AI FOR HIGH PRECISION 6G WIRELESS COMMUNICATIONS, INDUSTRIAL 5.0, AND HEALTHCARE 4.0

INTELLIGENT COMMUNICATIONS AND COMPUTING LAB

LI-CHUN WANG

- Research Areas:
  - Wireless and Mobile Communications
  - UAV Communications and Networking
  - Intelligent Internet of Things (IIoT)
  - Big Data Analysis and AI Solutions for complex systems
- Honor
  - IEEE Fellow (2011)
  - Two Distinguished Research Awards, Ministry of Science and Technology, Taiwan (2011 and 2017)

My Interested Research Areas:

Last 20 years

Model-Driven Research

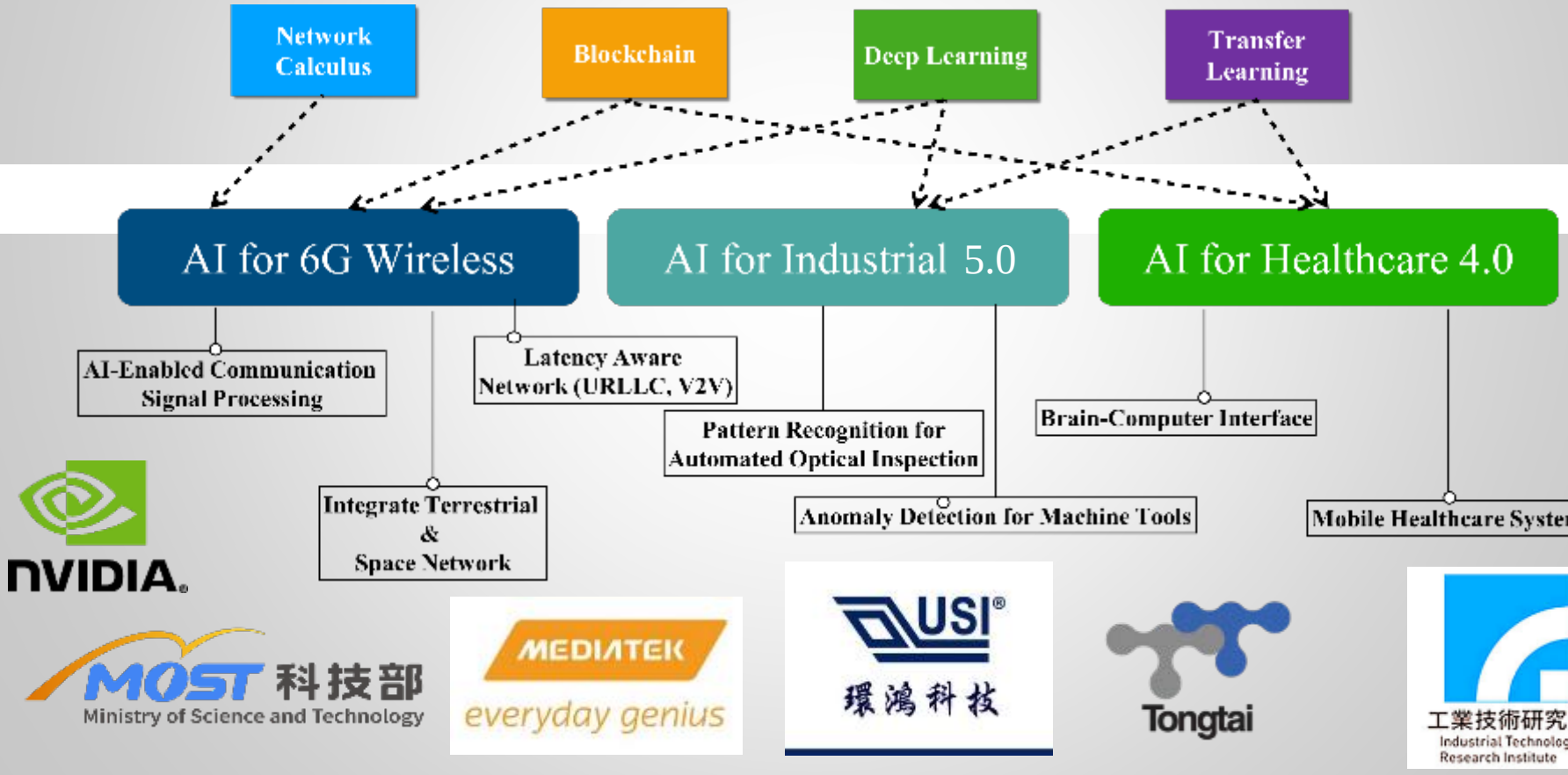
Optimization

Queueing Theory

Information Theory

Since 2018

Data-Driven Research



ACADEMIC COOPERATION PARTNER

UNIVERSITÀ
DI PARMA

NANYANG
TECHNOLOGICAL
UNIVERSITY

Queen Mary
University of London

UNIVERSITY of
HOUSTON

Georgia
Tech

AI FOR 6G WIRELESS

ANGEL Flying Base Station

ANGEL FBS
Artificial Intelligence Driven
Network On-Demand
Greater Flexibility
Extended Coverage
Longer Hover Time

