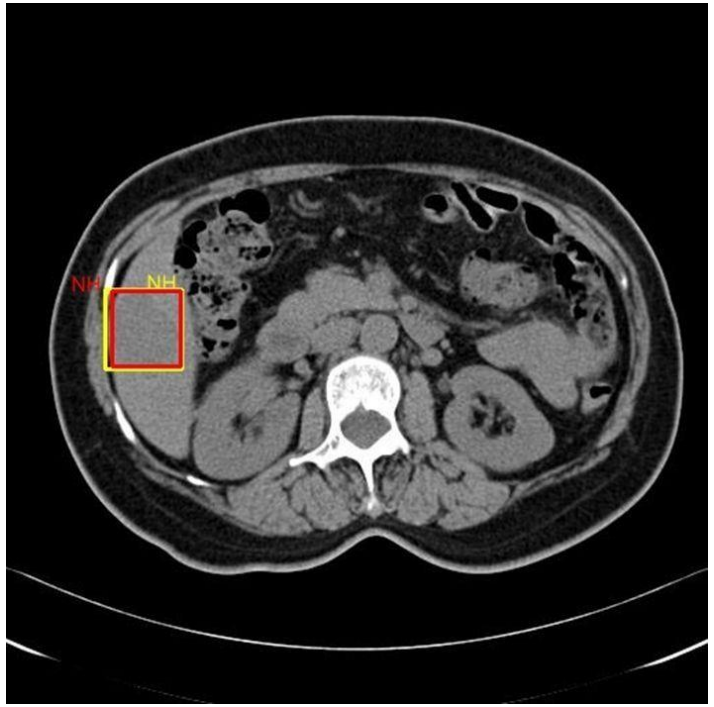
透過機器學習的模型，將腳踝的受傷類型進行沒有骨折、雙踝骨折、三踝骨折的分類。

X-ray images with preprocessing → Deep learning models → Classify
- bimalleolar
- trimalleolar
- no fracture



Automated radiology report generation from liver tumor computed tomography imaging

根據肝臟CT影像自動生成放射學報告。



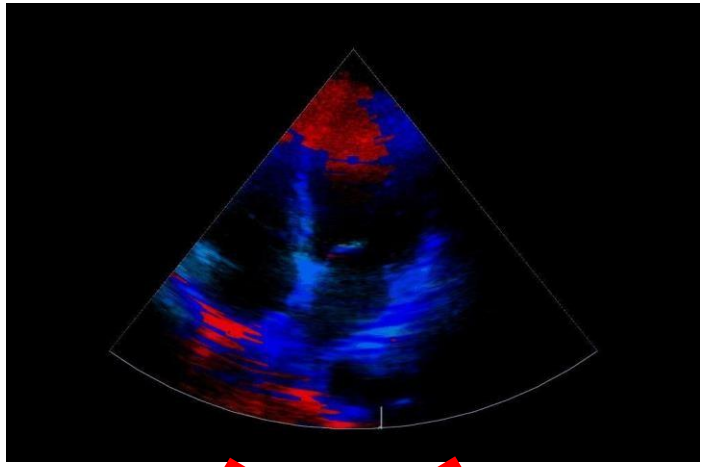
利用YOLO標記出病灶位置，並以方框呈現，接著提取腫瘤的類型、大小、位置等資訊。

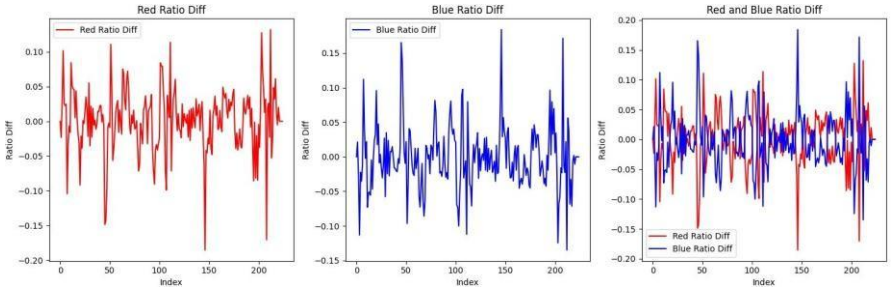
Generated Report

將提取出來的特徵，輸入微調後的AI模型，進行文本報告的生成。

Deep learning approach for diagnosing heart failure using cardiac color doppler ultrasound

透過心臟彩色都卜勒超音波影像，對心臟肌肉運動速度進行心衰竭預測。

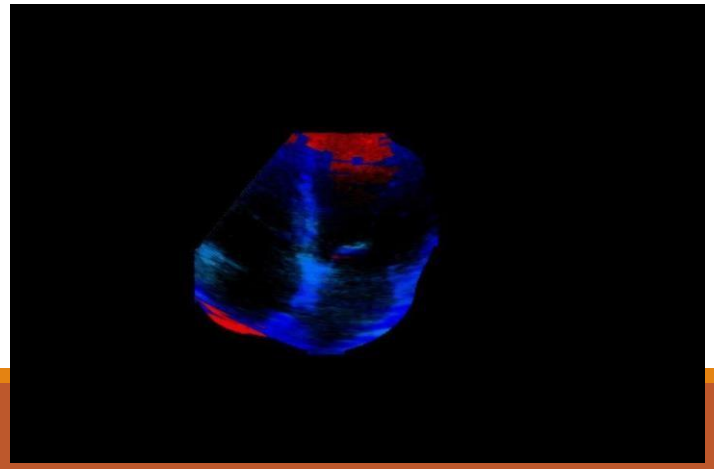


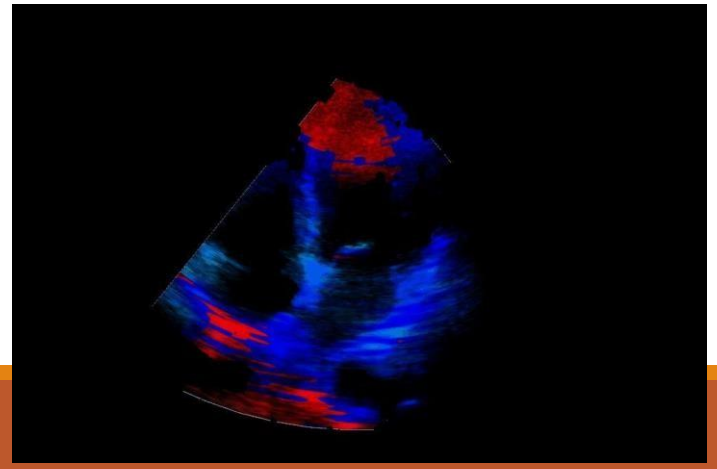


利用YOLO切割出預先label好的影像✲訓練，進而透過AI模型✲心臟肌肉區域的切割。

對超音波影像✲光流計算，推算出其累加動量，進而切割出心臟肌肉區域。

將切割後的心臟肌肉區域轉換成其速率訊號，以利後續AI模型✲預測。





指導學生優良事蹟

呂則賢同學

榮獲「2022第27屆大專校院資訊應用服務創新競賽耐能邊緣運算AI 運用組

第二名

專題名稱: 光學同調斷層掃描黃斑部皺摺辨識

呂則賢同學

榮獲「台灣雲端計算學會學術暨產業創新獎-最佳碩士論文獎第一名」

許煒淇同學

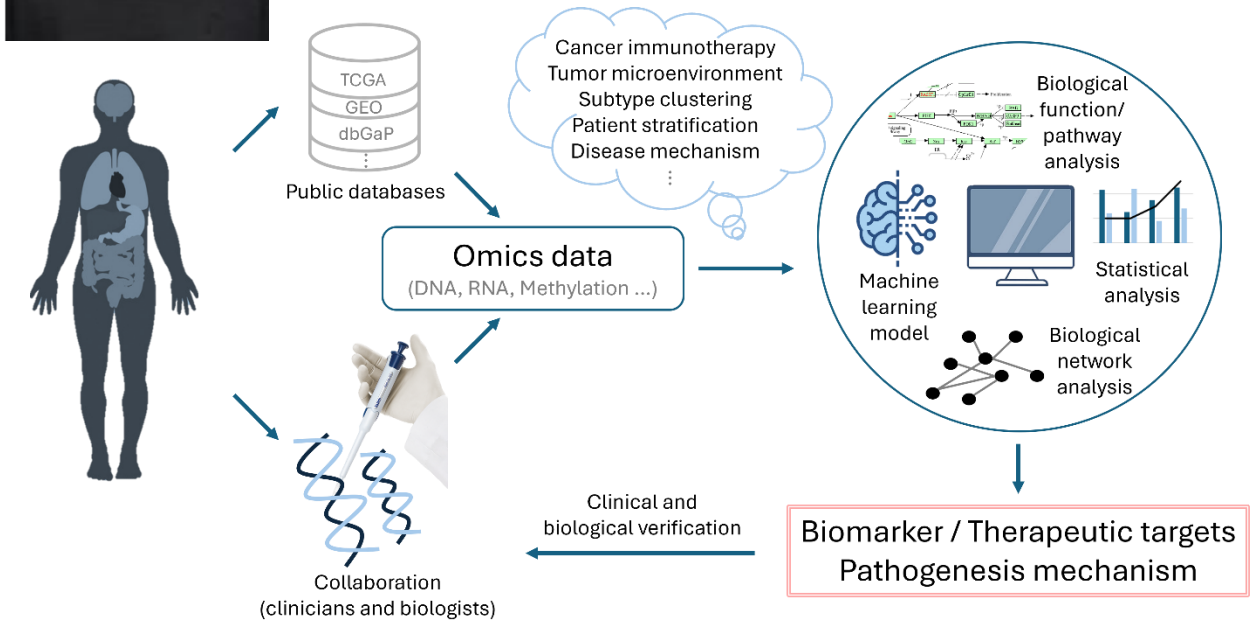
榮獲「 IVSP 2025 最佳簡報獎」

林宜嫻同學

榮獲「 TACC台灣雲端計算學會2022最佳碩士論文獎-第三名」

王禹超 教授

生物醫學資訊研究所教授
Tel: 02-28267973
Email: yuchao@nycu.edu.tw
Web: https://yuchao.web.nycu.edu.tw/



研究領域

- 生醫數據分析與人工智慧之臨床應用
- 轉譯生物資訊
- 系統生物學

目前研究方向

- 利用全面性多體學分析探索具有潛力的免疫檢查點抑制劑預測生物標記
- 肺腺鱗狀細胞癌之體學資料分析
- 內生性連續複製變異之跨癌症全面性分析
- 癌症多體學資料與病理影像分析及其在精準醫學的應用

鍾翊方 教授

國立陽明交通大學 生物醫學資訊研究所 專任教授
國立陽明交通大學 急重症研究所 合聘教授
網頁介紹: https://github.com/NYCUciflab

Tel: (02) 2826-7358
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研究領域

- 生物資訊
- 醫學影像分析
- 深度學習

正在進行之研究方向如下：

1. 引入人工智慧於建立肺腺癌病人之復發預測模型與跨資料集應用
2. 深度學習於腎臟切片病理影像切割分析
3. 以深度學習運用於未標註/高雜訊的醫學影像: 以睡眠內視鏡為例
4. 深度學習於藥物反應與協同作用預測

陳翎 助理教授

國立陽明交通大學
醫務管理研究所
Institute of Hospital & Health Care Administration

國立陽明交通大學 醫務管理研究所 專任助理教授
Clarivate (Australia) Researcher
TrademarkVision (Australia) Research Developer

網頁介紹: https://https://ihha.nycu.edu.tw/
Tel: (02) 2826-7000 #65337
E-mail : ling.chen@nycu.edu.tw

研究領域

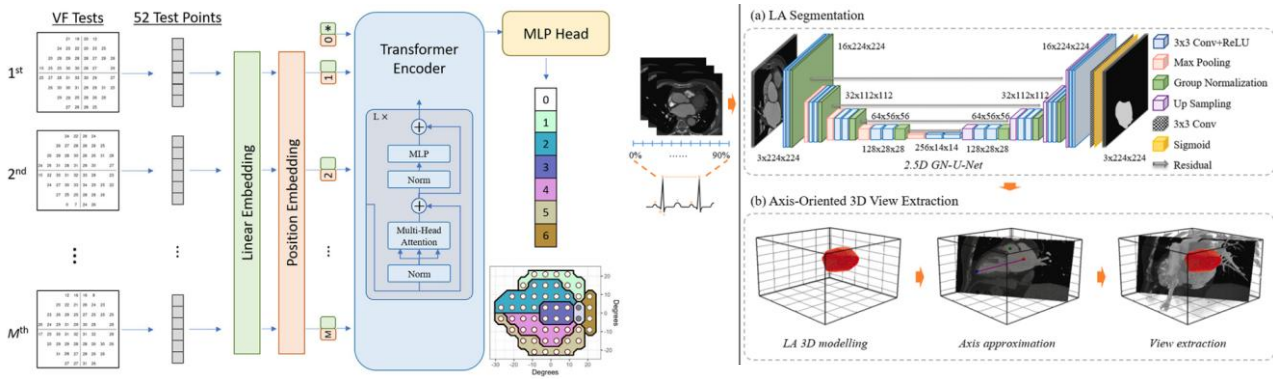
- 智慧醫療
- 深度學習
- 醫療影像分析

學歷

- 澳洲昆士蘭大學電腦科學博士
- 澳洲昆士蘭大學電腦科學碩士
- 國立台灣大學哲學系學士

主要研究方向

1. 開發多模態與時序性深度學習技術輔助青光眼診斷與治療
2. 基於深度學習技術的心臟影像分析
3. 從腦部電腦斷層影像辨識嬰幼兒虐待性頭部創傷



鄭浩民 教授

職稱:醫學系內科
北榮教研部實證醫學中心主任
電　話:02-2875-7434#307
Email : hmcheng@vghtpe.gov.tw

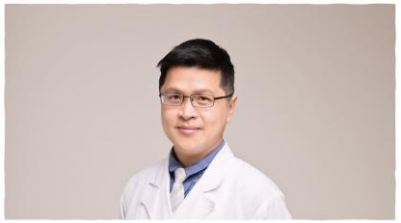
研究領域

- 統合分析
- 心臟血管血流動力學
- 心臟血管流行病

Cardiovascular Hemodynamic Lab

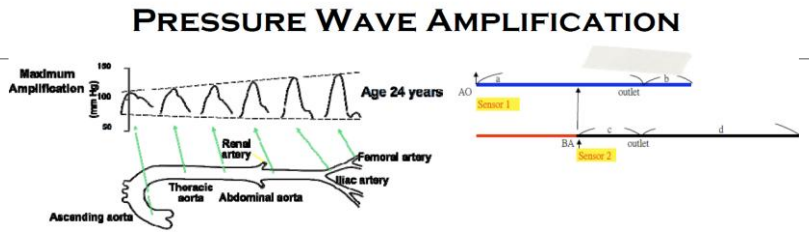
National Yang Ming Chiao Tung University & Taipei Veterans General Hospital

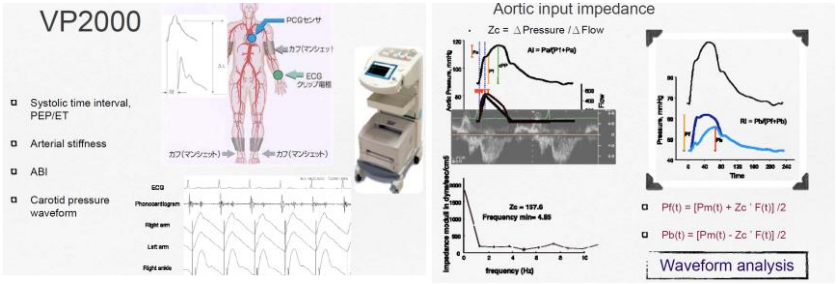
Hemodynamics Team

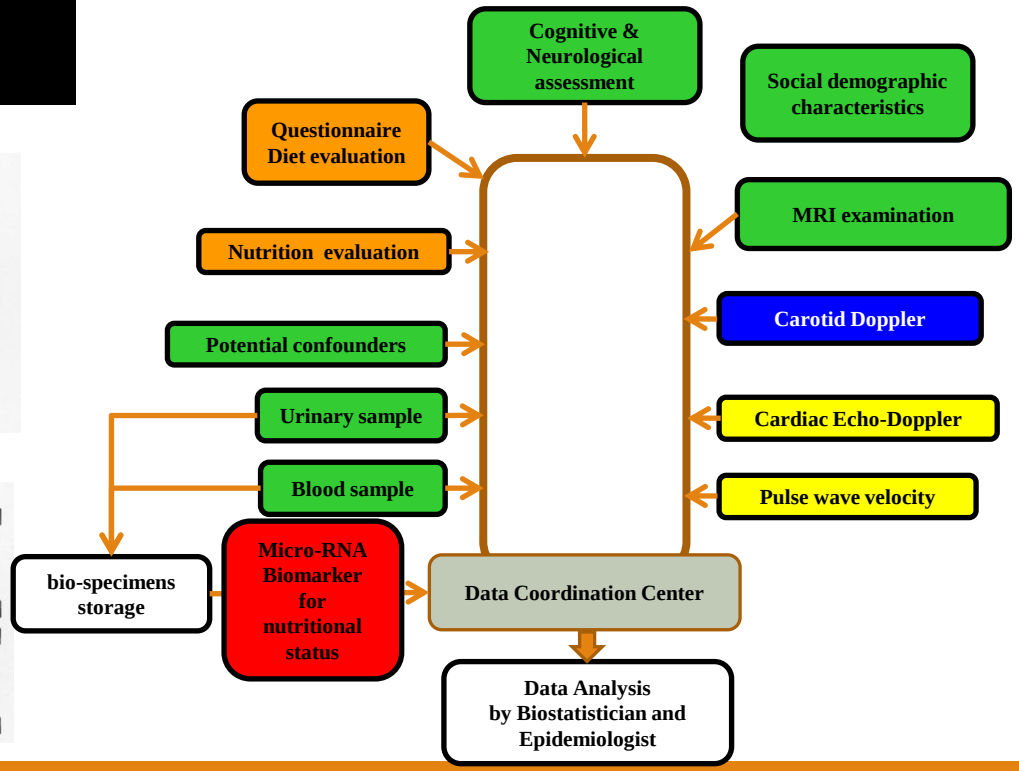


Research Fields

- Research and Development of new technologies
- Invasive and non-Invasive hemodynamic studies
- Epidemiological field studies
- Cardiac images







鄭浩民教授

Director, Division of Faculty Development, Taipei Veterans General Hospital

Visiting staff, Division of Cardiology, Taipei Veterans General Hospital

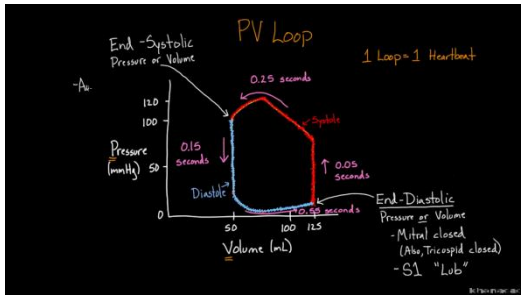
Doctor of Philosophy:

Doctor of Philosophy of Medicine, The University of Adelaide, Australia

- Medicinae Doctor (Doctor of Medicine)

  National Yang-Ming University, Taipei, Taiwan, R.O.C.

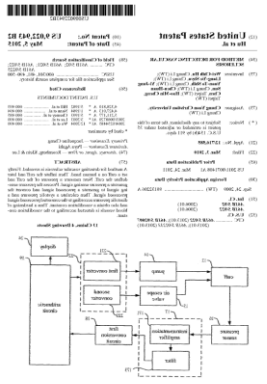
Major Research Interests

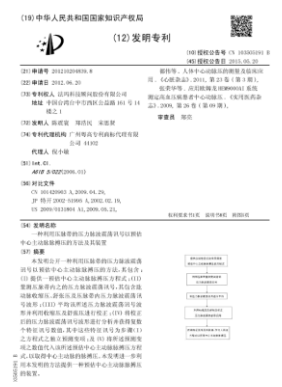


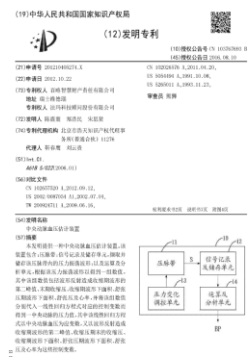
- Epidemiology in
  - Hypertension
  - Vascular aging and organ damage
  - Heart failure
- Systematic review and meta-analysis in cardiovascular medicine
- NHIRD research
- Development of medical devices

Pursuit of Innovation

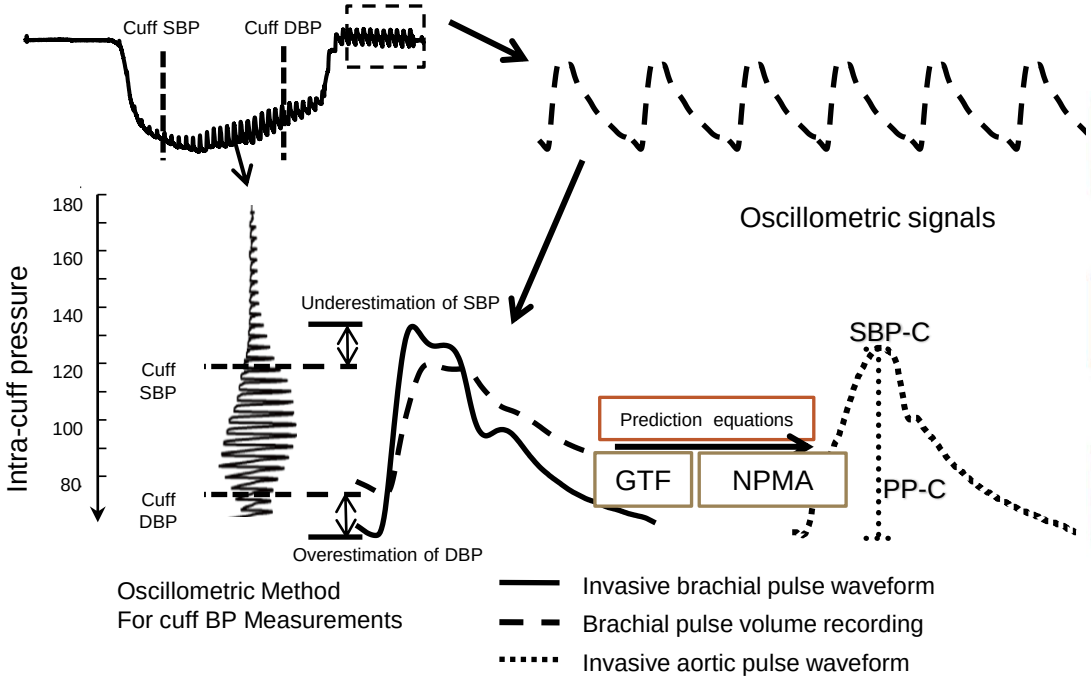
Patent

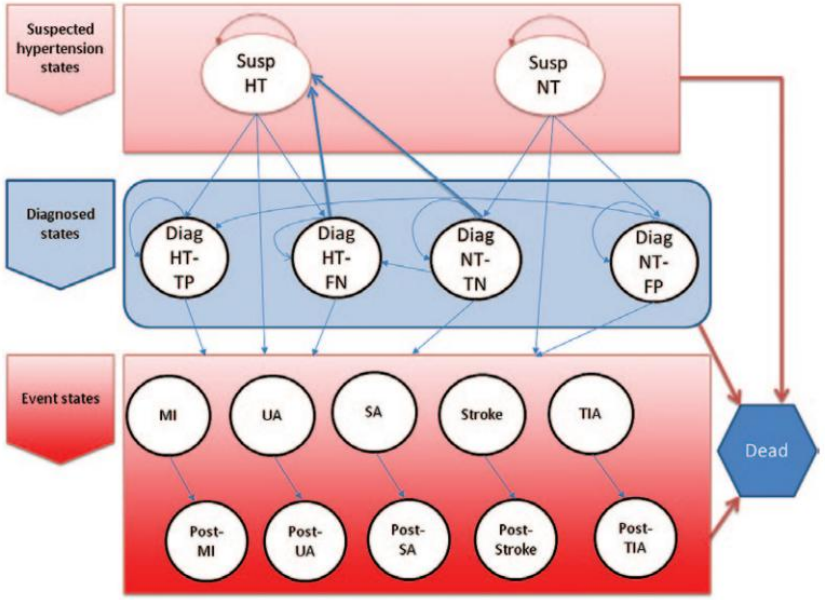






Research and Development





Hypertension. 2014;63(4):865-870.

Hypertens Res. 2010;33(6):592-599.

J Hum Hypertens. 2013;27(3):204-210.

Am J Hypertens. 2015;28:604-14

In the Field of Hypertension

Derivation and Validation of Diagnostic Thresholds for Central Blood Pressure Measurements Based on Long-Term Cardiovascular Risks

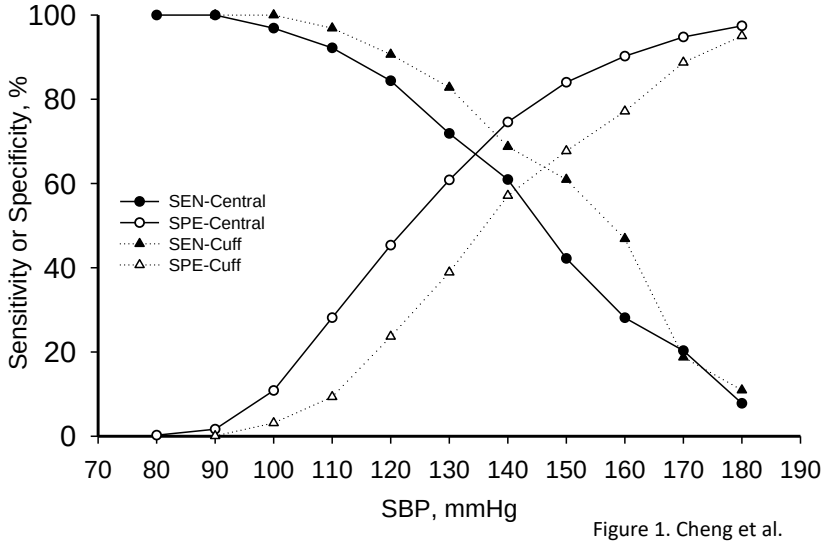


Figure 1. Cheng et al.

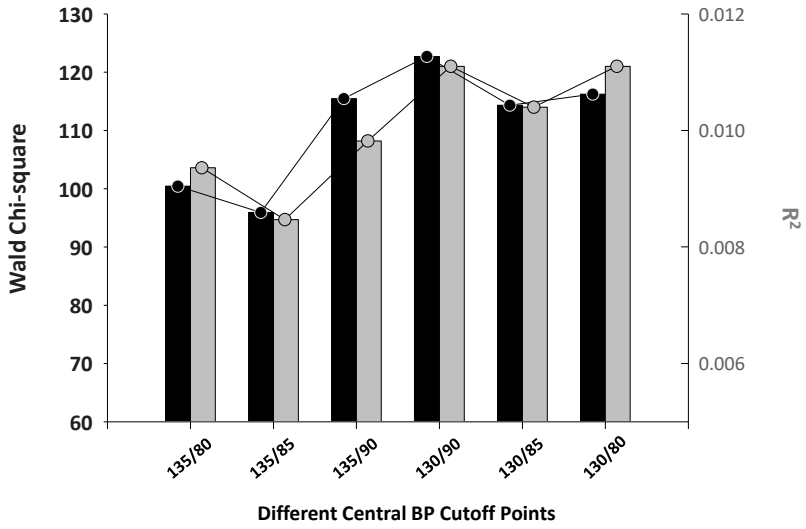
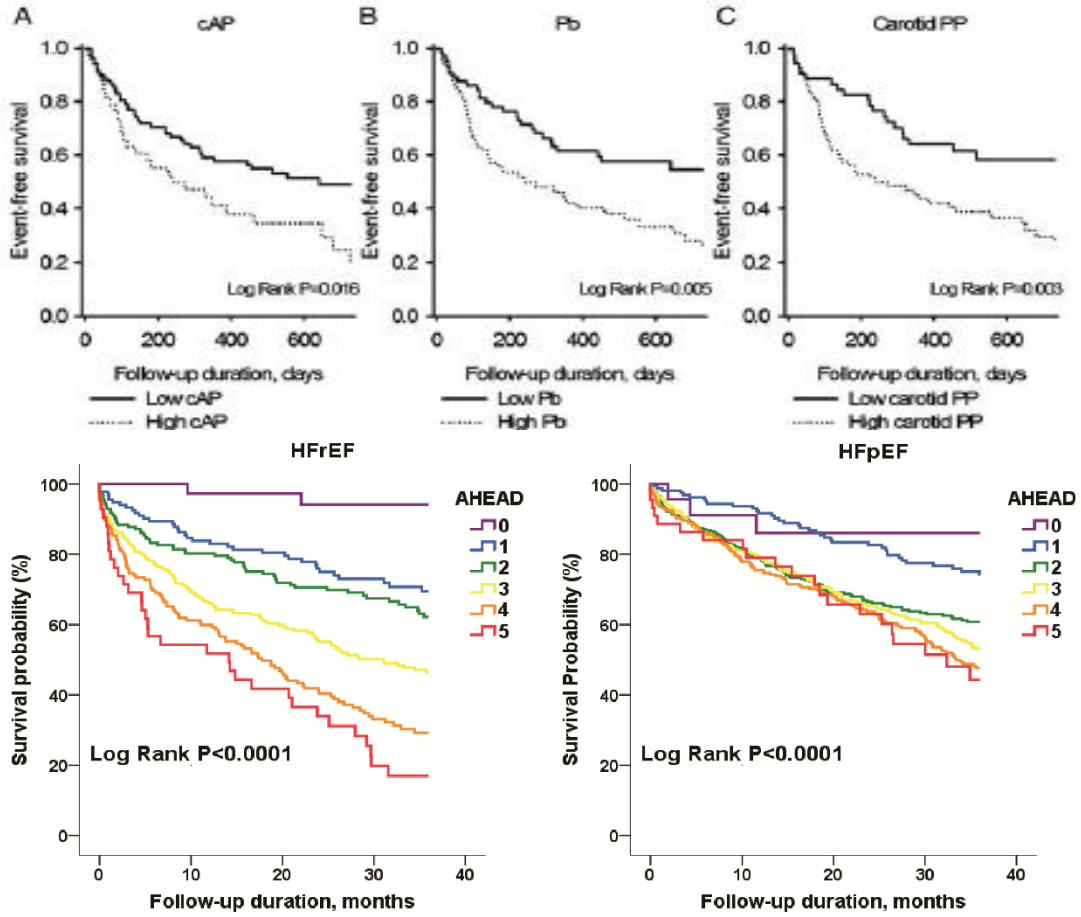


Figure 2. Cheng et al.

J Am Coll Cardiol. 2013;62(19):1780-1787.

In the Field of Heart Failure

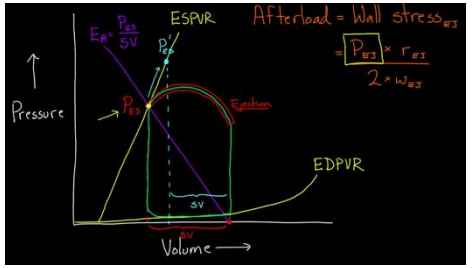


Eur J Heart Fail. 2008;10(12):1192-1200.

Eur J Heart Fail. 2012;14(12):1348-1355.

JAHA. 2017; in press

International Cooperation

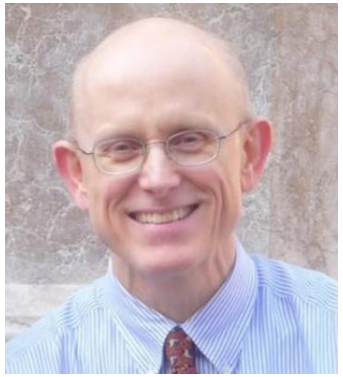


JOHNS HOPKINS MEDICINE

David Alan Kass

JICHI MEDICAL UNIVERSITY
自治医科大学
Jichi Medical University

Kazuomi Kario



Gary F Mitchell

Masters of blood pressure and hemodynamic researches

Framingham Heart Study
A Project of the National Heart, Lung, and Blood Institute and Boston University

MICHIGAN STATE UNIVERSITY
Founded 1855

Ramakrishna Mukkamala

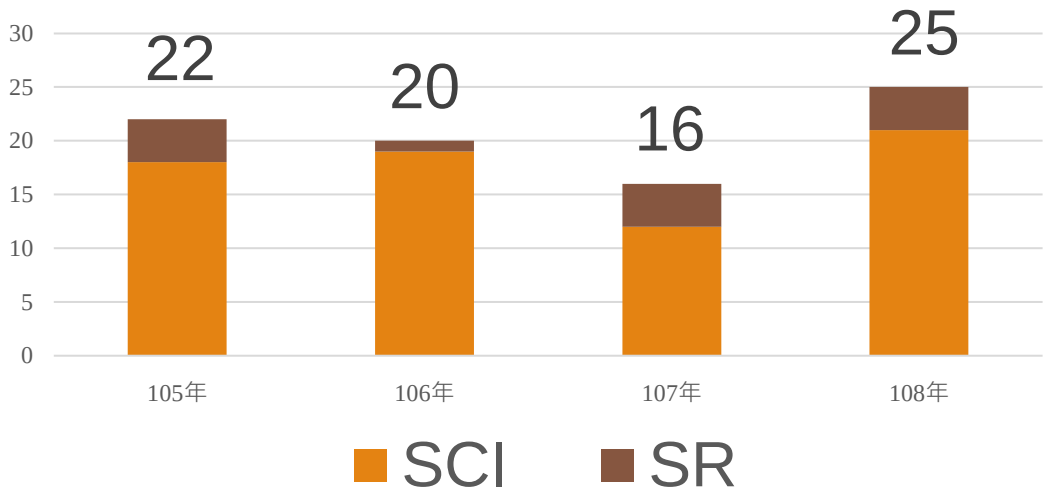
Achievement of Research Mentoring
指導年輕研究人員

姓名	身分	計畫	論文
張皓智	員榮心臟科主治醫師		Chang HC, Cheng HM, Chen CH, et al. Dietary intervention for the management of hypertension in Asia. J Clin Hypertens (Greenwich). 2021;23(3):538-544. Chang HC, Cheng HM, Huang WM, et al. Risk stratification in patients hospitalized for acute heart failure in Asian population. J Chin Med Assoc. 2020;83(6):544-550. Chang HC, Huang CJ, Cheng HM, et al. Nocturnal thoracic volume overload and post-discharge outcomes in patients hospitalized for acute heart failure. ESC Heart Fail. 2020. Chang HC, Cheng HM. P wave peak time: A time window to evaluate left ventricular diastolic function. J Clin Hypertens (Greenwich). 2019;21(5):616-617.
王維庭	北榮心臟科主治醫師		Wang WT, Sung SH, Wang JJ, et al. Excess Pressure Integral Predicts Long-Term All-Cause Mortality in Stable Heart Failure Patients. Am J Hypertens. 2017;30(3):271-278. Wang WT, You LK, Chiang CE, et al. Comparative Effectiveness of Blood Pressure-lowering Drugs in Patients who have Already Suffered From Stroke: Traditional and Bayesian Network Meta-analysis of Randomized Trials. Medicine (Baltimore). 2016;95(15):e3302.
陳右荏	萬芳醫院主治醫師	科技部年輕學者計畫	Chen YJ, Sung SH, Cheng HM, et al. Performance of AHEAD Score in an Asian Cohort of Acute Heart Failure With Either Preserved or Reduced Left Ventricular Systolic Function. Journal of the American Heart Association. 2017;6(5). Chen YJ, Chiang CE, Cheng HM. Rethinking of the hypertension management in the elderly with comorbidity: Should we forget the age in treating elderly hypertensives? J Clin Hypertens (Greenwich). 2020;22(6):1080-1082.
黃睿慈	北榮內科 PGY		Huang JT, Cheng HM, Yu WC, Lin YP, Sung SH, Chen CH. Increased Nighttime Pulse Pressure Variability but Not Ambulatory Blood Pressure Levels Predicts 14-Year All-Cause Mortality in Patients on Hemodialysis. Hypertension. 2019;74(3):660-668. Huang JT, Cheng HM, Yu WC, et al. Value of Excess Pressure Integral for Predicting 15-Year All-Cause and Cardiovascular Mortalities in End-Stage Renal Disease Patients. Journal of the American Heart Association. 2017;6(12).
葉俊廷	陽明交大醫學系七年級學生	科技部大專生研究計畫	Tzu-Jung Chiua*, Jiunn-Tyng Yeh, Ph.D.a*, Chi-Jung Huang, Ph.D.b, Chern-En Chiang, M.D., Ph.D.a,c, Shih-Hsien Sung, M.D., Ph.D.a,d, Chen-Huan Chen, M.D.a,e,f, Hao-Min Cheng M.D., Ph.D.a,b,e,f. Blood Pressure Variability and Cognitive Dysfunction: A Systematic Review and Meta-analysis of Longitudinal Cohort Studies. in submission
邱子容	陽明交大醫學系六年級學生		Tzu-Jung Chiua*, Jiunn-Tyng Yeh, Ph.D.a*, Chi-Jung Huang, Ph.D.b, Chern-En Chiang, M.D., Ph.D.a,c, Shih-Hsien Sung, M.D., Ph.D.a,d, Chen-Huan Chen, M.D.a,e,f, Hao-Min Cheng M.D., Ph.D.a,b,e,f. Blood Pressure Variability and Cognitive Dysfunction: A Systematic Review and Meta-analysis of Longitudinal Cohort Studies. in submission
鄭淳予	北榮神經內科住院醫師		Cheng CY, Cheng HM, Chen SP, et al. White matter hyperintensities in migraine: Clinical significance and central pulsatile hemodynamic correlates. Cephalalgia. 2018;38(7):1225-1236.
陳筱伶	高雄大同醫院藥師		Lee HY, Chen HL, Teoh JY, et al. Abiraterone and enzalutamide had different adverse effects on the cardiovascular system: a systematic review with pairwise and network meta-analyses. Prostate Cancer Prostatic Dis. 2021;24(1):244-252.
林佳佑	陽明交大生資所碩士		Lin JY, Kuo KL, Kuo YH, et al. Association between real-world home blood pressure measurement patterns and blood pressure variability among older individuals with hypertension: A community-based blood pressure variability study. J Clin Hypertens (Greenwich). 2021;23(3):628-637.
李穎顥	北榮心臟科研究醫師		Yin-Hao Lee1, MD, Tsung-Hsien Tsai 2, PhD, Jun-Hong Chen2, MSc, Chi-Jung Huang3, PhD, Chern-En Chiang4,5, MD, PhD, Chen-Huan Chen6,7,8, MD, Hao-Min Cheng3,4,7,8, MD, PhD. Machine Learning-based Diagnostic Models Improve the Diagnostic Performance of Treadmill Exercise Test

計畫名稱	計畫內擔任之工作	執行年度	補助或委託機構	核定經費
應用P4 醫療模式進行心血管老化個案之高風險特徵的預測及處理	共同主持人	2021/5-2024/5	科技部整合型計畫	40,000,000
透過早期或是超乎正常的血管老化過程發現血管老化及認知功能障礙的保護機轉－藉由探索不同血管老化型態之微菌叢及相關的免疫路徑找出可能的保護機轉	子計畫主持人	2020/8-2022/7	科技部整合型計畫	17,100,000
藉由探索不同血管老化型態之微菌叢及相關的免疫路徑找出可能的保護機轉	主持人	2020/8-2022/7	科技部	2,524,317
血管鈣化對於心臟及認知功能的影響: 改善心臟血管的不良匹配及脈波性腦病變的可能標的	主持人	2017/08-2020/07	科技部	4,110,000
心音分析與心律變異對於急性心臟衰竭病人的預後風險預測效果-台灣心臟衰竭登錄研究	主持人	2018/07-2021/07	產學合作-麗台科技	7,820,000
心臟血管、頸動脈、顱內血管動力學及營養素介入對大腦認知功能之影響--心臟血管脈動性血流動力學對於中年人大腦認知功能的影響	共同主持人	2017/08-2020/07	科技部整合型計畫	16,800,000
認知功能衰退之流行病探討：心臟及腦血流動力學、短長期營養、以及微型核糖體之分子調控等機制研究--心臟脈動性血流動力學對於大腦認知功能的影響	共同主持人	2014/08~2017/07	科技部整合型計畫	9,900,000

研究成果

總計83篇SCI著作



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Acknowledgement

- **Taipei Veterans General Hospital, Taiwan**
  - Shih-Hsien Sung
  - Wen-Chung Yu
  - Chen-Huan Chen
  - Pei-Ning Wang
  - Liang-Kung Chen
  - Chih-Ping Chung
- **National Health Research Institutes, Taiwan**
  - Shao-Yuan Chuang
- **National Yang Ming Chiao Tung University**
  - Shien-Fong Lin
  - Kun-Hsien Chou
- **Fu Jen Catholic University**
  - Jiun-Jr Wang
- **University of Washington**
  - Weichih Wang
- **HOPE Asia**
  - Kazuomi Kario
- **INSPECT Consortium**
  - James Sharman

Michigan State University, USA
- Jiankun Liu
- Jin-Oh Hahn
- Ramakrishna Mukkamala

- **IDACO Collaboration**
  - Jan Staessen

專題指導老師介紹(交大光復校區)

專題指導老師列表

交大校區

單位	姓名職稱	email	專長領域	教師介紹連結	實驗室介紹連結
電機所	邱一教授	yichiu@nycu.edu.tw	微機電系統、微感測器、能量擷取	http://himems.cn.nycu.edu.tw/	異質整合微系統實驗室
	冀泰石教授	tschi@nycu.edu.tw	聽覺訊息處理、語音訊號處理、音訊感知處理	https://dee.nycu.edu.tw/teachers.php?pa=getItem&teacher_id=98&locale=tw	感知訊號處理實驗室
	廖育德教授	yudoliao@nycu.edu.tw	低功率積體電路設計、射頻通訊積體電路、感測器介面電路、能量擷取與管理電路設計、生醫電子系統設計	https://wiml.web.nycu.edu.tw/	無線感測晶片與系統實驗室
	黃薇蓁副教授	weichenh@nycu.edu.tw	軟性電子、腦機界面元件、微機電、生醫材料、奈米科技	https://sites.google.com/nctu.edu.tw/weichenhresearchgroup/home	軟性電子與先進醫電感測實驗室

專題指導老師列表

交大校區

單位	姓名職稱	Email	專長領域	教師介紹連結	實驗室介紹連結
電控所	歐陽盟 教授	oym@nycu.edu.tw	高光譜儀、無人機3D建模、醫學與農業影像處理、高精密光學編碼器	https://ebil.web.nycu.edu.tw/	電機與生醫整合實驗室與網宇實體系統實驗室(EBIL & CPSL)
	蔡德明 教授	c.t.choi@ieee.org	人工耳蝸、斷層影像技術、人工智慧、神經手術導航、深層腦電刺激、穿顱磁刺激、數值電磁學	http://neural.lab.nycu.edu.tw/	http://neural.lab.nycu.edu.tw/
	柯立偉 教授	lwko@nycu.edu.tw	神經工程、腦機介面系統、人工智慧與機械學習於臨床資料探勘、人工智慧與機械學習於生醫訊號處理、計算神經科學、神經網路與模糊類神經網路、智慧型照護系統	https://neuroengineering.lab.nycu.edu.tw/	神經工程實驗室
	戴立嘉 副教授	j.tai@nycu.edu.tw	1. Internet of Things: Wearable Electronics for Monitoring Biomolecules 2. Subject Studies and Artificial Intelligence for Health Analytics 3. Integrated Microfluidic and Electrochemical Sensors	https://sites.google.com/site/lichiajerrytai	https://sites.google.com/site/lichiajerrytai

專題指導老師列表

交大校區

單位	姓名職稱	email	專長領域	教師介紹連結	實驗室介紹連結
電子所	李鎮宜 教授	cylee@nycu.edu.tw	積體電路與系統設計、視訊通訊與高速網路、電腦輔助系統設計	https://si2lab.iee.nycu.edu.tw/	System Integration and Silicon Implementation (SI2)
	鄭耿璽 副教授	jeng@nycu.edu.tw	超音波成像系統、訊號處理、非接觸式生理訊號偵測、機器學習式成像、醫學成像系統	https://sites.google.com/nctu.edu.tw/jeng/	超音波成像實驗室

專題指導老師列表

交大校區

單位	姓名職稱	email	專長領域	教師介紹連結	實驗室介紹連結
醫電所	陳冠宇 教授	guanyu@nycu.edu.tw	生醫微型裝置、仿生器官晶片、智慧影像分析、感測元件、智能材料	https://www.nycu.edu.tw/ibe/ch/app/artwebsite/view?module=artwebsite&id=6791&serno=8704e68e-d00b-4805-90a8-514d5ecf316f	http://www.gychen.website/
	李博仁 教授兼副所長	liborran@nycu.edu.tw	奈米材料合成、感測元件製作、表面化學修飾、生物晶片整合、生醫樣品檢測		http://liborran.weebly.com/
	陳榮治 教授兼所長	george@nycu.edu.tw	失智-阿茲海默症、生醫感測、生醫奈米、生醫材料、腫瘤醫學		https://nctubsolab.weebly.com/
	江柏翰 助理教授	phc@nycu.edu.tw	深層腦磁刺激、遠距離遙控神經技術、神經電生理、磁遺傳學、奈米生醫材料、帕金森氏症及自閉症、離子攝影、深度學習		https://chianglab.wixsite.com/chianglab/
	李佳燕 副教授	chiayenlee@nycu.edu.tw	智慧醫療、人工智慧輔助診斷系統、機器學習與深度學習模型開發、電腦視覺技術應用、醫學影像處理與分析、醫療器材設計整合開發、居家照護		

專題指導老師列表

交大校區

單位	姓名職稱	email	專長領域	教師介紹連結	實驗室介紹連結
光電系	冉曉雯 教授	hsiaowen@nycu.edu.tw	(1)新穎半導體元件：使用各種新穎奈微米結構以及光直寫製程發展可撓式電晶體或超靈敏氣體感測器、(2)生醫感測：針對臨床需求，開發非侵入式生醫偵測器並與醫院密切合作進行臨床研究	https://dop.nycu.edu.tw/ch/people_ii.html?tID=59	清交聯合有機半導體實驗室
	孫家偉 教授	chiaweisun@nycu.edu.tw	生醫光子學、神經光子學、智慧生醫光電技術、臨床醫用光學影像	https://dop.nycu.edu.tw/ch/people_ii.html?tID=62	生醫光學影像實驗室
	黃耀緯 助理教授	ywh@nycu.edu.tw	奈米光子學、超穎介面、超穎透鏡、物理光學、深度感知、空間運算、半導體光學、半導體製程	https://dop.nycu.edu.tw/ch/people_ii.html?tID=143	超穎光子學實驗室

iBiophotonics

Anti-entropy thinking in the great era

國立陽明交通大學 孫家偉

樂達創意科技攜手陽明交大 推動AI技術於生醫研究與高科技領域的創新應用

2024.12.30 / 20:14 / 工商時報 文 / 謝易晏

#樂達創意科技 #SeaDeep AI 平台

樂達創意科技執行長黃哲瑄博士(左三)、陽明交大林奇宏校長(右三)、孫家偉所長(左二)、郭浩中講座教授(右一)、王蒨君院長(右二)等多位師長嘉賓於捐贈儀式合影。圖/陽明交大提供

陽明交大創新醫材轉譯研發中心 妙手將Biotech化為Medtech

撰文｜記者 李林瑗　　日期｜2022-11-04

陽明交大首任校長林奇宏融合陽明的臨床資源和交大的工程技術，於今年1月設立一級校級研發中心——「創新醫材轉譯研發中心」。左起為腦科所教授林慶波、醫工系教授林峻立、校長林奇宏、生醫所教授孫家偉、醫工系教授楊世偉、醫工系教授賴穎暉、醫工系教授駱俊良、生醫所副教授陳榮治，右二為物輔系副教授游忠煌、右一為生醫光電所教授吳育德。(攝影/羅翊方)

麗寶新藥攜手陽明交大 運用 AI 技術加速抗癌藥開發

2025/07/01 14:17:50

經濟日報 記者黃淑惠／台北即時報導

麗寶新藥與陽明交大簽約現場，包括輝達等知名科技與生技公司都派代表，見證歷史性一刻。麗寶提供

TDUA陽明交大聯手掌舵 強攻智慧醫療

文 謝易晏 2022.04.28

「全球醫療產業前瞻技術合作論壇-TDUA陽明交大聯手掌舵」4/28盛大登場，陽明交大生醫工程學院林峻立院長(左起)、閩渡醫院院長陳亮恭、友達光電總經理柯富仁、陽明交大林奇宏校長、竹銘醫院院長唐高駿、陽明交大光電系孫家偉教授。圖/謝易晏

生醫光電技術 生醫光學智慧實驗室 BOIL 智慧醫療產業

目標：研發先進生醫光電技術，解決臨床醫學重要問題，提出健康照顧新方案。

穿戴式近紅外光光譜儀 Near-infrared spectroscopy	光學同調斷層掃瞄術 Optical coherence tomography	光學骨質密度儀 Optical bone densitometry

分辨式人工智慧 Discriminative AI / Classifier				生成式人工智慧 Generative AI	
支持向量機	決策樹	邏輯式迴歸	卷積神經網路	生成對抗網路	大語言模型

神經外科　神經內科　精神科　小兒科　牙科　胸腔外科　胸腔內科　心臟外科　心臟內科　骨科

智慧醫療技術	預防醫學發展	智慧居家照顧	民生健康產業
智慧光學影像系統開發應用於腦腫瘤手術導航 用於肺癌診斷之光學同調斷層智能掃描操作設計開發	多元智慧光學系統於健康評估偏頭痛嚴重程度分級及預後之縱向研究	智慧型穿戴式近紅外光裝置於臨床復健應用研究 高維度智慧光學骨質密度檢測系統	多元智慧光學系統於健康評估 智慧型光學膚質動態特性分析系統

Intelligent optical bone densitometry (iOBD)

J Biophoton 2018

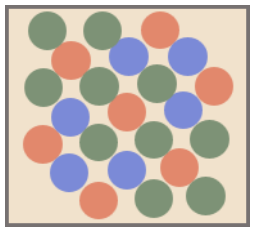
Taiwan Patent 2023

IEEE Trans Eng in Heal and Med 2024

AI Innovation Award 2025

i-OBD

近紅外光光源 (LEDs 矩陣)



LEDs矩陣

由3種不同波長LED排列組成

(工作原理類似DXA)

零放射線，就是光，超安全

量測位置於**手腕處**

操作方便又衛生

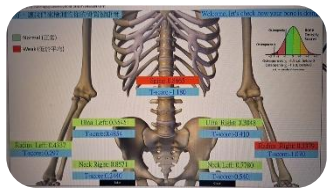
高速像素感測器

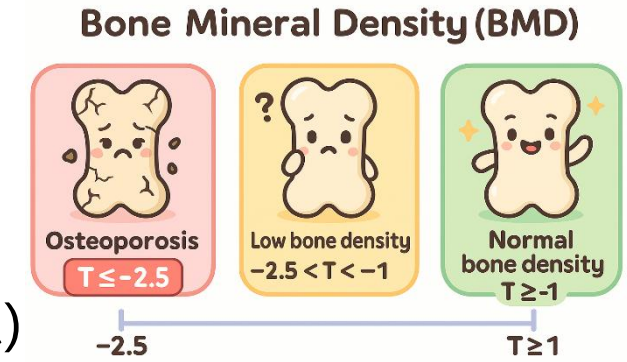
快速取得骨質密度影像

CMOS 照相機

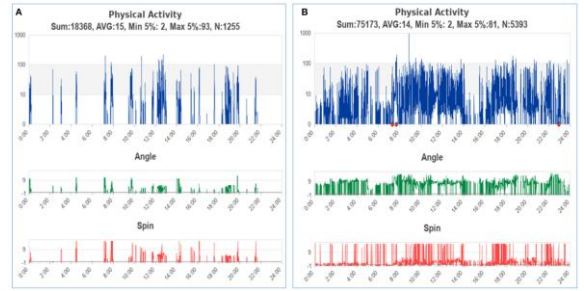
符合人體工學設計(大小與血壓計相似)

體積小便於攜帶

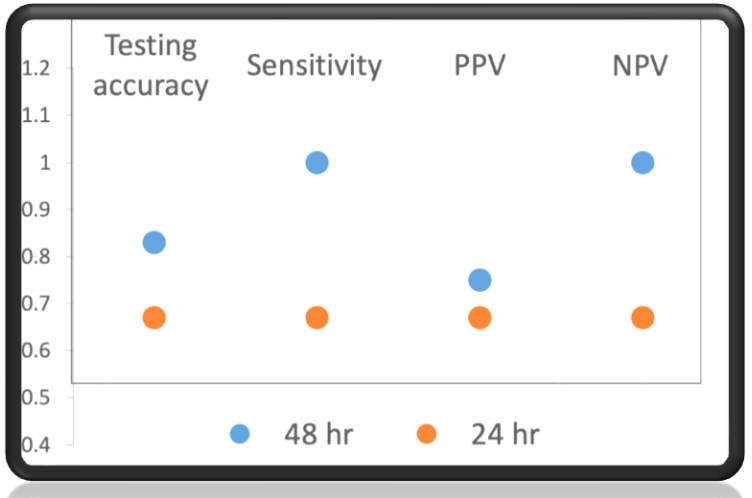




Hospice care unit



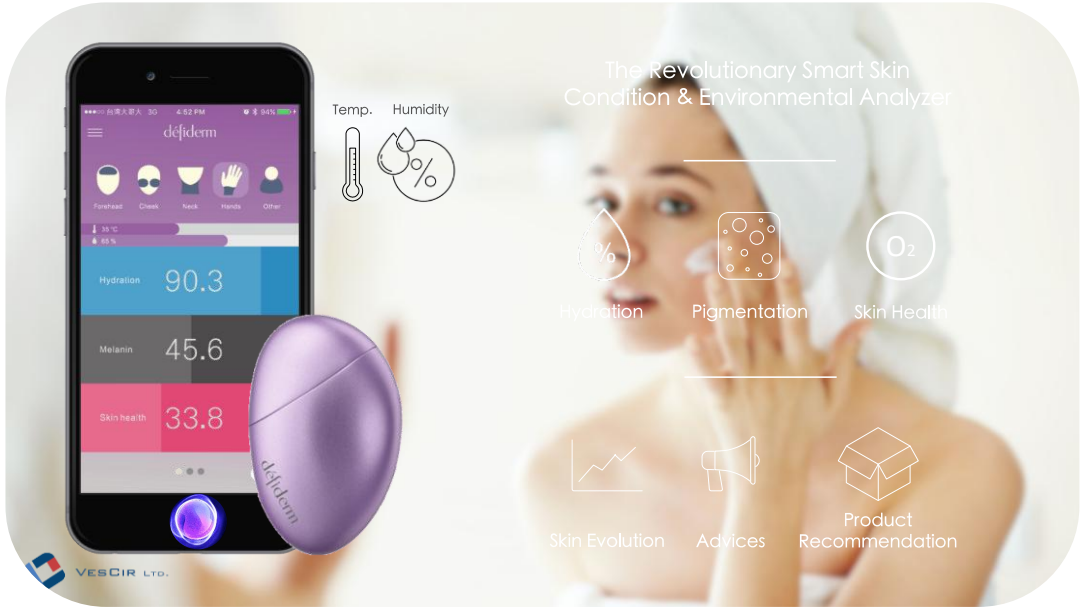
Actigraphy wristband monitoring predicts survival outcome by deep learning

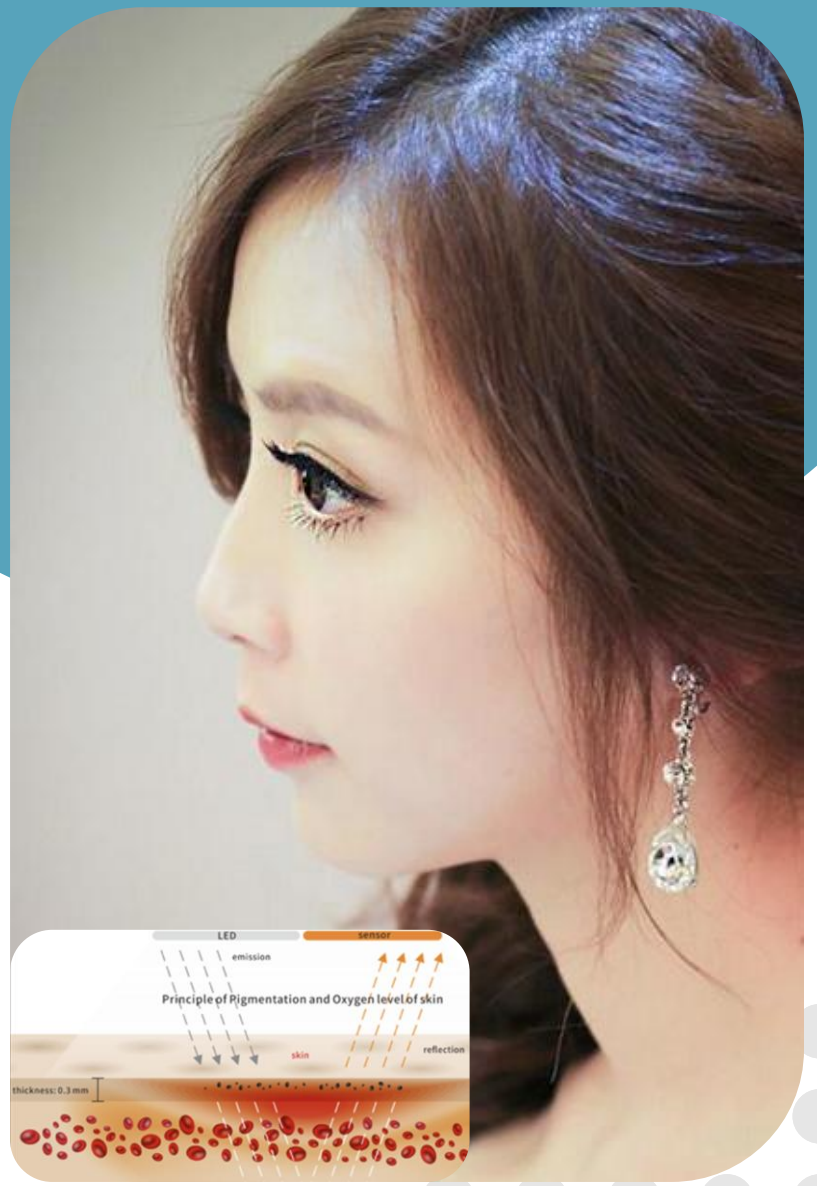


Frontiers in Public Health 2022

VESCIR LTD.

Intelligent optical skin care monitoring





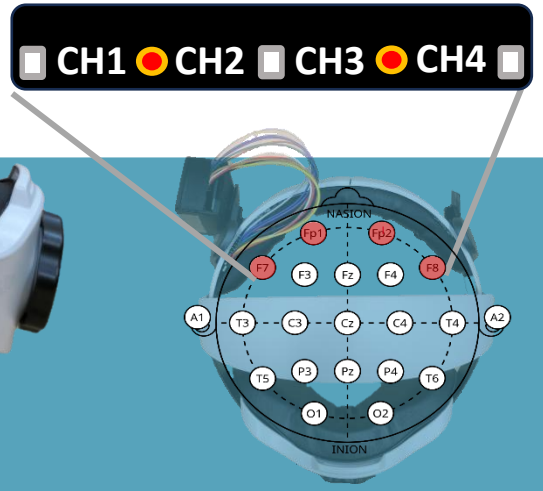
智慧功能性近紅外光光譜術

Intelligent Functional Near-Infrared Spectroscopy

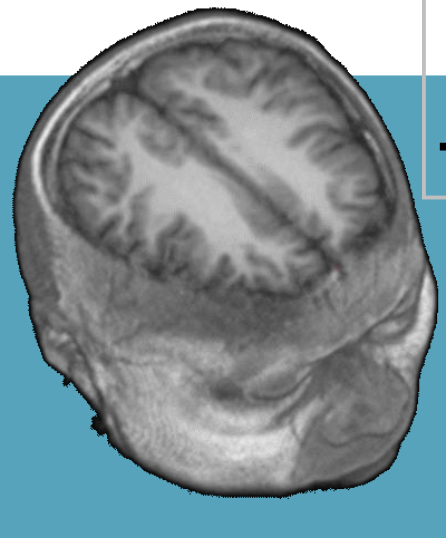
NYCU BOIL

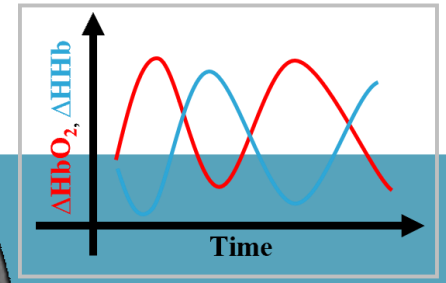
Intelligent functional near-infrared spectroscopy (ifNIRS)

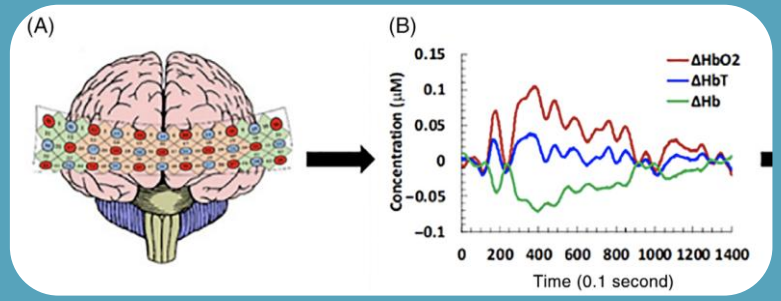
Microcontroller unit



Adjustment knob

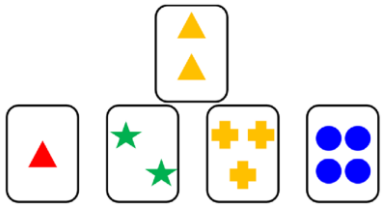




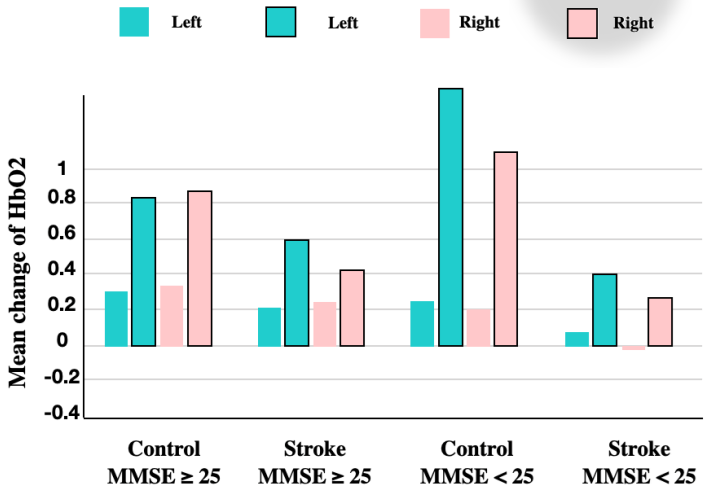


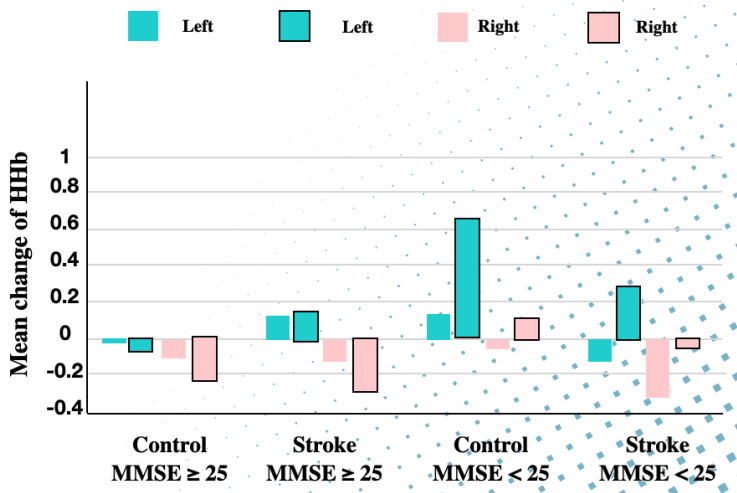
J. Biophoton. 2021

Mild cognitive impairment (MCI) diagnosis

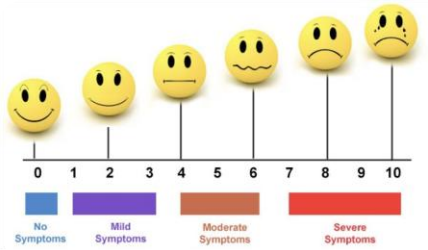


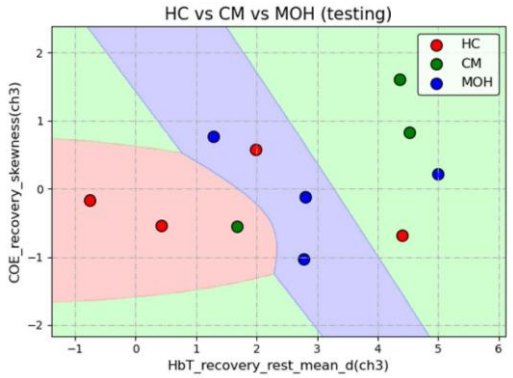
J. Biophoton. 2023

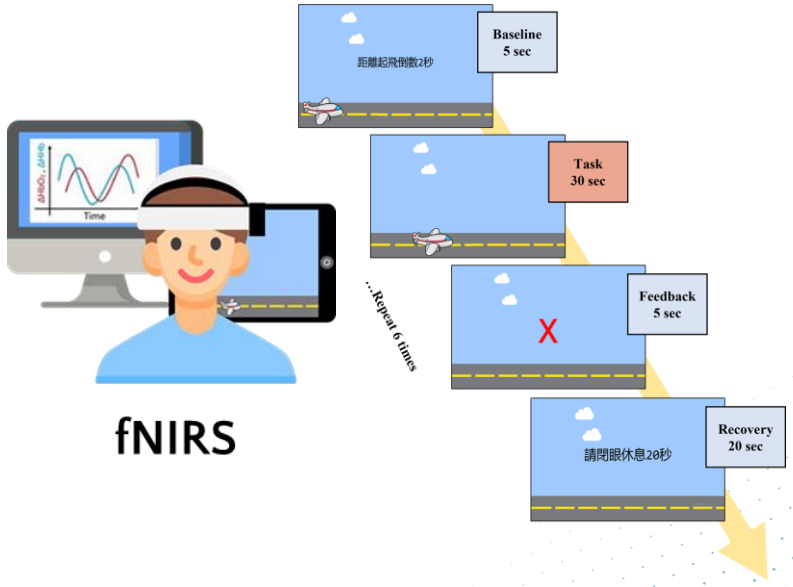




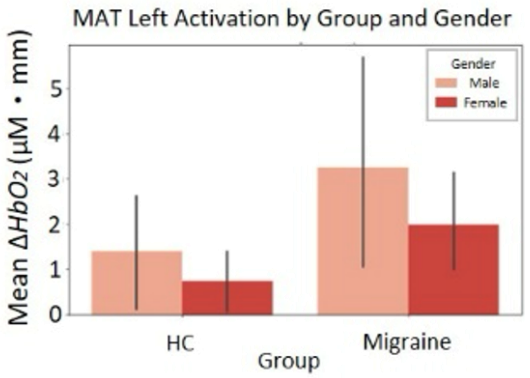
Migraine detection

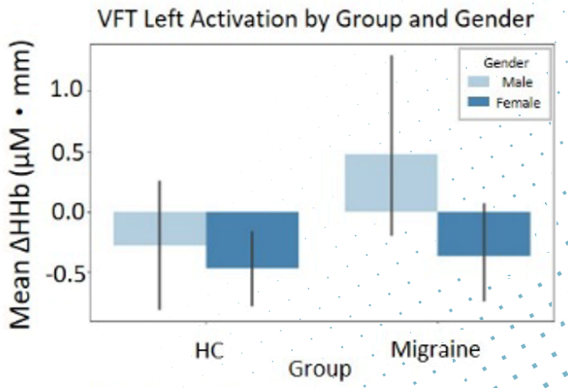






fNIRS

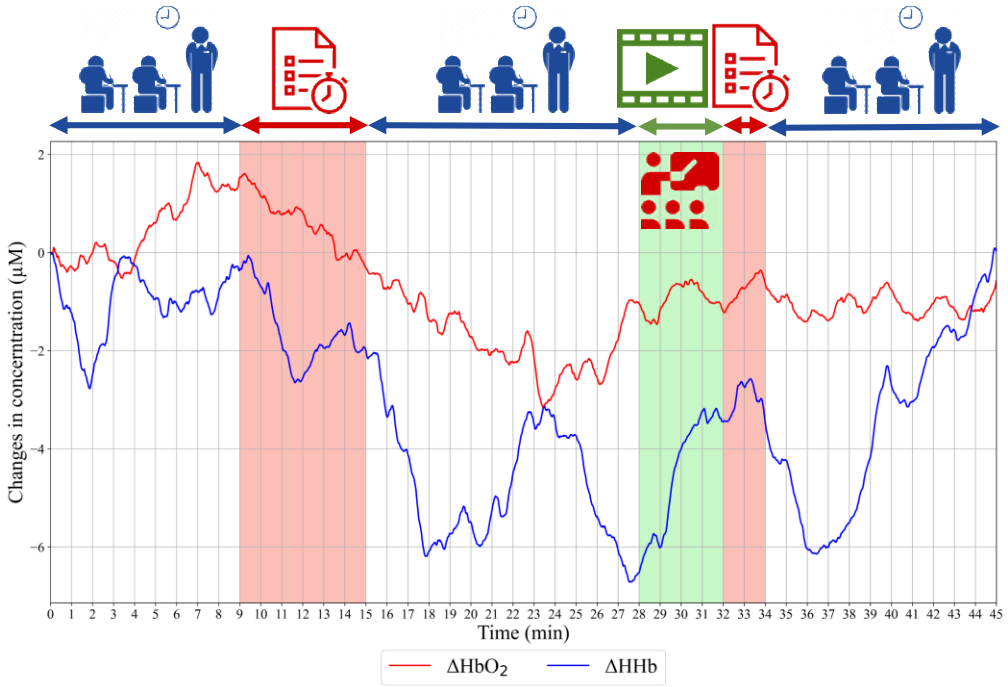




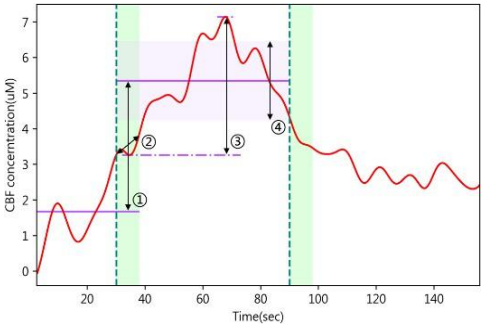
Sci. Rep. 2022

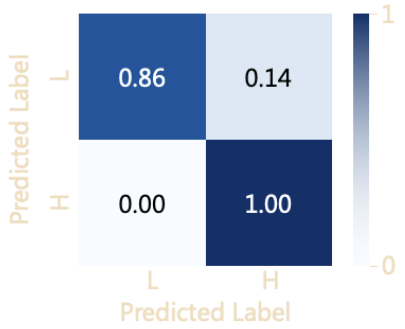
IEEE JSTQE 2025

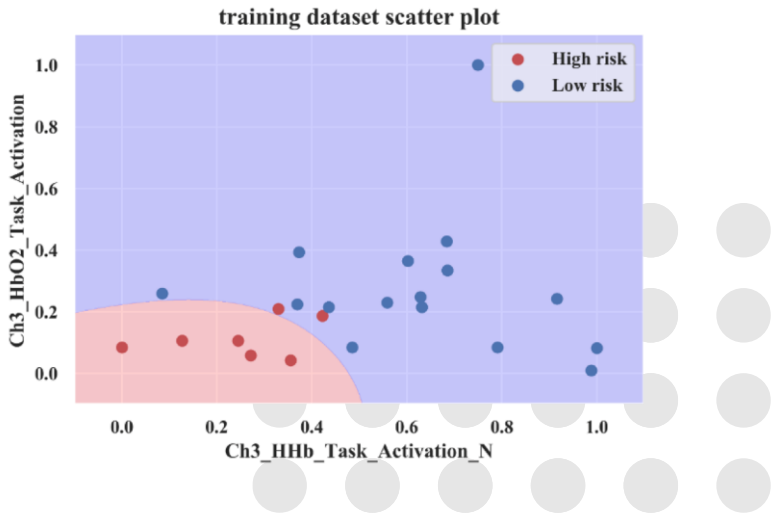
Example of Neuroeducation



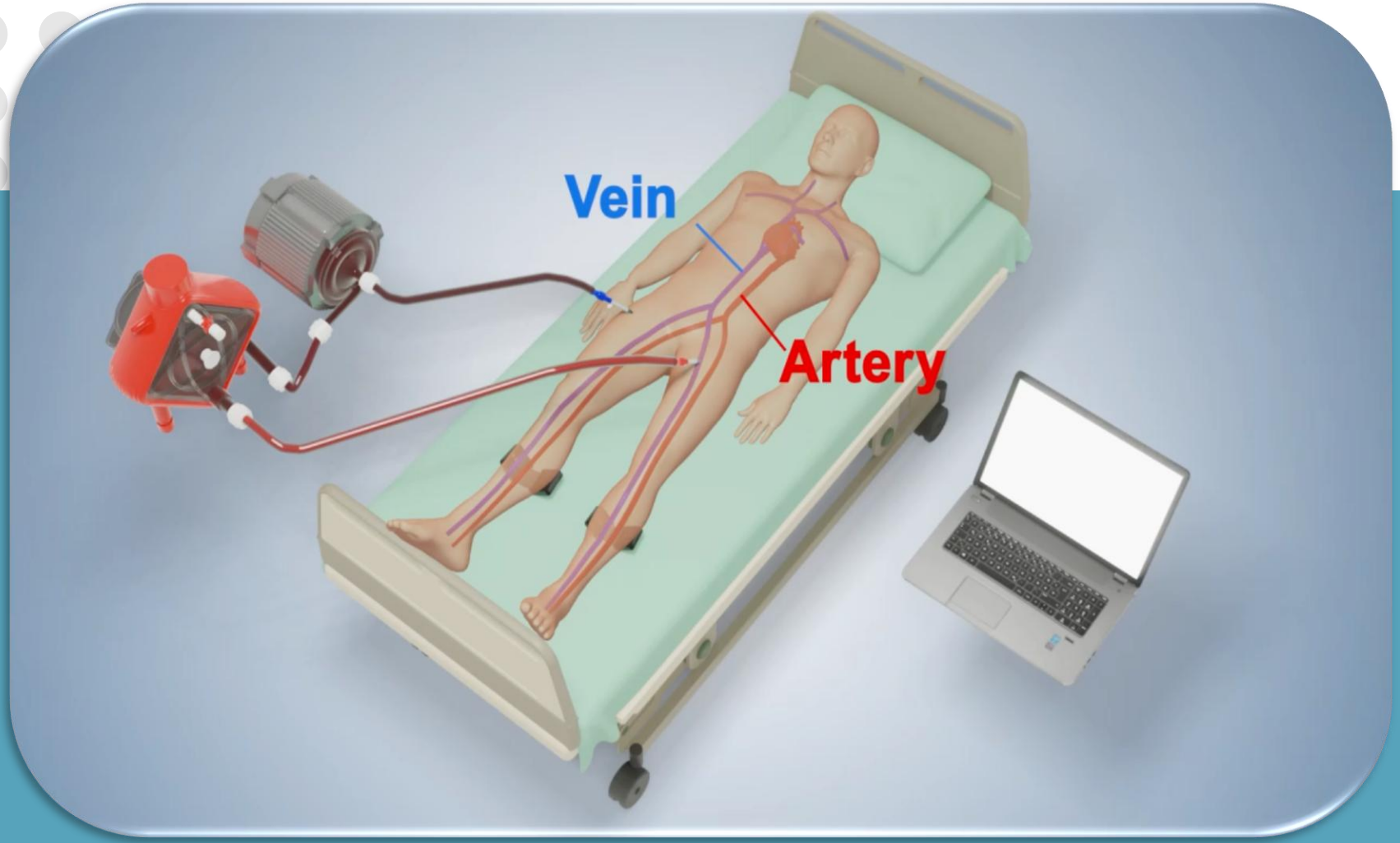
Burnout estimation for police





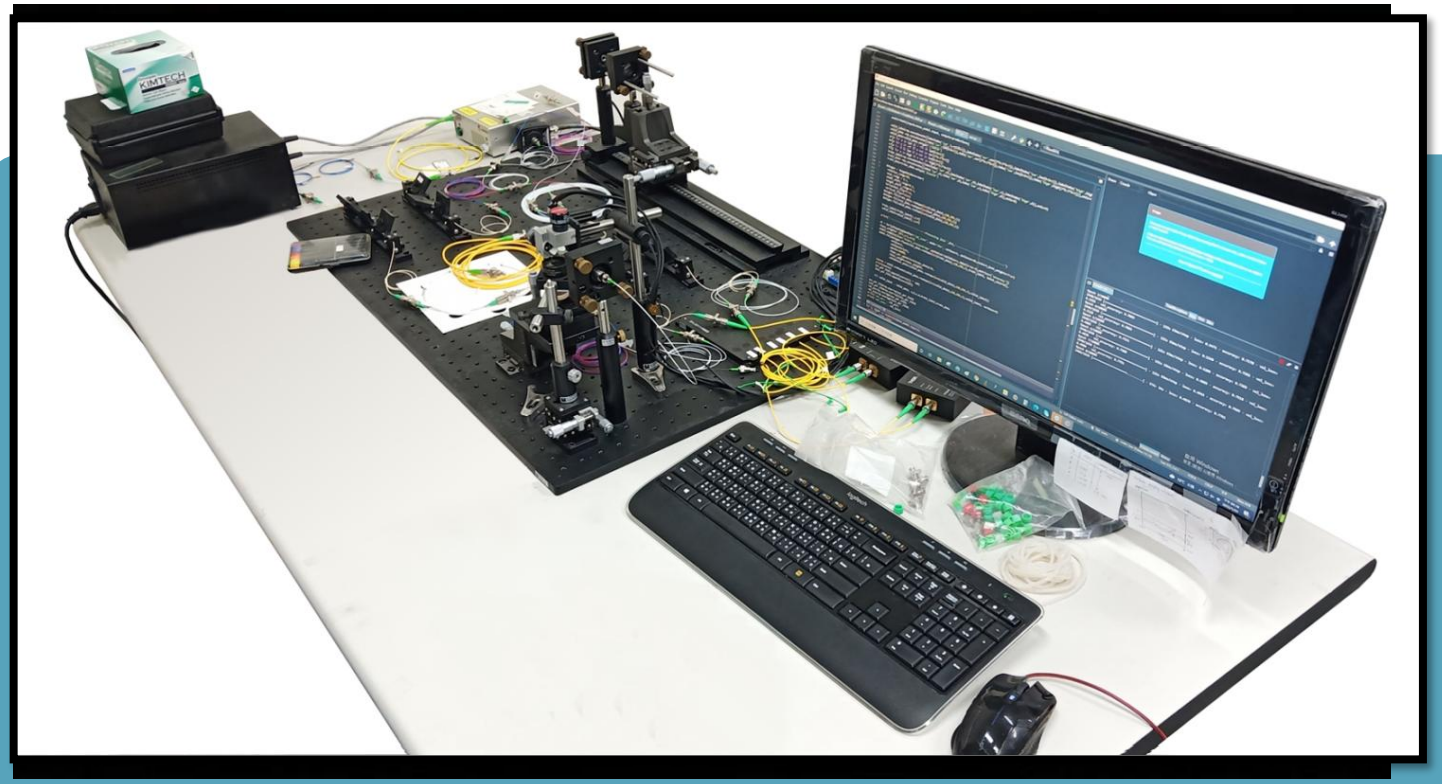


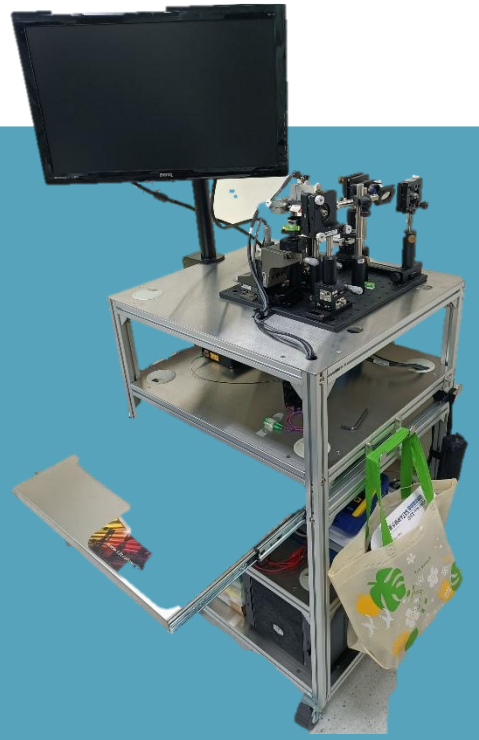
ECMO patient monitoring



IEEE JSTQE 2023
Bioeng 2024
J Biophoton 2025

Intelligent optical coherence tomography (iOCT)





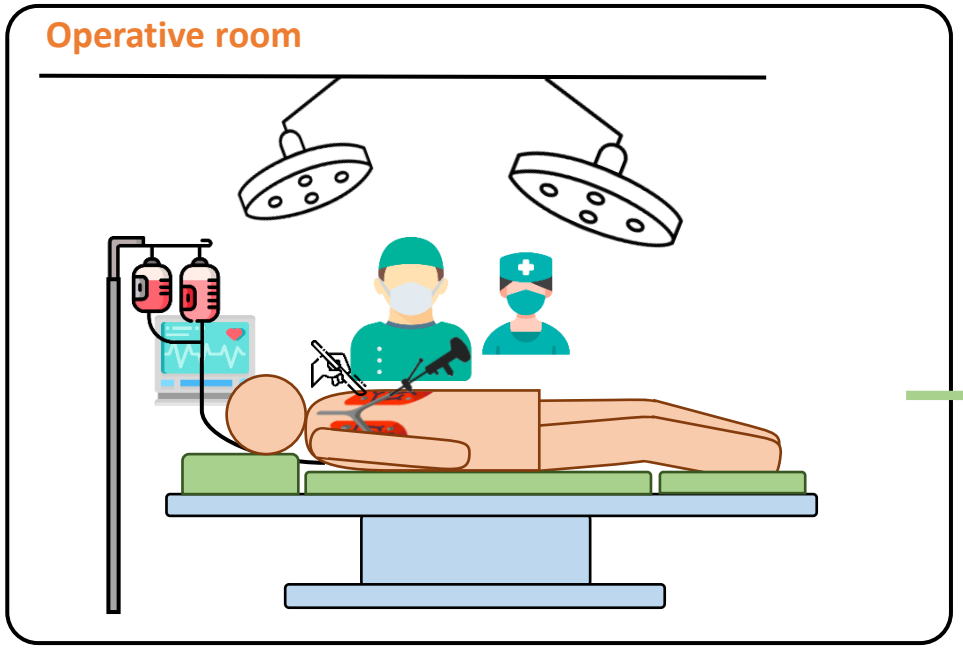
working area expansion

width reduction

From bench to bedside

Heal Tech 2021
Cancers 2023
J Biophoton 2023

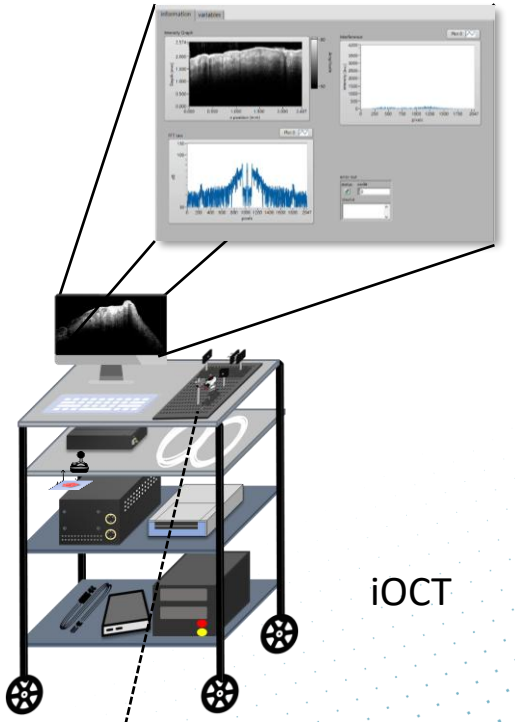
iOCT-assisted lung surgery



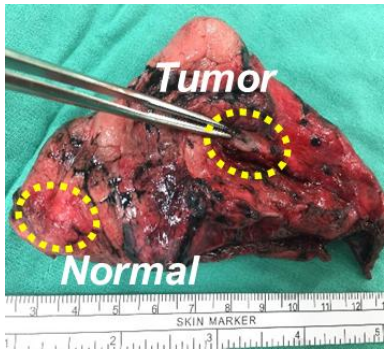
Specimen

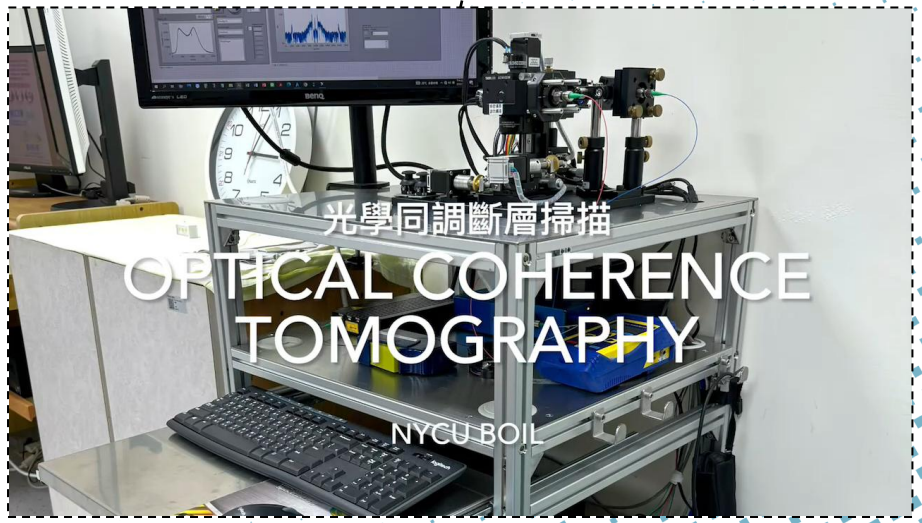
4mm*4mm*4mm

Frozen section



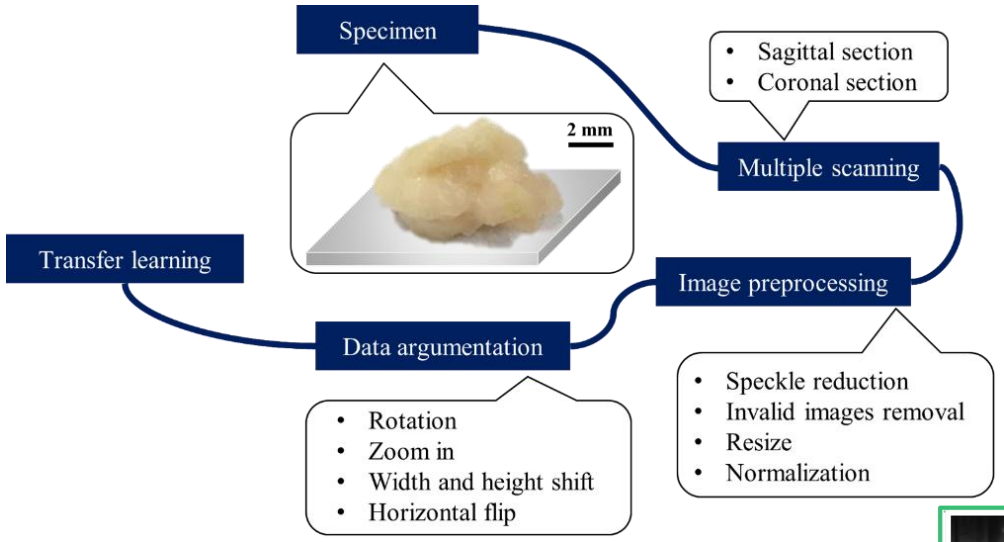
iOCT

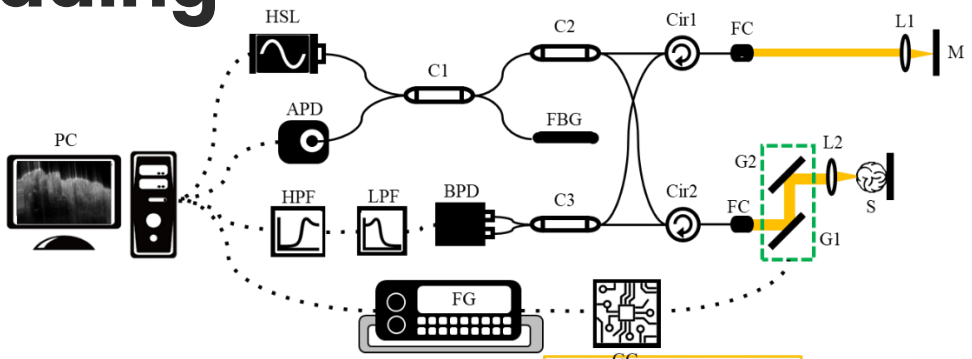


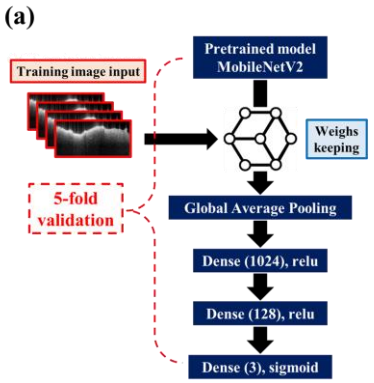


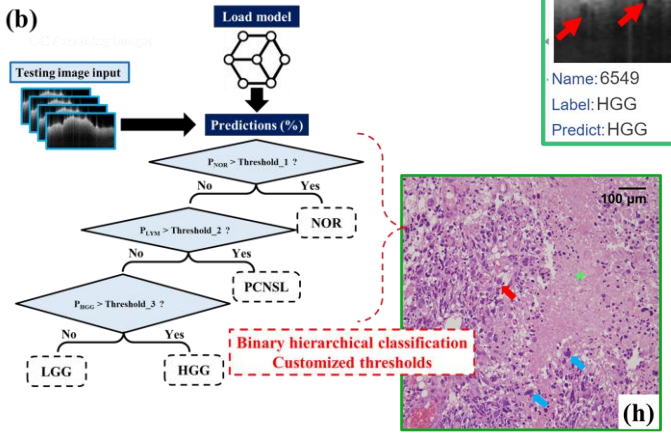
Neurophoton 2022
Biomed Opt Express 2024

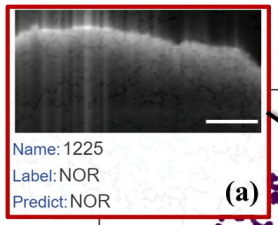
Brain tumor grading

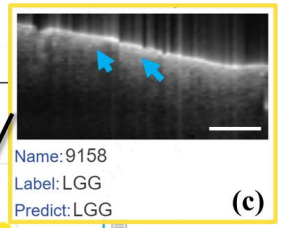


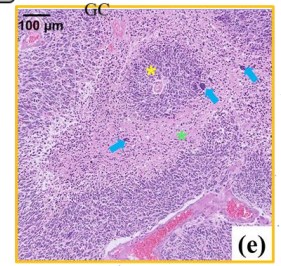


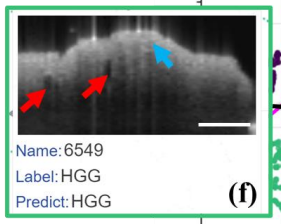


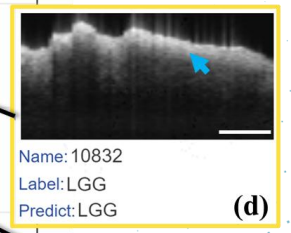


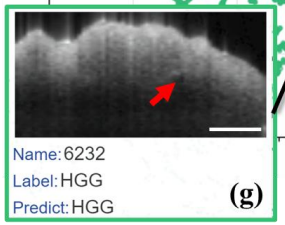


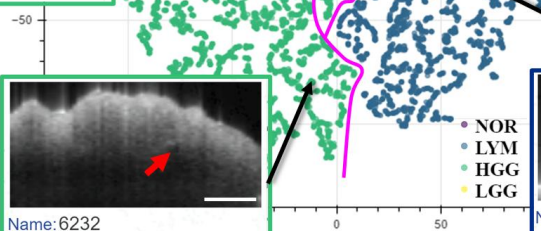


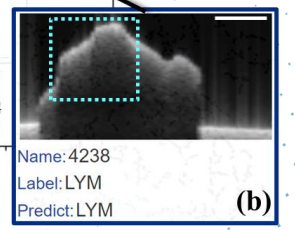


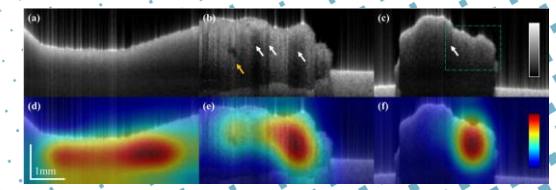






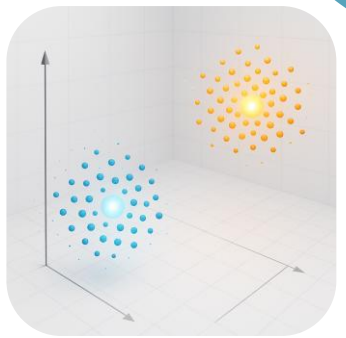


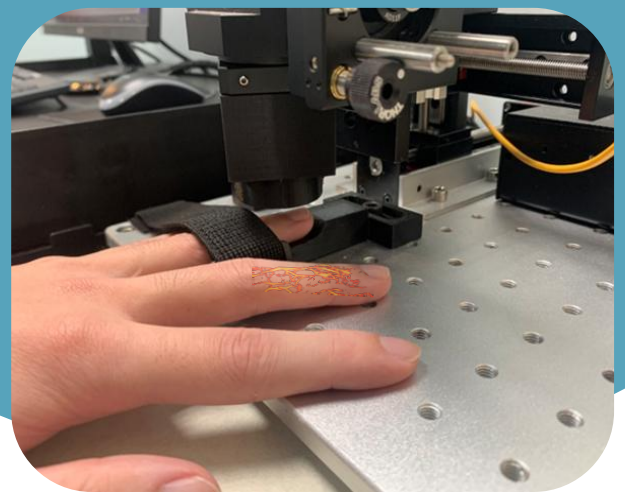


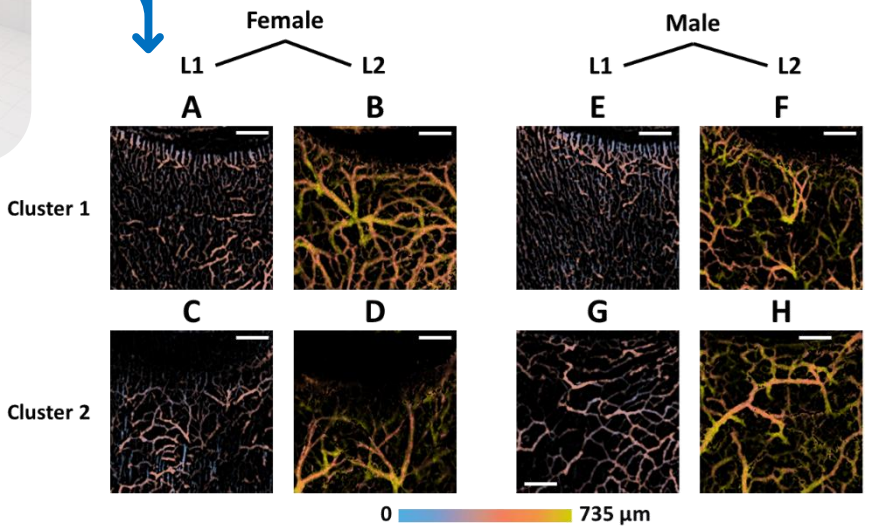


OCTA assessing vascular health

Subclinical cardiovascular abnormalities are recognized as primary risk factors for cardiovascular disease (CVD). We employed OCTA to obtain a comprehensive view of the 3D nailfold microvasculature and applied unsupervised hierarchical clustering algorithms to discern differences in vascular similarity across two distinct clusters in healthy octogenarians. Our study highlights the potential of estimating cardiovascular health in the elderly from nailfold microvascular structure.





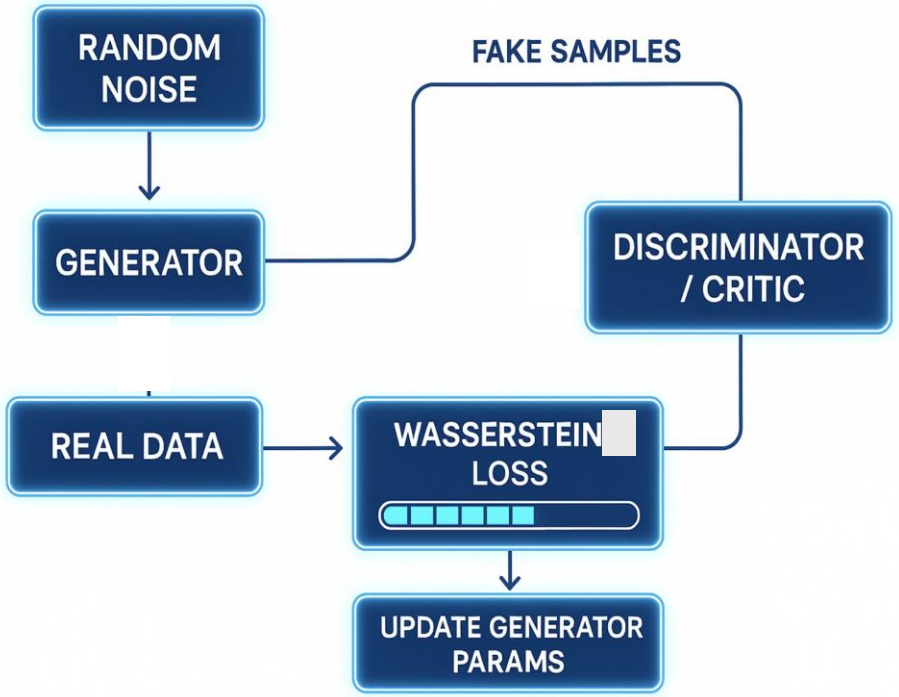


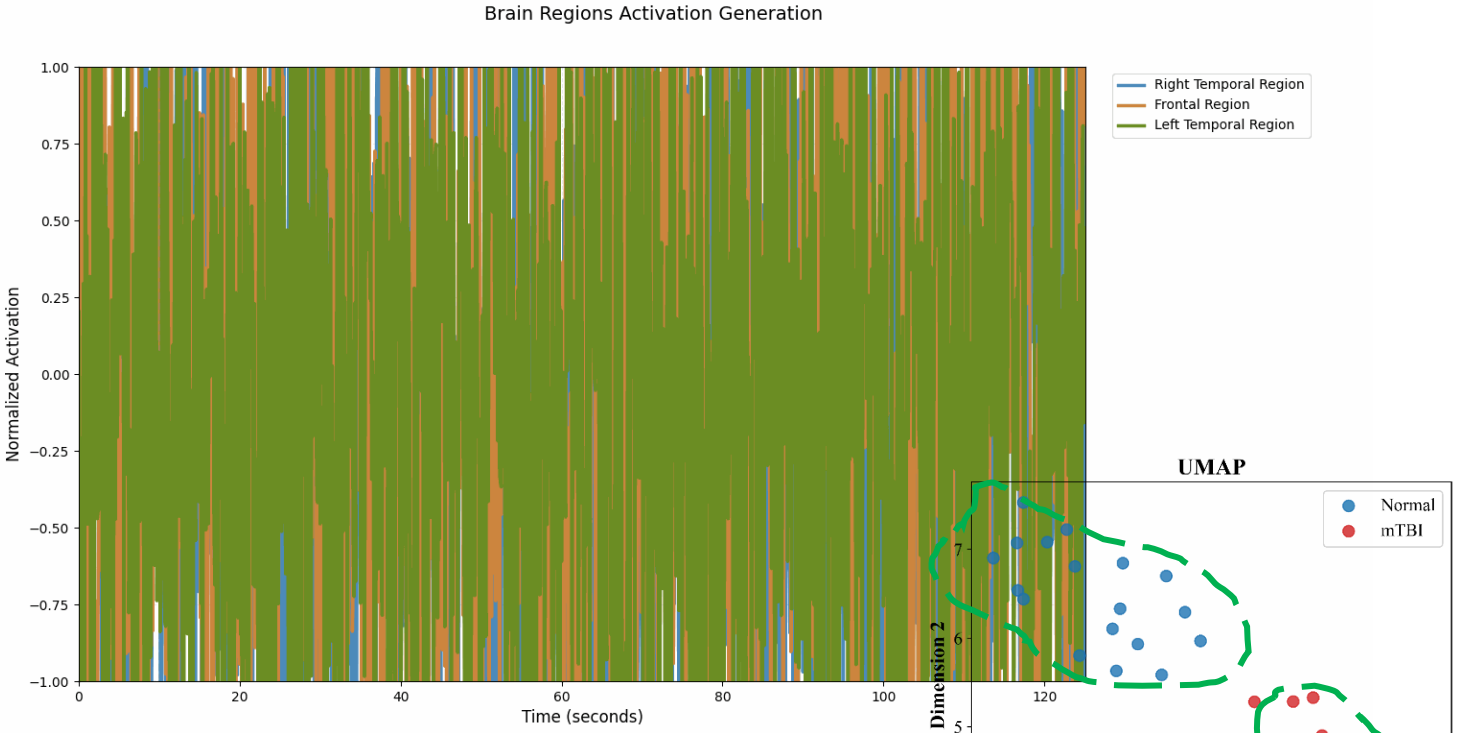
Generative AI

When applying new biophotonic technologies to clinical research, the biggest challenge is often the difficulty in quickly collecting sufficient human trial data for big data analysis and the development of intelligent medical algorithms. Generative AI may be able to accelerate this research process.

Wasserstein Generative Adversarial Network (WGAN)

- Data augmentation for NIRS signals



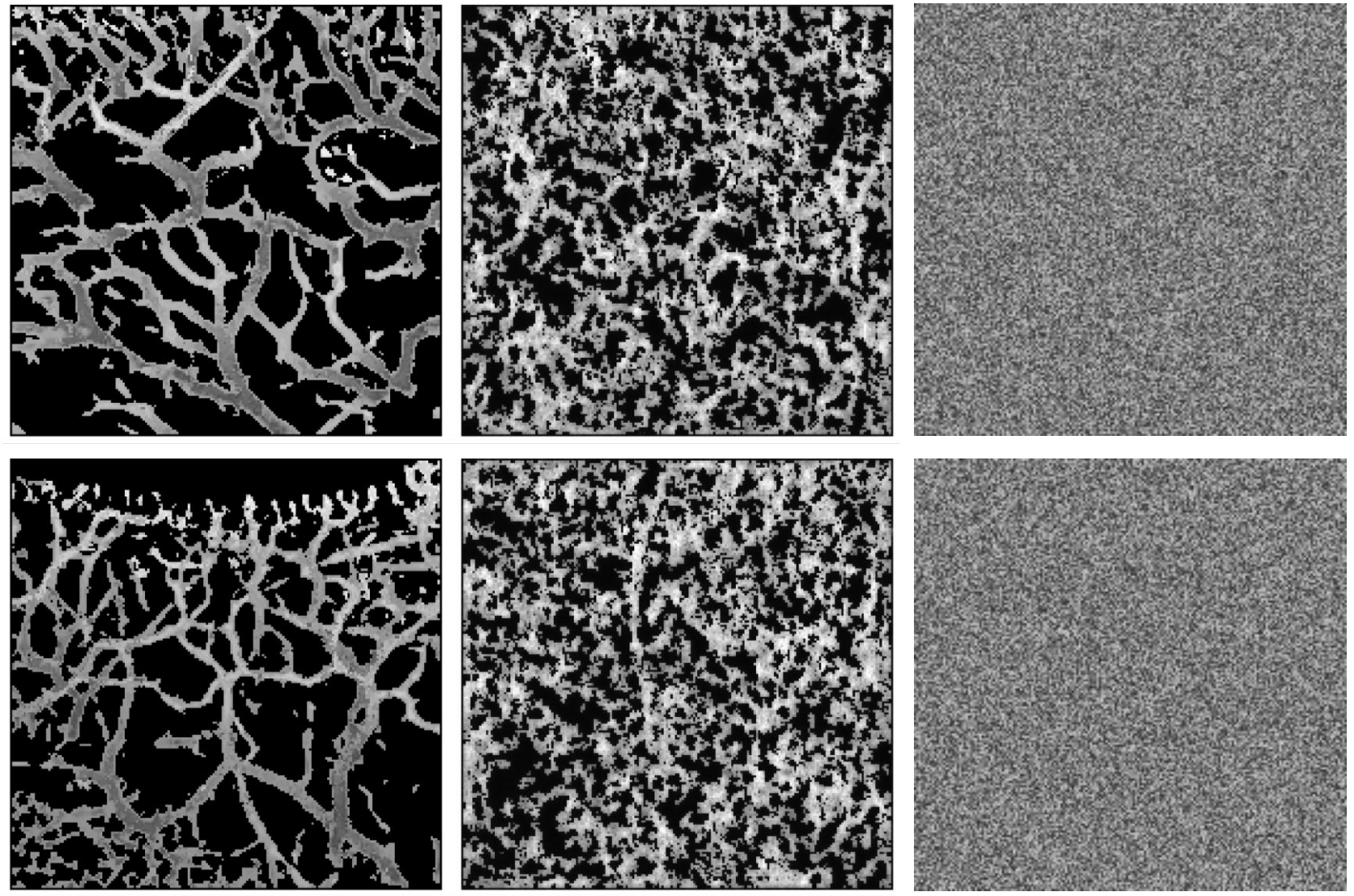


Denoising diffusion probabilistic model (DDPM)

- OCTA

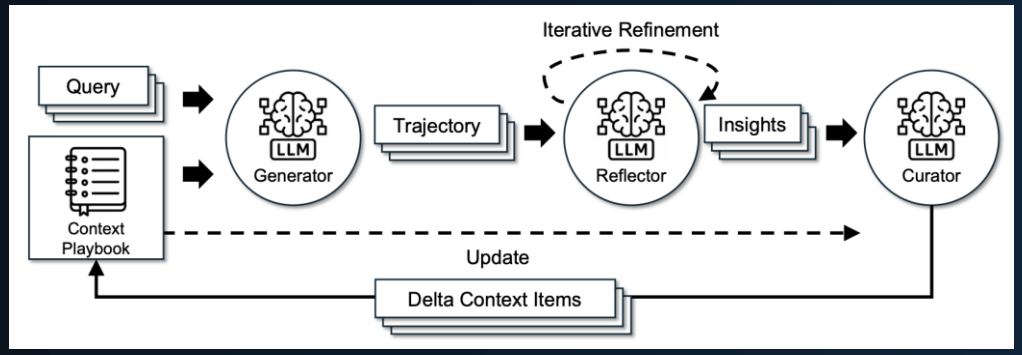
Structural features begin to emerge

- Structural optimization
- Self-attention mechanism



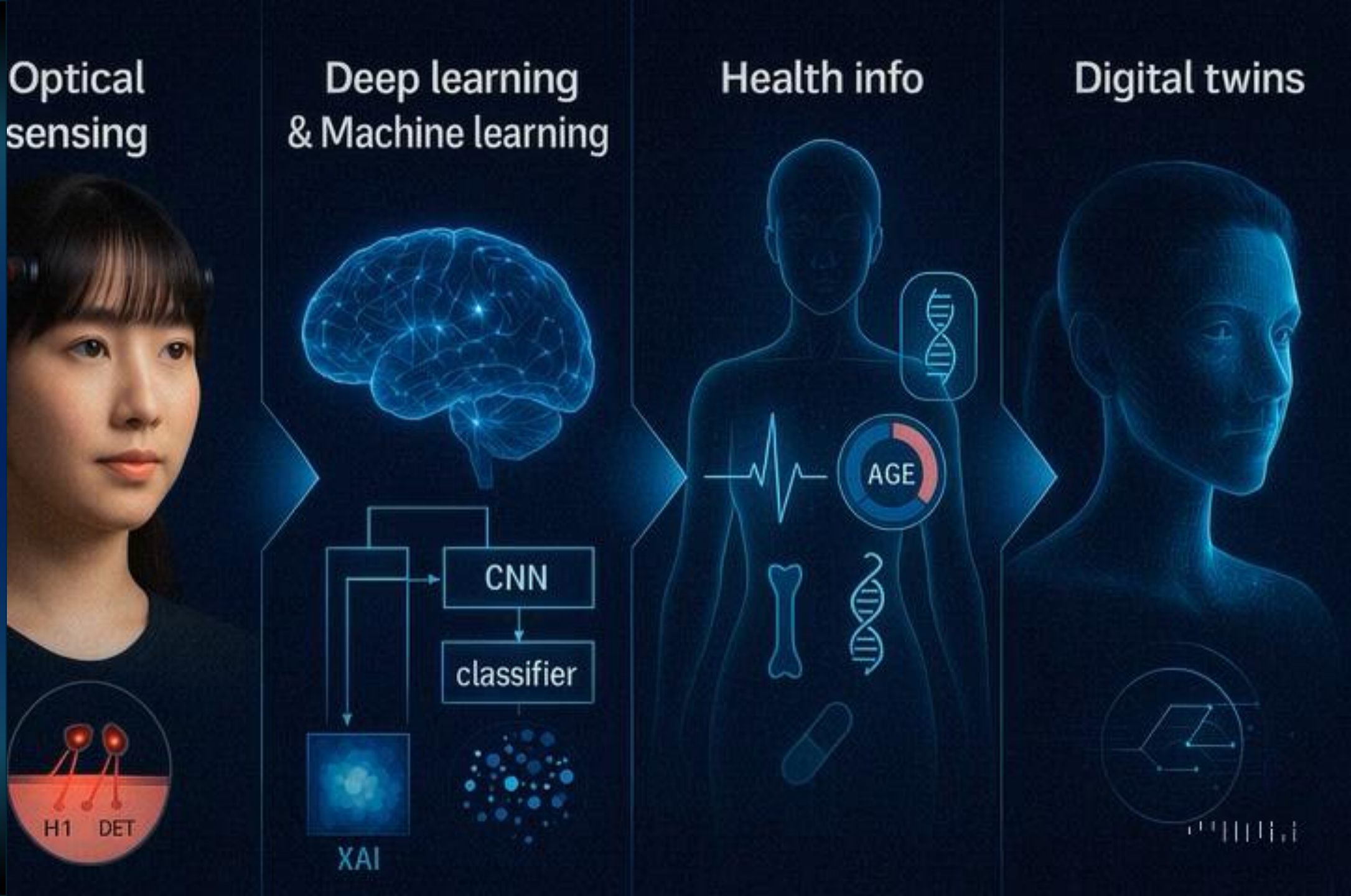
Context Engineering

Large language model (LLM) applications such as agents and domain-specific reasoning increasingly rely on context adaptation—modifying inputs with instructions, strategies, or evidence, rather than weight updates.



6 Oct 2025

iBiophotonics strategy in BOIL



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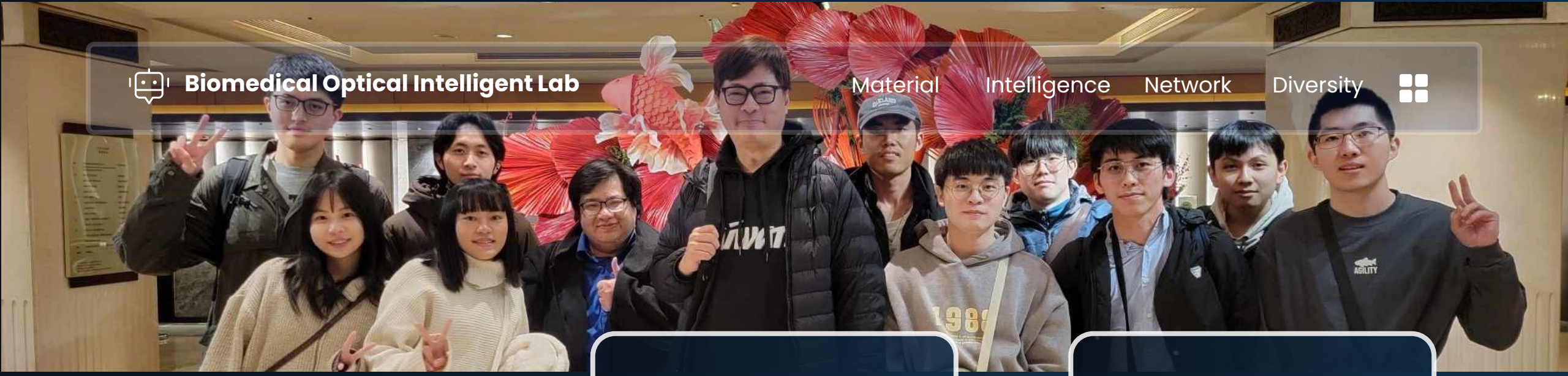

Biomedical Optical Intelligent Lab

Material Intelligence Network Diversity

Thanks for your attention

Attention is all you need

This paper introduces the Transformer architecture, which replaces recurrence and convolution entirely with self-attention mechanisms, enabling much more parallelism and faster training.

Multi-agent systems

Robin successfully proposed and validated ripasudil as a novel therapeutic candidate for dry age-related macular degeneration, showing it can accelerate the pace of AI-driven therapeutics.

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Search Information

HiMEMS Lab

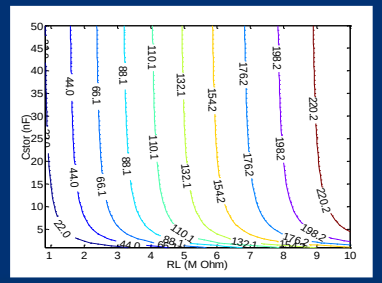
Heterogeneous Integrated MEMS Lab

Prof. Yi Chiu

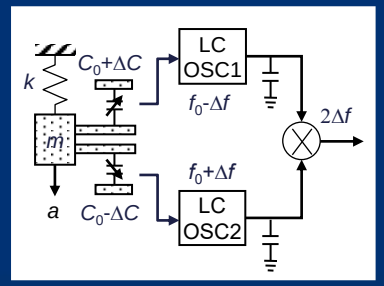
email: yichiu@mail.nctu.edu.tw website: http://himems.cn.nycu.edu.tw/

Interests: CMOS-MEMS, micro sensor, energy harvester

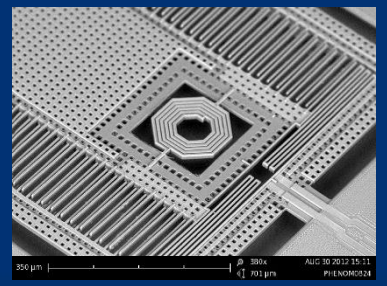
Analysis



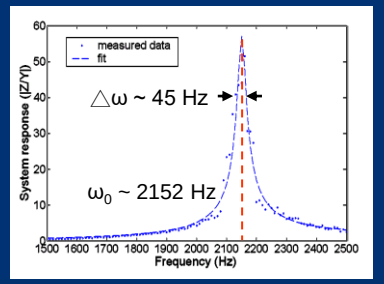
Circuit Design



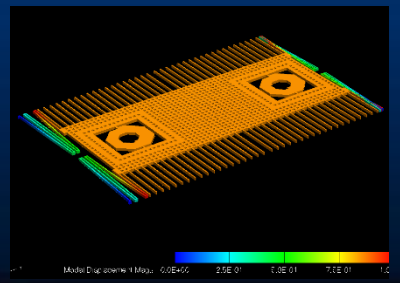
Fabrication



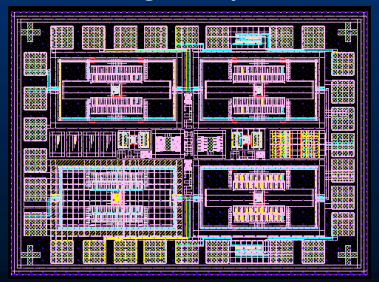
Device Characterization



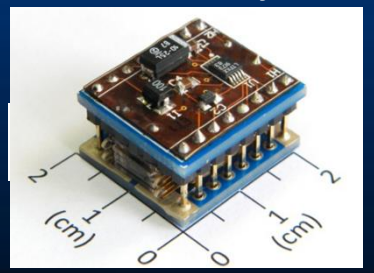
Simulation



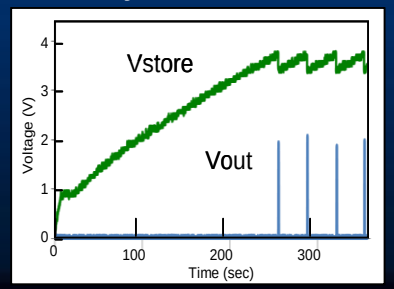
Design Tapeout



Assembly

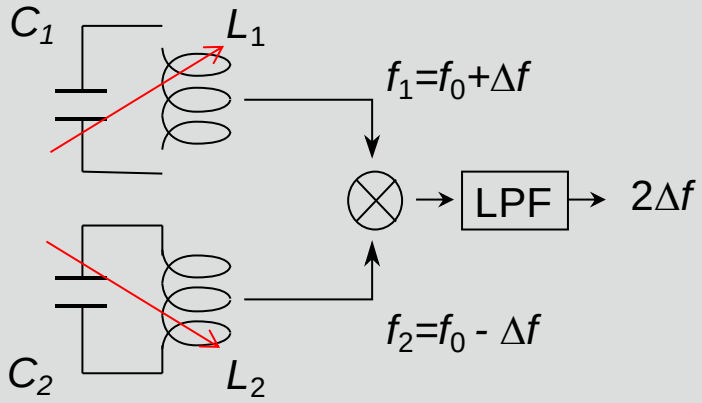


System Test

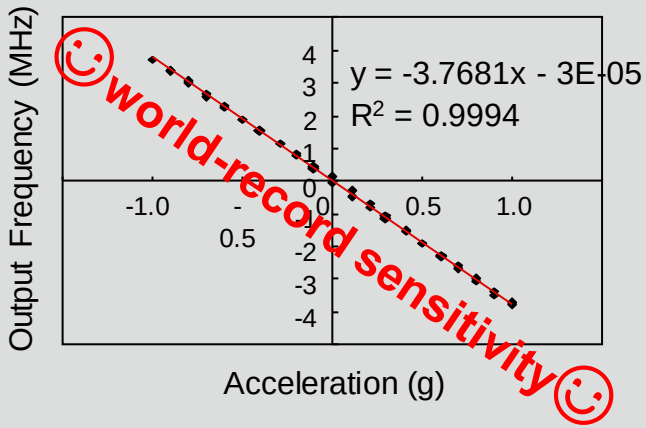


CMOS-MEMS Accelerometer*

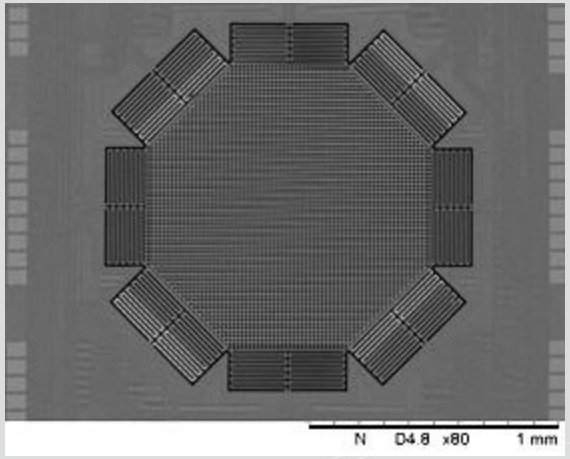
* co-developed with Prof. H.-C. Hong

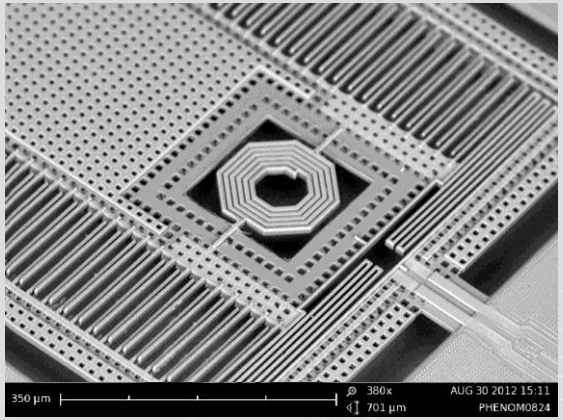


Inductive Accelerometer



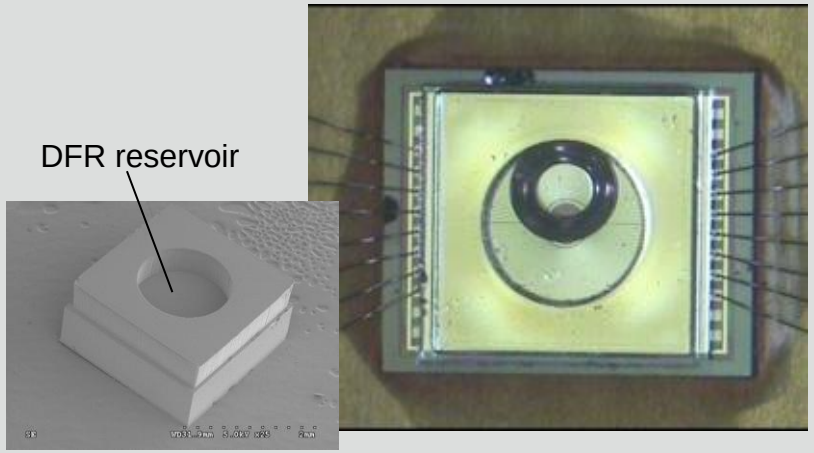
Capacitive Accelerometer

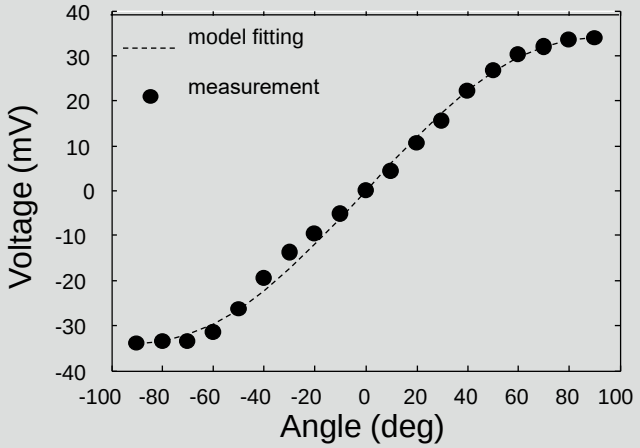




Other CMOS-MEMS Sensors

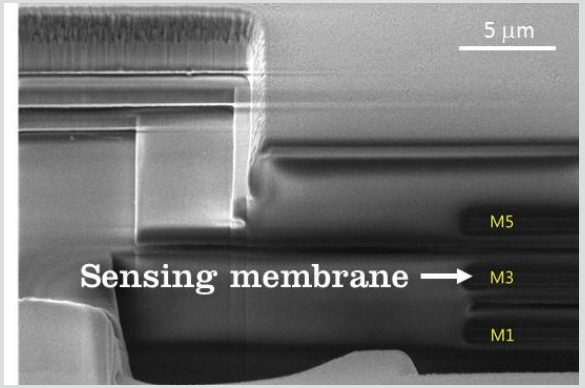
Inclinometer



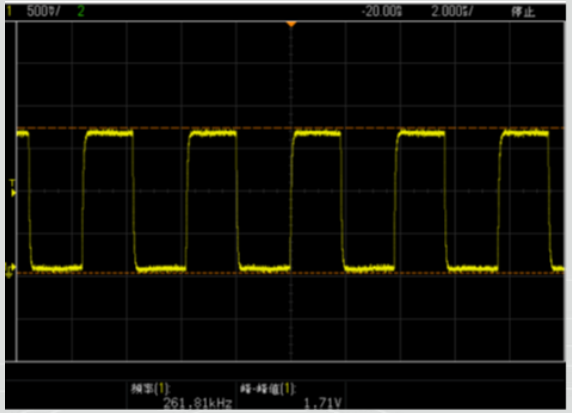


Pressure Sensor

FIB cross section

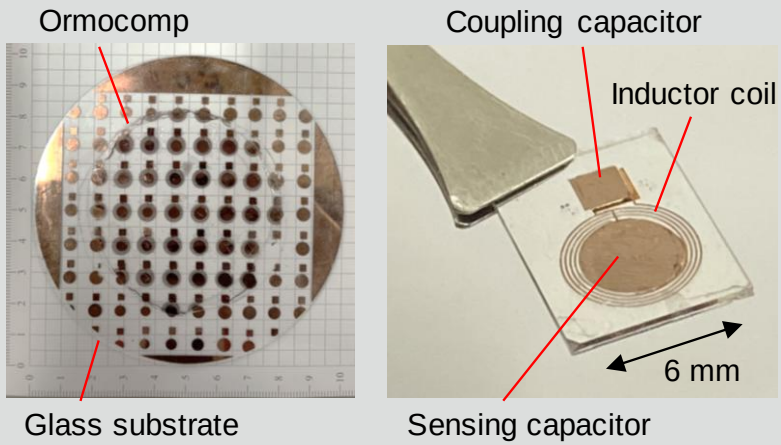


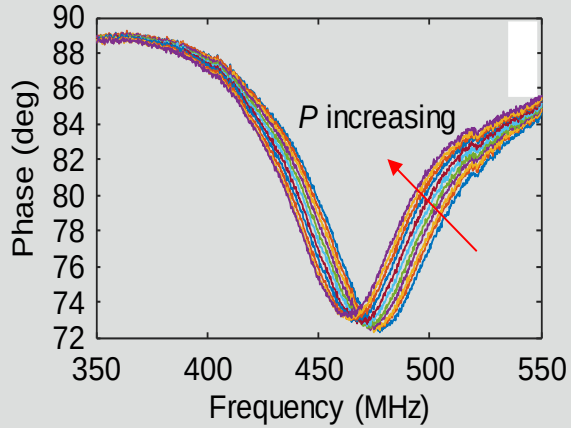
Output RC oscillator signal



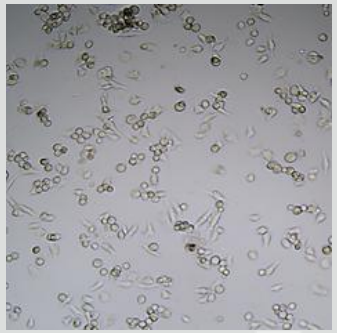
Wireless Body Implantable Sensors

Ormocomp Pressure Sensor

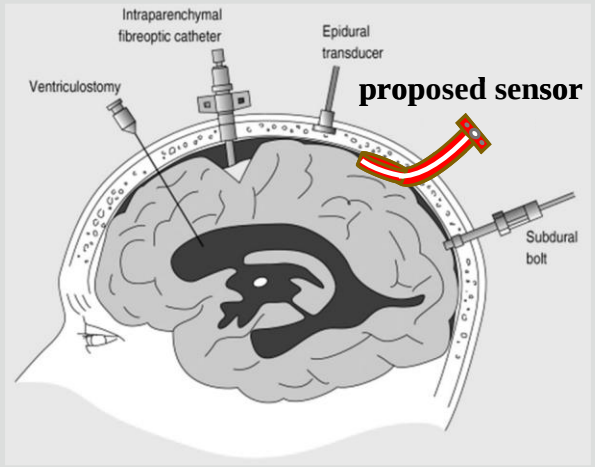


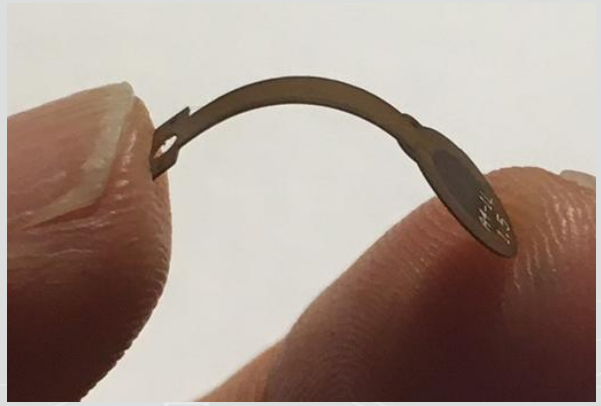


Cytocompatibility



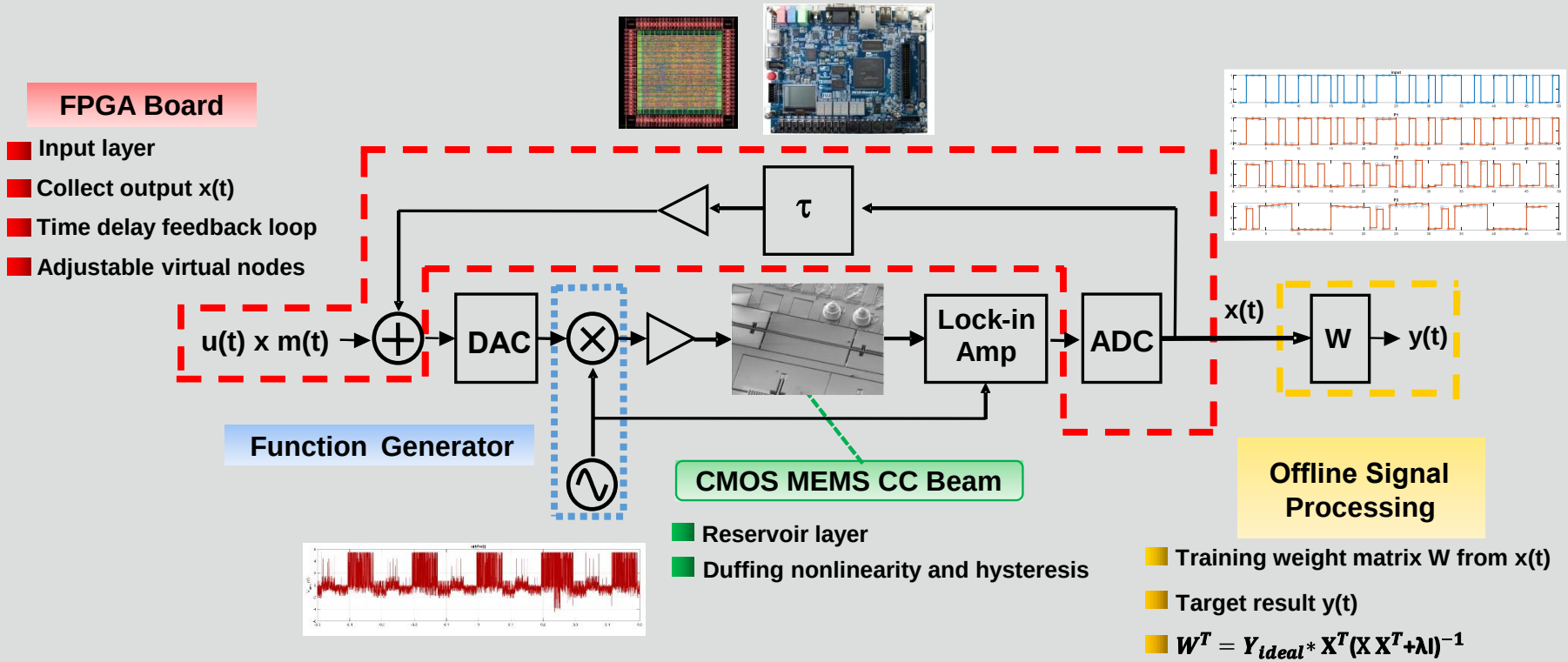
FPCB Pressure Sensor





CMOS MEMS for AI

Reservoir Computing



[1] Dion, et al., “Reservoir computing with a single delay coupled non-linear mechanical oscillator”, J. Appl. Phys. 124, 152132 (2018)
[2] Chiu. et al., “CMOS MEMS resonator for physical reservoir computing,” Y. Chiu, F.-W. Tsai, L.-K. Wang, Y.-C. Lee, M. Garg, 2023 IEEE Sensors, Austria, 1-4 (2023)

陽明交通大學電子研究所
Institute of Electronics, National Yang Ming Chiao Tung University

超音波成像實驗室
Ultrasound Imaging (UI@NYCU)

鄭耿璽(Geng-Shi Jeng)

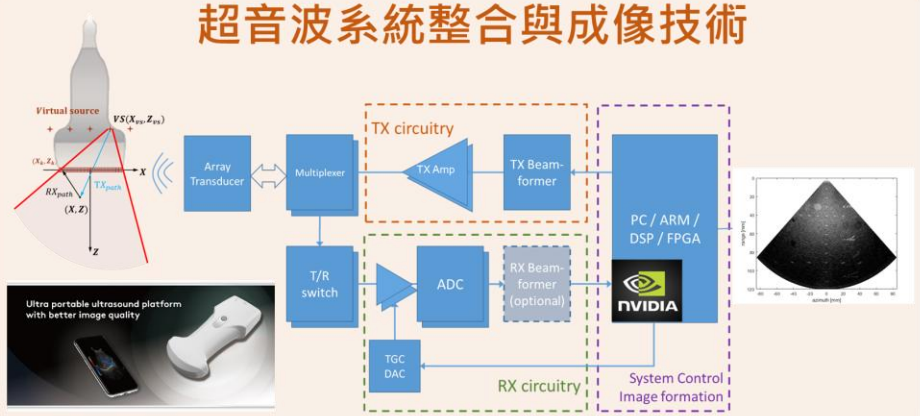
陽明交通大學電子所副教授
華盛頓大學醫工系訪問科學家
思銳生醫執行長、技術長
揚泰光電(中強光電集團)處長

Team: 1PhD, 9 MS

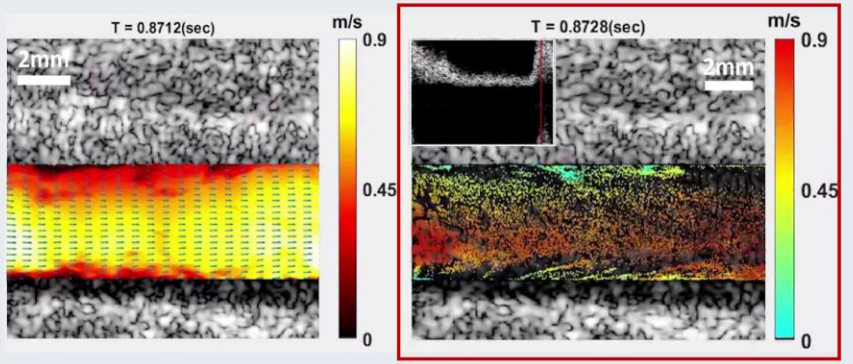
超音波成像與系統
非接觸式生理偵測
訊號處理
機器學習式功能造影

實驗室研究方向與成果

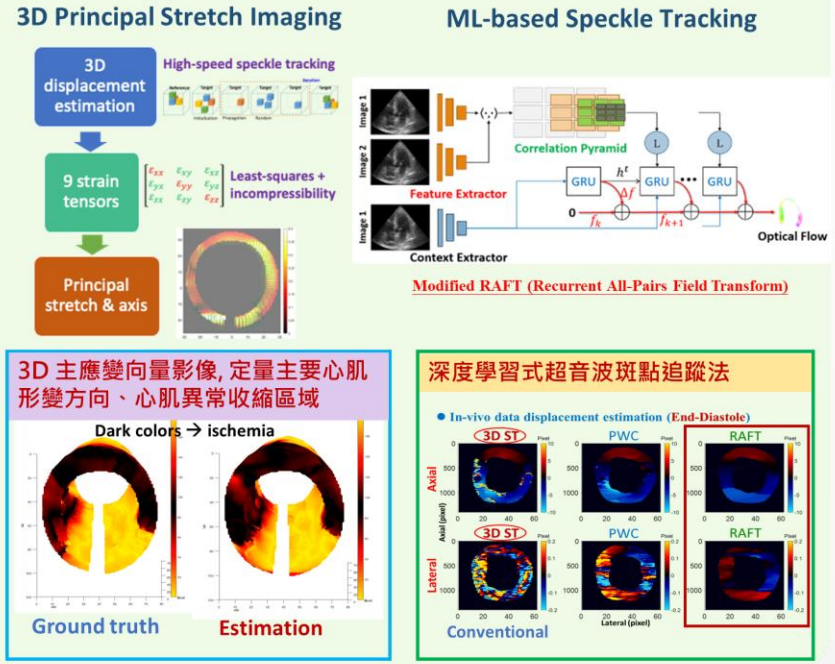
超音波系統整合與成像技術



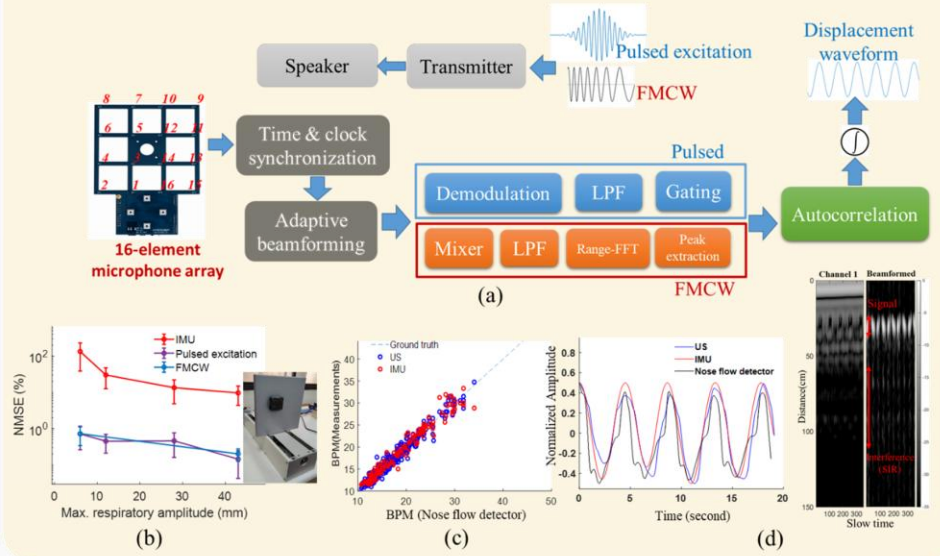
超快血流動力影像技術



3D超音波心臟功能影像



非接觸式生理訊號偵測



1. G.-S. Jeng, et al., ***Applied Physics Letters***, 2022.
2. G.-S. Jeng, et al., ***IEEE Trans. on Ultrasonics, Ferroelectrics and Frequency Control.***, 2021.
3. G.-S. Jeng, et al., ***Nature Communications***, 2021.

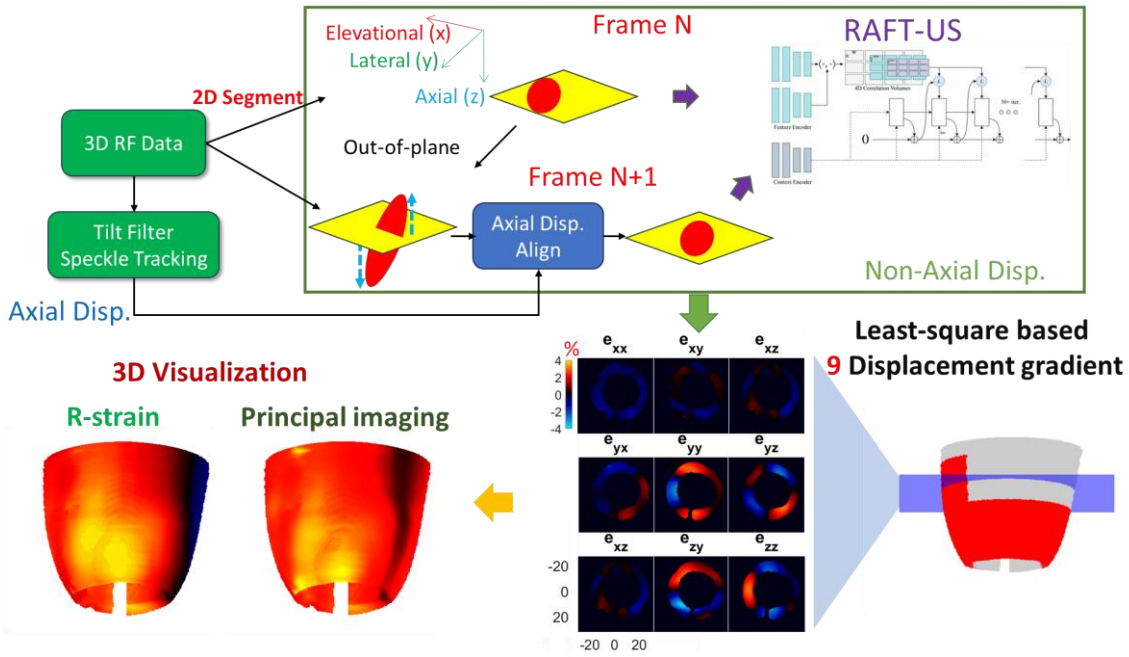
看的見的超音波

醫用超音波 (Medical US)
環境成像 (Airborne US)
水下成像 (Underwater US)

Ultrasound Cardiac Strain Imaging

Coordinate-Independent 3-D Ultrasound Principal Stretch and Direction Imaging

Geng-Shi Jeng, Po-Syun Chen, Min-Yen Hsieh, Zhao Liu, Jonathan Langdon, Shawn Ahn, Lawrence H. Staib, *Senior Member, IEEE*, John C. Stendahl, Stephanie Thorn, Albert J. Sinusas, James S. Duncan, *Life Fellow, IEEE*, and Matthew O'Donnell, *Life Fellow, IEEE*



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BIOMEDICAL ENGINEERING

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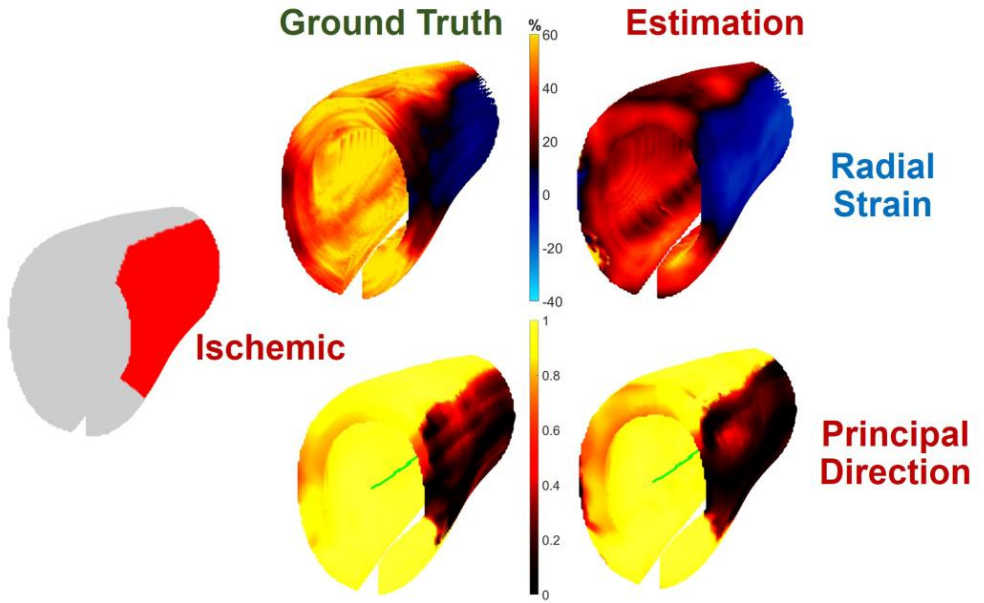
NOVEMBER 2024 VOLUME 71 NUMBER 11 IEBEAX (ISSN 0018-9294)

FRONT COVER, Nov. 2024



Ultrasound 3-D cardiac strain imaging using novel principal directions provides more robust detection of ischemic regions than traditional radial strain imaging. See "Coordinate-Independent 3-D Ultrasound Principal Stretch and Direction Imaging" by Jeng et al., p. 3312.

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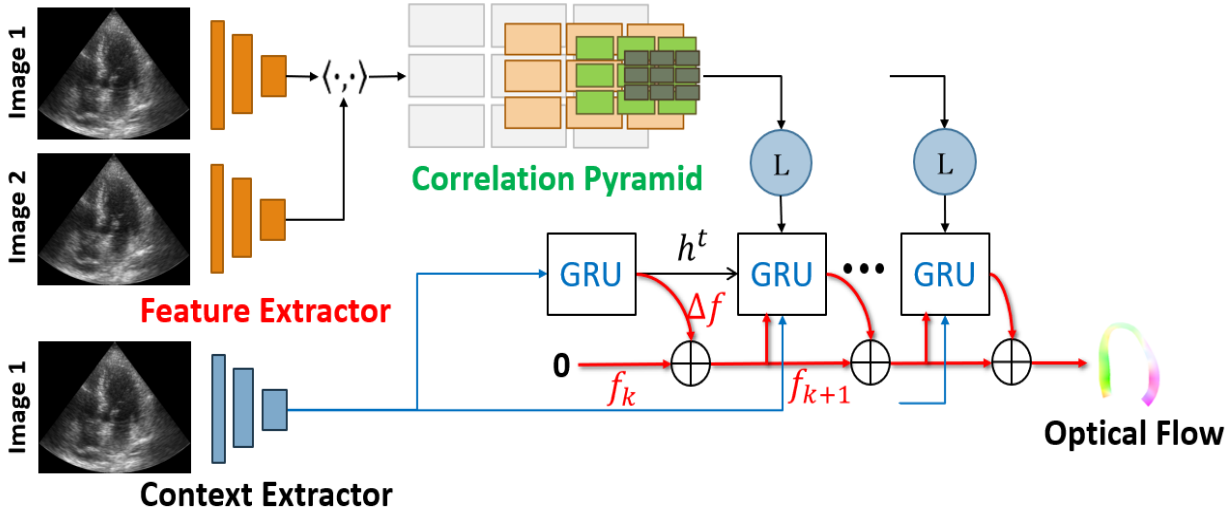
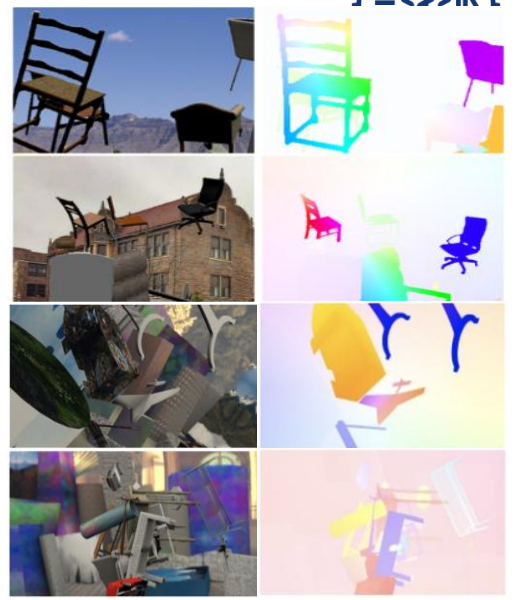
Deep Learning Cardiac Strain Imaging

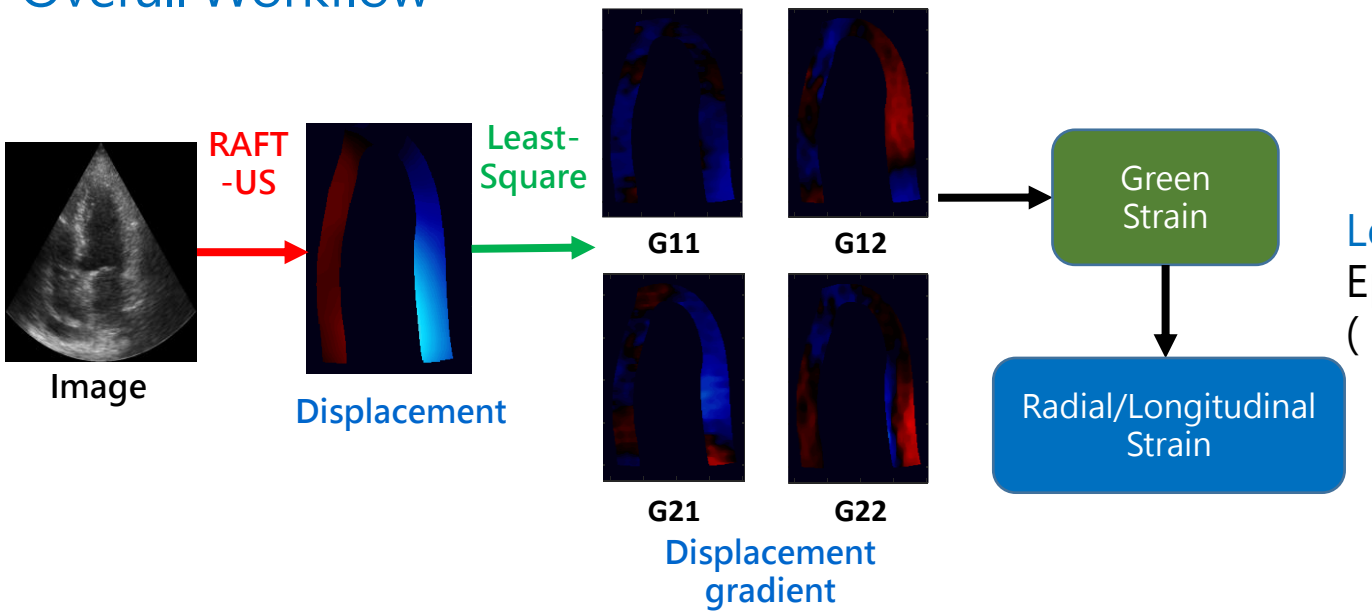




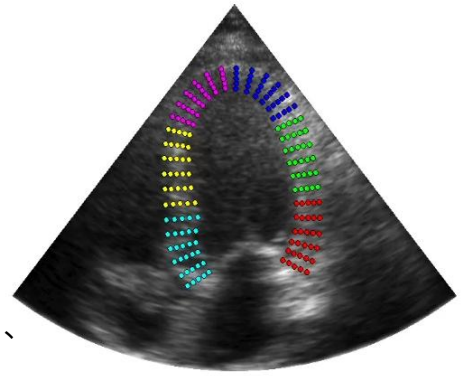
Flyingchairs
- Random movement various chairs
- Total 22,000 images

FlyingThings3D
- Virtually generated 3D objects
- Total 39,000 imaging

Overall Workflow



2D ultrasound Simulation Database
(Philips Research Suresnes FRANCE)
- 100 simulated patients,
- 60%training, 10%validation, 30%testing
- about 6000 images



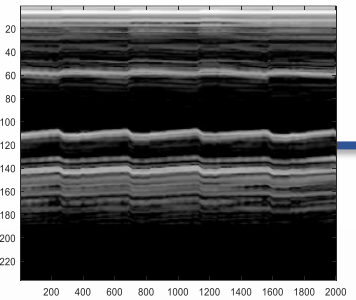
Loss function(Learning rate 1.25e-4 、Epoch 166)
(Ultrasound database focus on **myocardial region**)

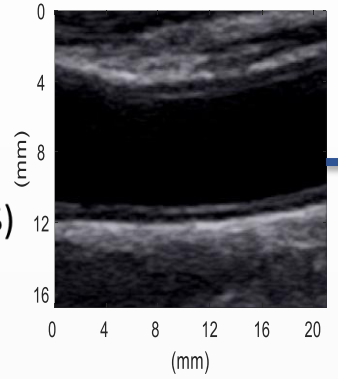
$$L = \sum_{i=1}^{N} \gamma^{i-N} \|f_{GT} - f_i\|_1 + \theta^2$$

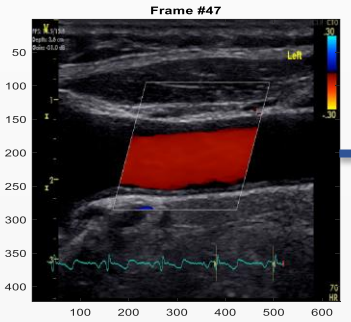
Blood Pressure: Continuous Monitoring

Wireless US Probe (POCUS)

Wearable US







M-mode Cross correlation

speckle tracking (vessel wall)

Volume flow rate estimate

Diameter waveform

PWV estimate (c)

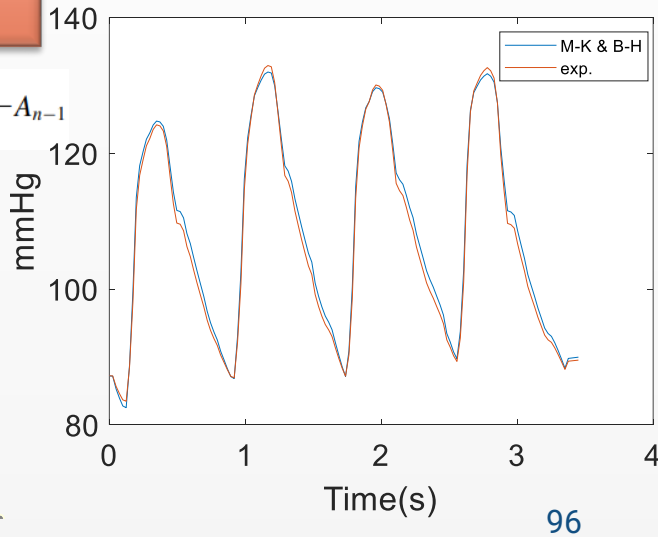
$$p(t) = p_d\, e^{\alpha\left(\frac{A(t)}{A_d}-1\right)}$$

Exponential relationship

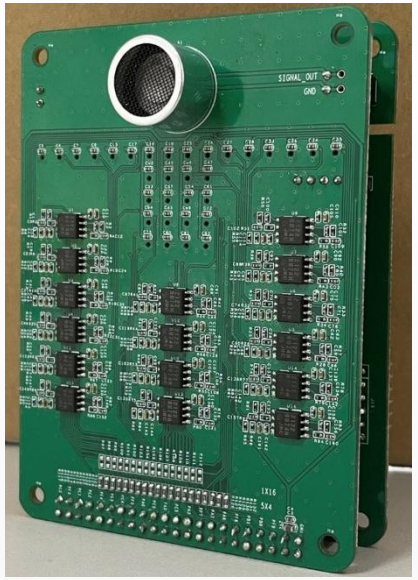
B-H equation and M-K equation

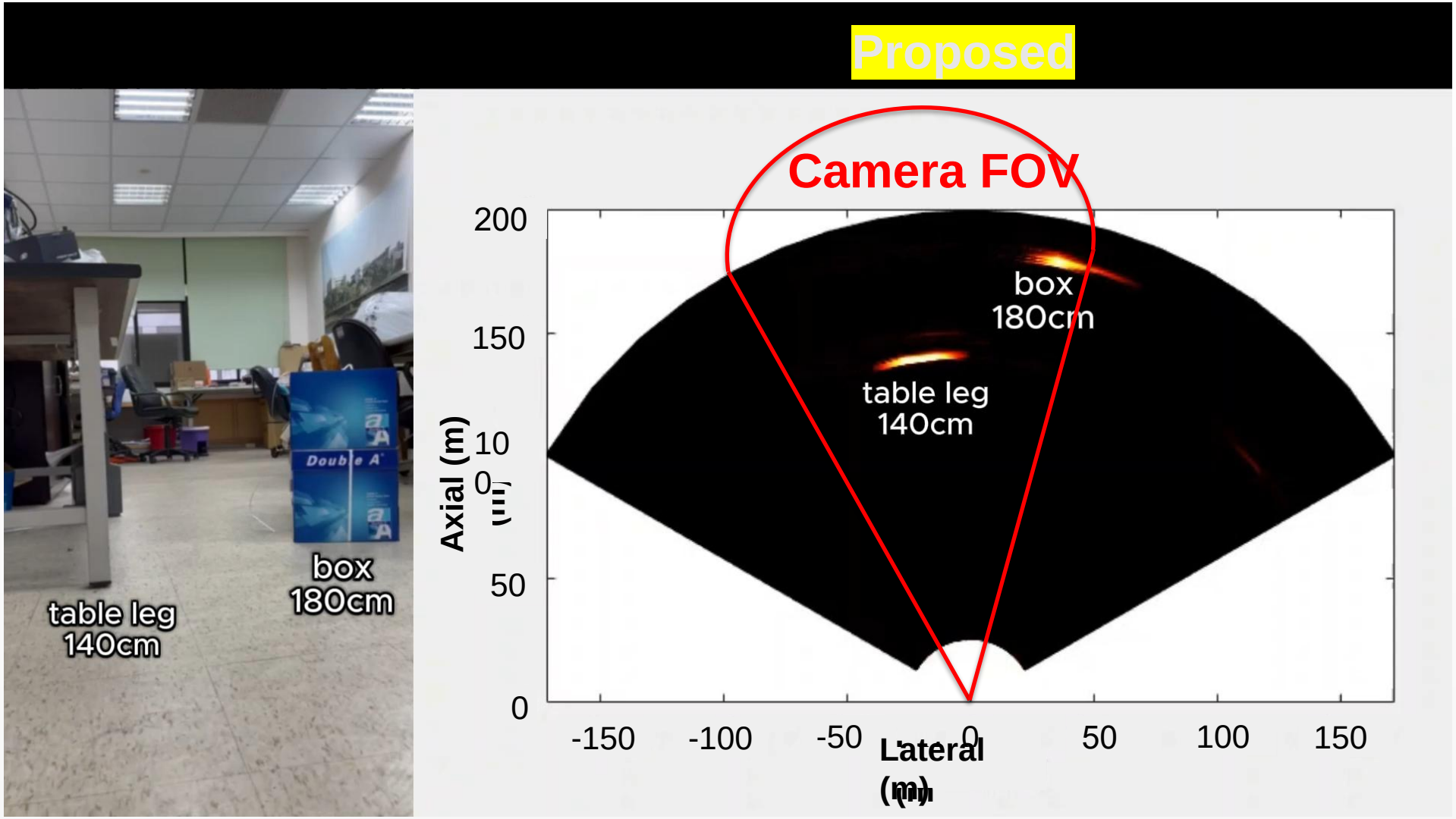
$$P_n = P_0 + \frac{\rho c^2}{A_0}\sum_{i=1}^{n}\Delta A_i \; with \; \Delta A_n = A_n - A_{n-1}$$

Blood pressure estimate



Airborne Single-Chip Ultrasound Imager





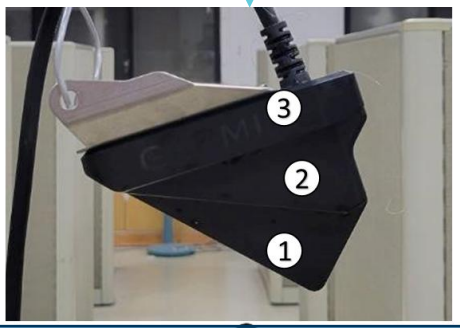
Beamformed imaging consumes time between 23.2 to 68ms

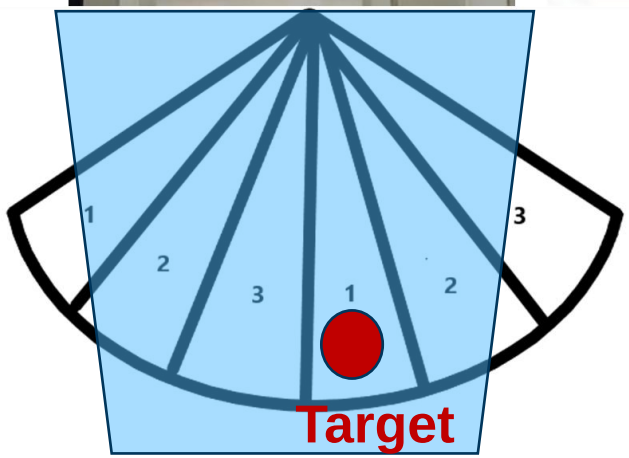
Underwater Sonar/ Fishfinder

- **Purpose**: Develop a **real-time**, forward-looking ultrasound imaging system
- **Our technologies: One-shot two-way beamforming**

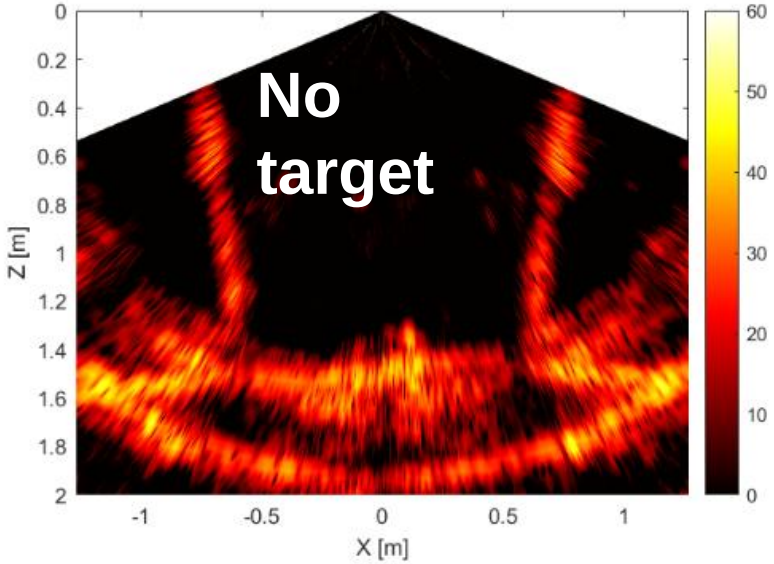
Transceiver

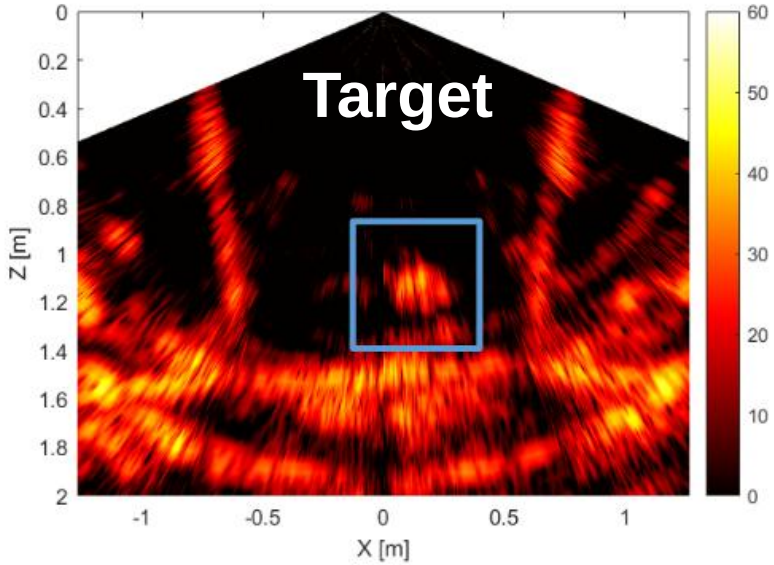
Transducer





- 1-MHz, 96-element phased array
- 30 fps at 25m depth
- FOV: 135° × 20° × 50m

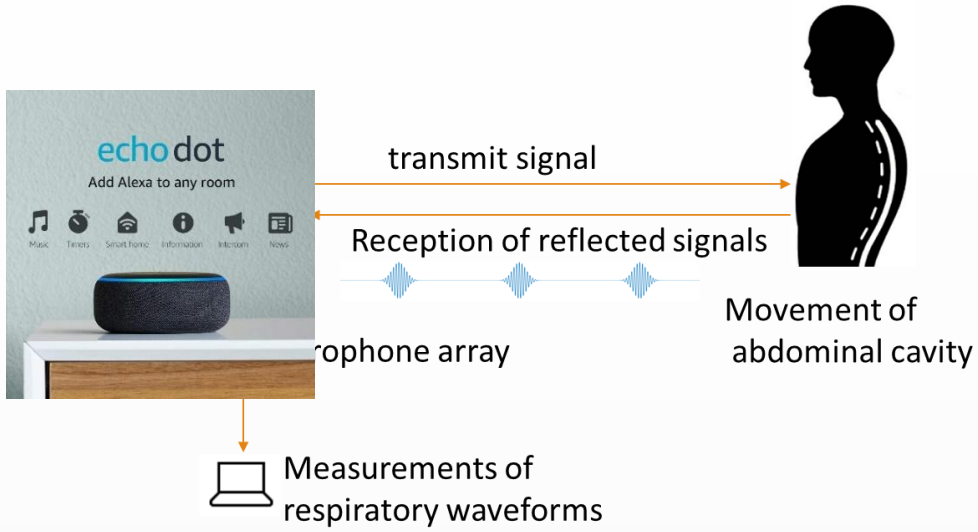


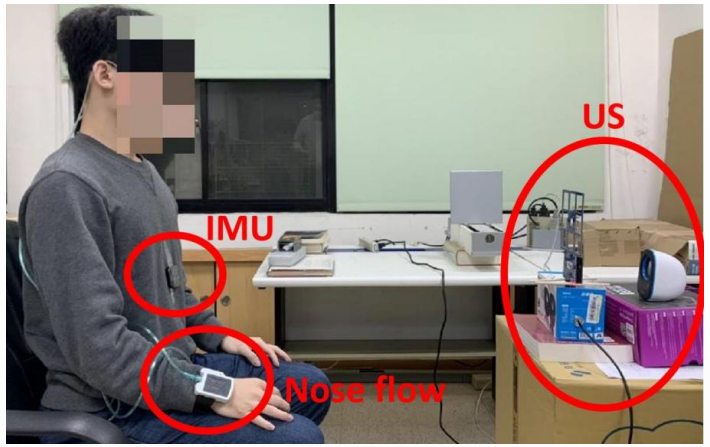


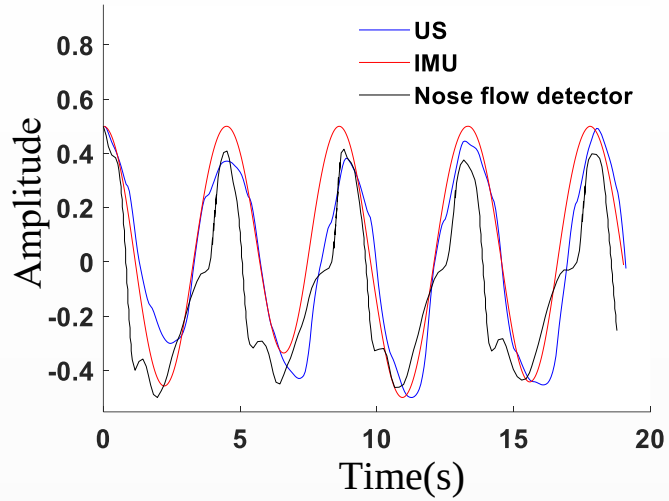
聽的見的超音波

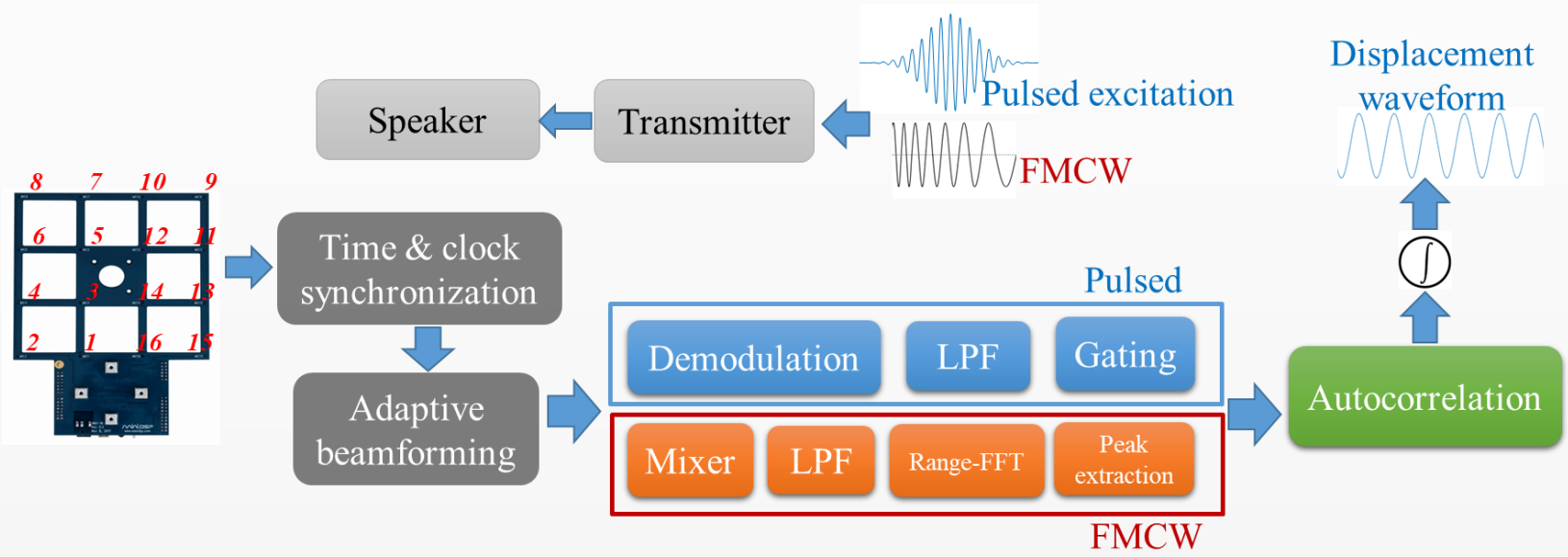
- 非接觸式生理訊號偵測
- 指向性喇叭

Non-contact Respiratory Detection

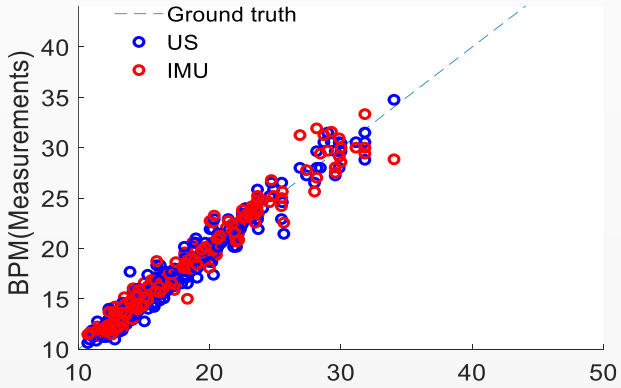








Instantaneous breath rate

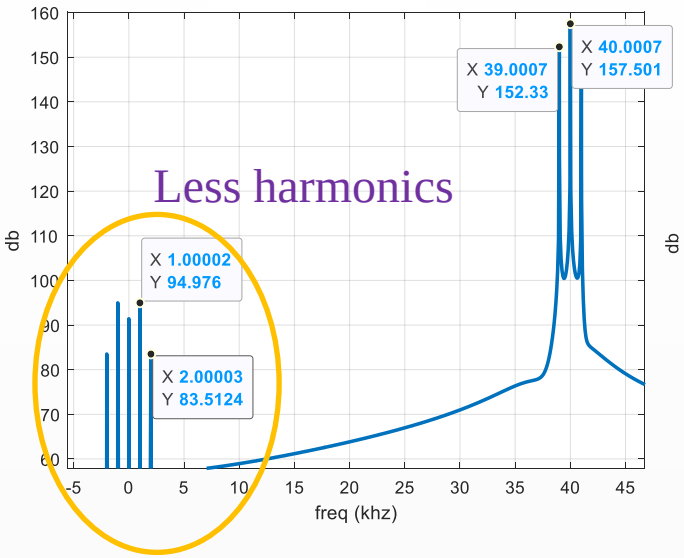


BPM : Nose flow detector

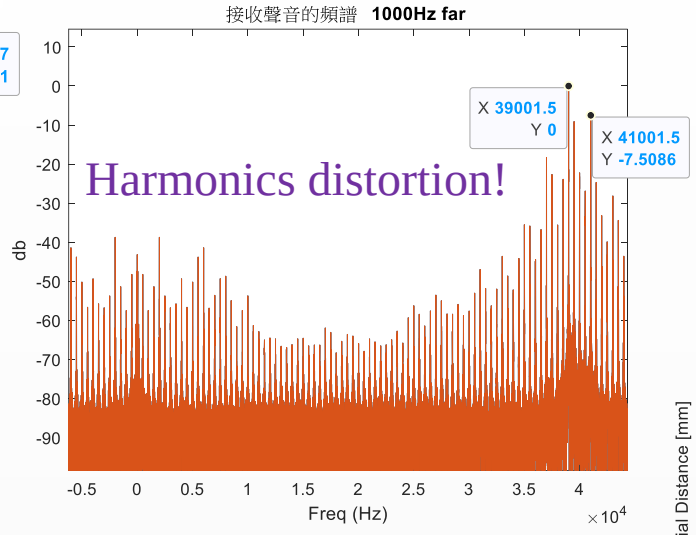
(Instantaneous BPM: reciprocal of each breathing cycle)

Parametric Array Loudspeaker

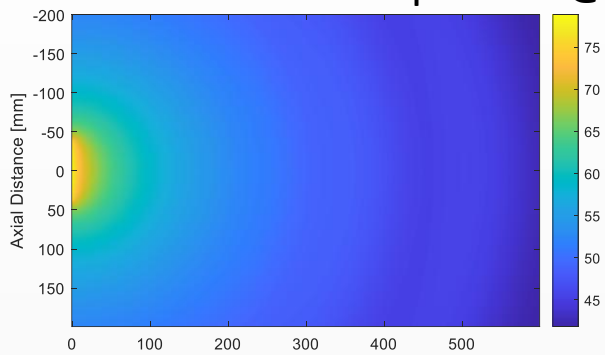
AM Modulation (1kHz tone)



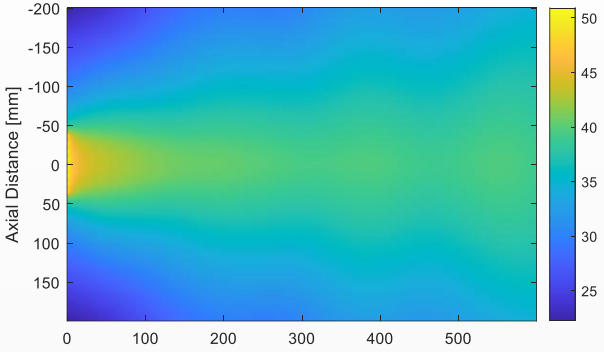
Conventional PWM



Radiation pattern @1 kHz



Traditional speaker

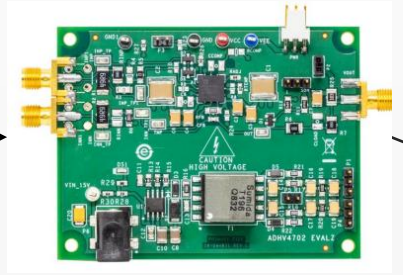


Parametric array loudspeaker

Computer Processed signal

1 Vpp signal

3.5mm



Linear amplifier

40 Vpp signal

40kHz array

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Institute of Electronics, National Yang Ming Chiao Tung University

超音波成像實驗室

國立陽明交通大學
NATIONAL YANG MING CHIAO TUNG UNIVERSITY

ULTRASOUND IMAGING (UI@NYCU)

Looking for

喜歡動手組系統、訊號處理
超音波海、路、空應用
跨領域研究

Partnership

University of Washington
台北榮總
台北醫學大學
臺大醫院
中央生醫
清大電機

國立陽明交通大學工程四館ED423室 (實驗室)
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謝旻諺, 謝樂彤, 李佳璋,
石璧誠, 呂靜瑤, 邱俊瑋
黃育豪

無線感測晶片與系統實驗室

廖育德(Yu-Te Liao) 教授

- 工五館768; 分機54394; yudoliao@nycu.edu.tw
- 美國華盛頓大學電機工程博士(University of Washington)

研究領域

- 低功率類比與射頻積體電路
- 生醫晶片與系統設計
- 感測器介面電路與能量擷取電路設計

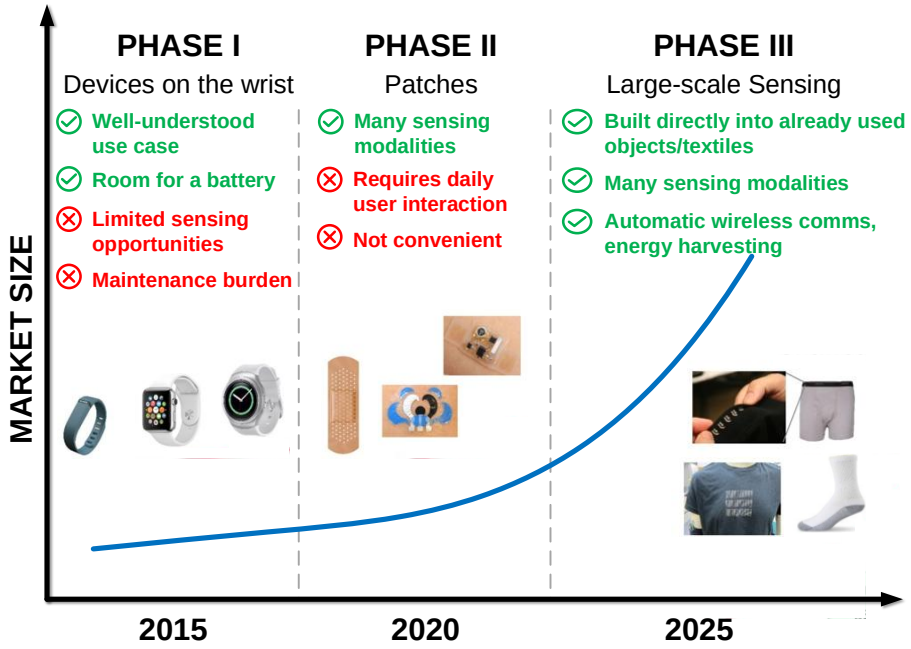
榮譽與服務

- TSRI 年度優良晶片 2014, 2016-2019, 2021, 2023
- 旺宏金矽獎 優勝 2017-2021
- 國家新創獎-學研創新 2015, 2019
- 科技部未來科技突破獎 2020
- 2016 中國電機工程師學會青年工程師獎
- 2018 台灣積體電路學會優秀年輕學者獎
- 科技部年輕學者養成計畫(哥倫布計畫) 2019-2024

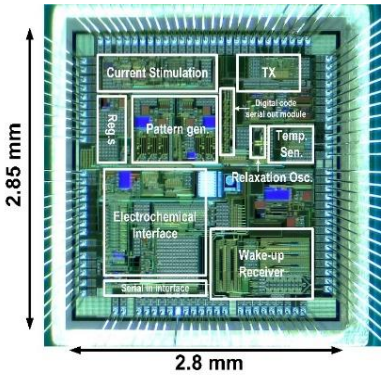
WIML
Wireless Integrated Microsystems Lab

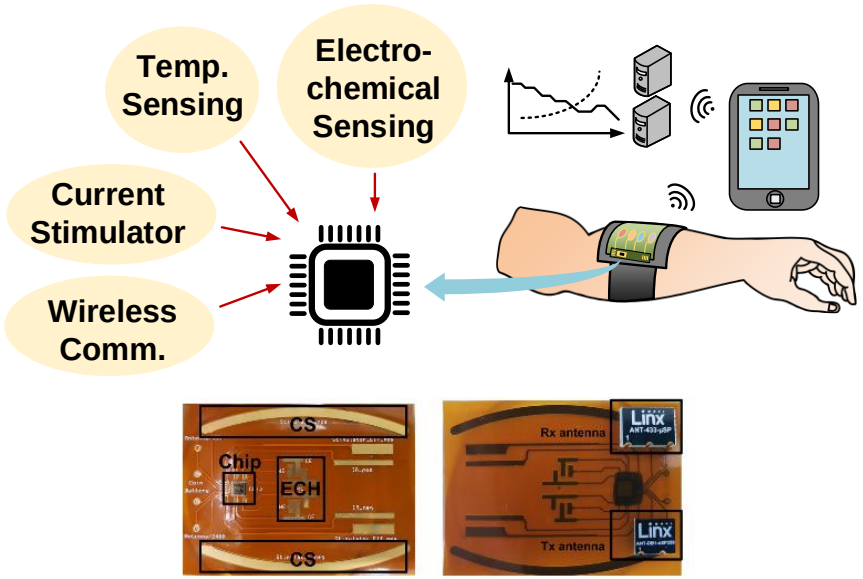
誠信 感恩 創新

智慧感知晶片系統



- 積體電路 + 異質整合 + 跨領域研究 (生醫、材料、半導體、通訊、能量)
- 無電池式自主感測系統 = 低功耗電子 + 環境能量擷取 + 智慧感知
- 仿生科技(電子皮膚、電子鼻)、腦神經科學、植物生長感測





電子皮膚: 多功能傷口照護貼片 (尿酸、C反應蛋白、溫度、電刺激、給藥) (ISSCC 2021)

Smart inhaler for Asthma/COPD

Measure inhaler technique by inhalation sound

Smarthaler： personalized inhalation model

- ✔ Guide correct inhaler use
- ✔ Accurate inhalation flow pattern
- ✔ Real time records

Smarthaler App：

- Monitor and records
- Education
- Remind

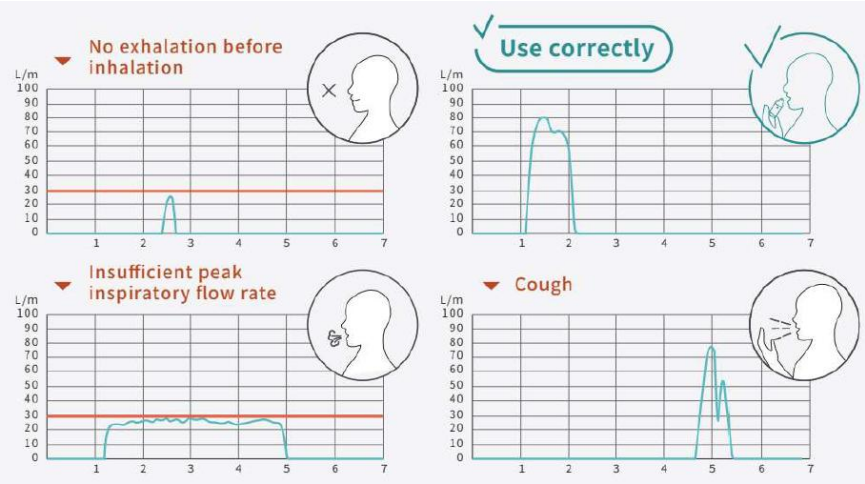
i-Breath Platform:

- Telemedicine
- Improve respiratory care capability
- Information security (blocked chain)

Improving patients' inhaler technique

AI model:

- **Risk prediction**
- **Disease control model**
- **Self management program**

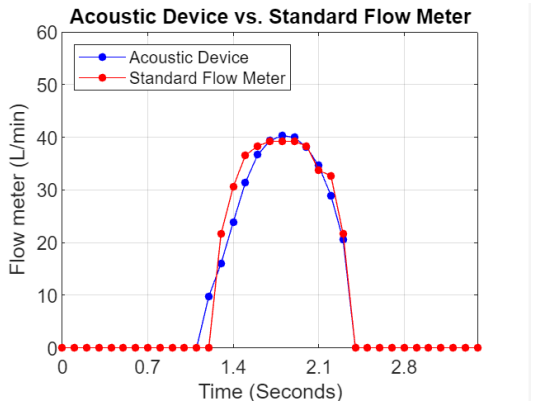


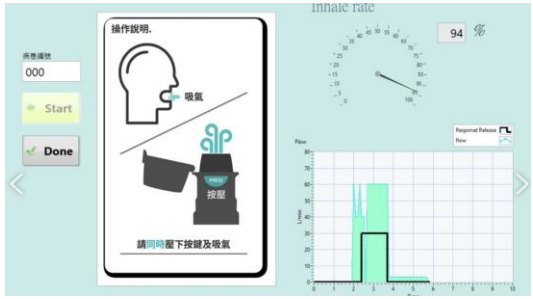
合作: 馬偕醫院、中研院、陽明交通大學

Smart inhaler for Asthma/COPD

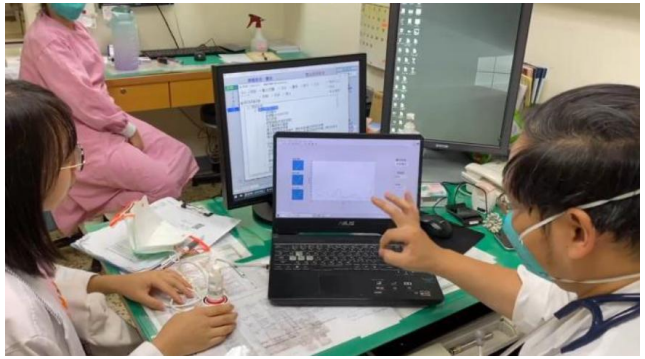
Sensors :
- Attach on inhaler
- Measure using sound

Data analyze:
- Inspiratory flow pattern
- Inhaler install check



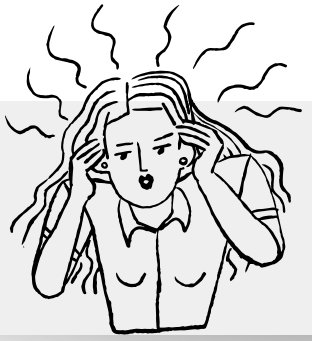


Clinical use:
- Health education
- Digital health

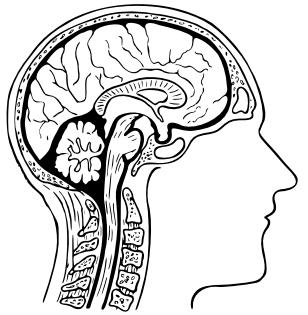


Neurodegenerative Disorder

Aging society



Stressful society

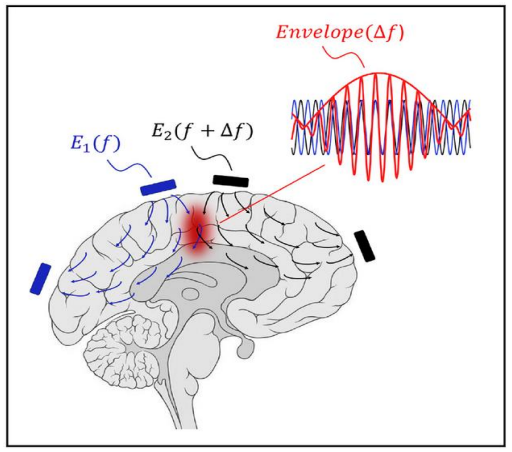


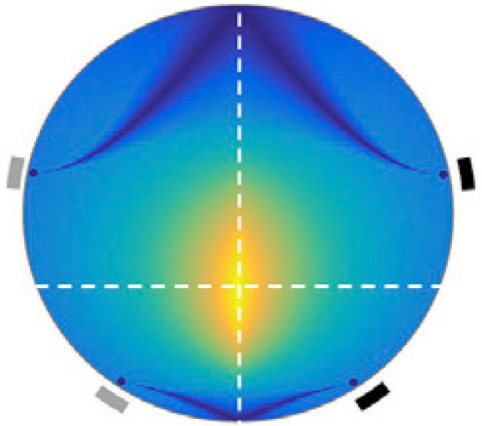
Neurodegenerative disorder

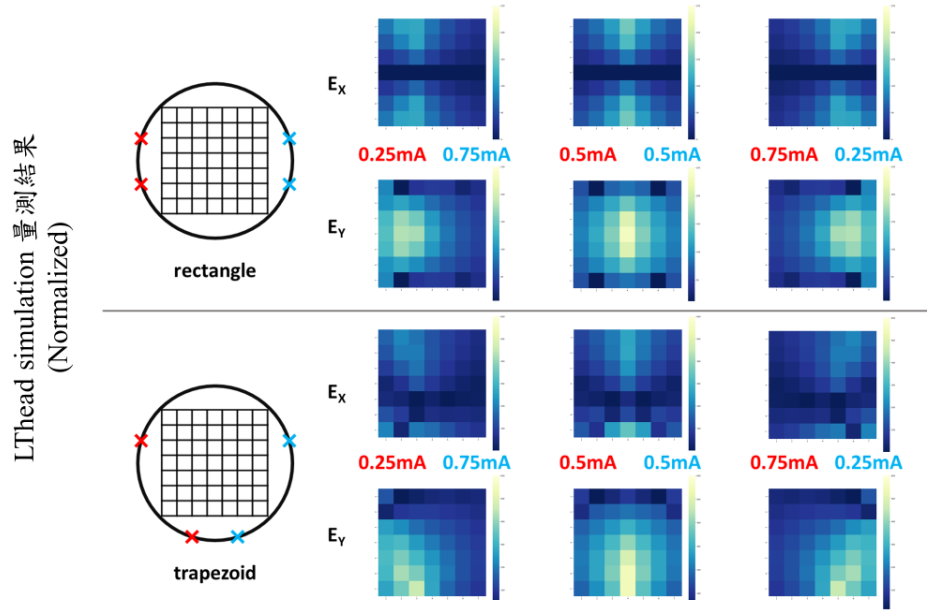
- Alzheimer's disease
- Parkinson's disease
- treatment-resistant depression
- treatment-resistant schizophrenia

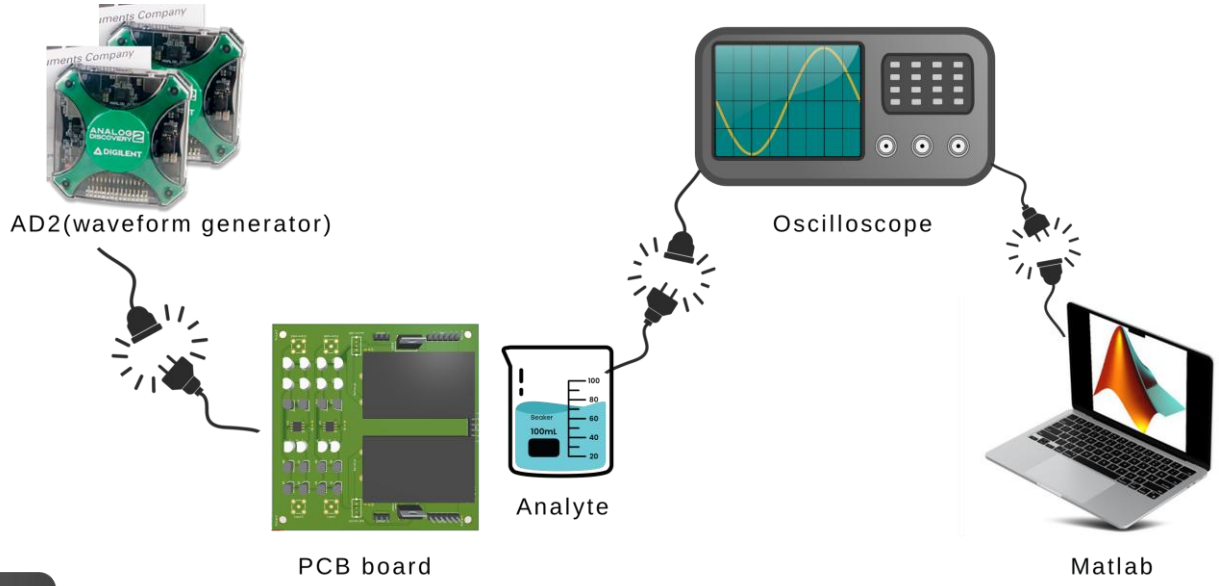
合作: 陽明交通大學醫學系楊智傑副主任、生醫工程研究所、成大

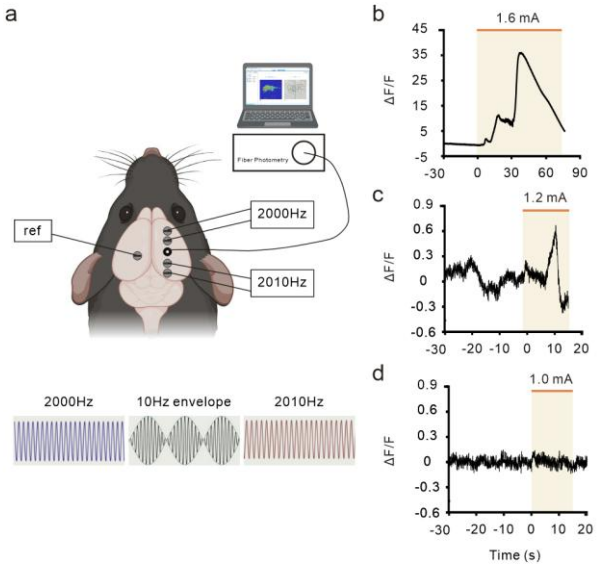
TIBS System


$Envelope(\Delta f)$
$E_1(f)$
$E_2(f+\Delta f)$

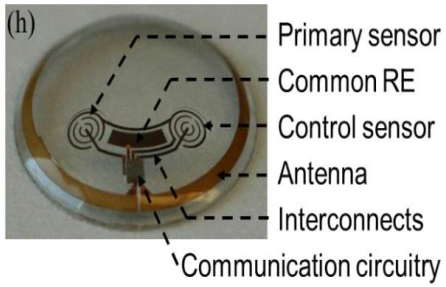


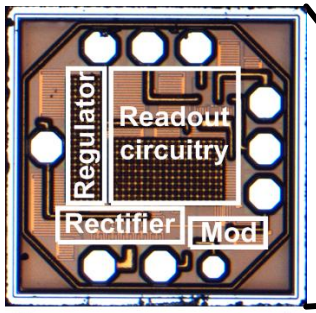

LThead simulation 量測結果
(Normalized)
E_X
E_Y
0.25mA 0.75mA
0.5mA 0.5mA
0.75mA 0.25mA
rectangle
trapezoid


AD2(waveform generator)
Oscilloscope
PCB board
Analyte
Matlab


a
b
c
d
ref
2000Hz
2010Hz
1.6 mA
1.2 mA
1.0 mA
ΔF/F
10Hz envelope
Time (s)

Biomedical System-on-a-Chip (SoC)



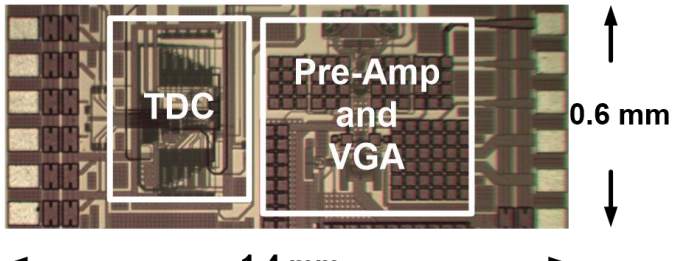


ISSCC11, JSSC12

智慧型隱形眼鏡

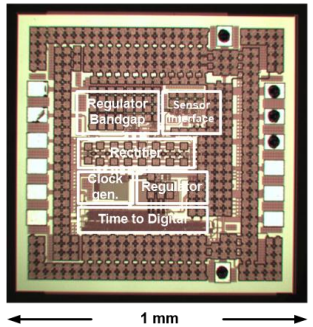
(葡萄糖、眼壓、生理化學成分)

人工電子耳



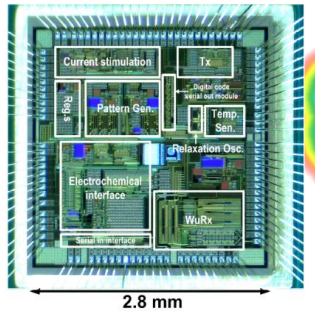
心電訊號檢測

(心跳、心律、心臟疾病)



無線電化學感測

(葡萄糖、蛋白質檢測)

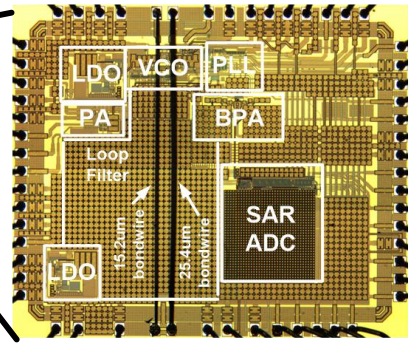


傷口照護晶片

(電流刺激、溫度監控)

TCASI 16, 18,
TBioCAS 19, 20, 21, 22, 23

ISSCC 21



無線加速度計

(位置、跌倒、計步)

VLSI'09, Jsensor'11 TCASI 15