國立交通大學 National Chiao Tung University


王蒞君


帥宏翰


李奇育

TAIPEI TECH 國立臺北科技大學 National Taipei University of Technology


林信標

國立虎尾科技大學 National Formosa University


李朝陽

國立中央大學 National Central University


陳昱嘉

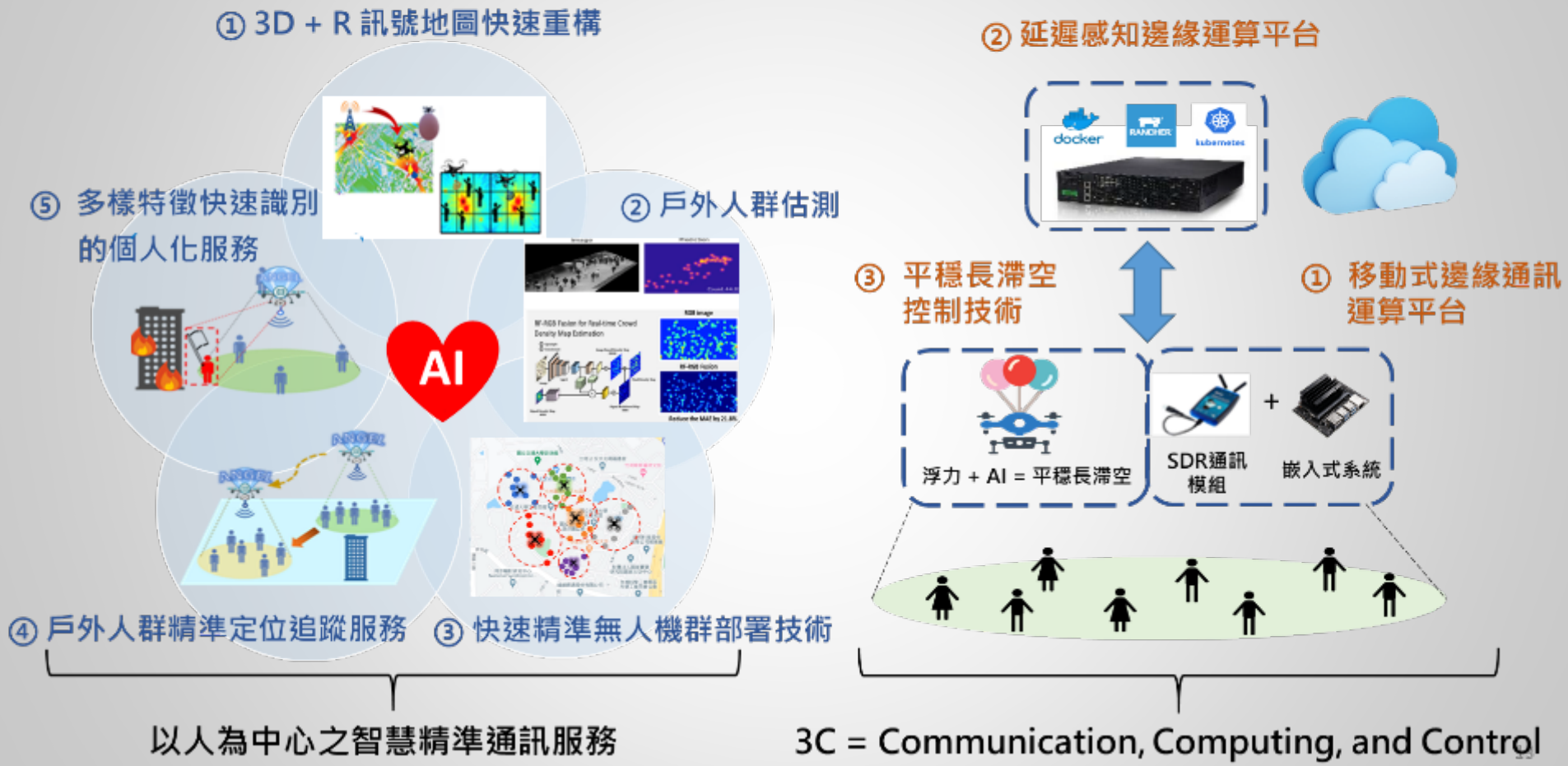
國立成功大學 National Cheng Kung University


張志文

國立中正大學 National Chung Cheng University


劉維正

人本精準行動通訊服務


① 3D + R 訊號地圖快速重構
② 延遲感知邊緣運算平台
⑤ 多樣特徵快速識別的個人化服務
② 戶外人群估測
AI
③ 平穩長滯空控制技術
① 移動式邊緣通訊運算平台
docker
RANCHER
kubernetes
浮力 + AI = 平穩長滯空
SDR通訊模組
+
嵌入式系統
④ 戶外人群精準定位追蹤服務
③ 快速精準無人機群部署技術
以人為中心之智慧精準通訊服務
3C = Communication, Computing, and Control

3D + R 訊號地圖快速重構

R+3D Signal Map Construction

(Signal Visualization)

Demo Video

國立交通大學
National Chiao Tung University

ICCL
Intelligent Communication and Computing Lab

AINGEL

快速精準無人機群部署技術

應用情境：

- 透過訊號地圖快速重構與電腦視覺技術，以無人機追蹤多群用戶並提供精準通訊服務

問題與挑戰：

- 在用戶群分布隨機且不均的情況下，無人機在不同高度下易導致服務範圍相互重疊，進而引發嚴重干擾

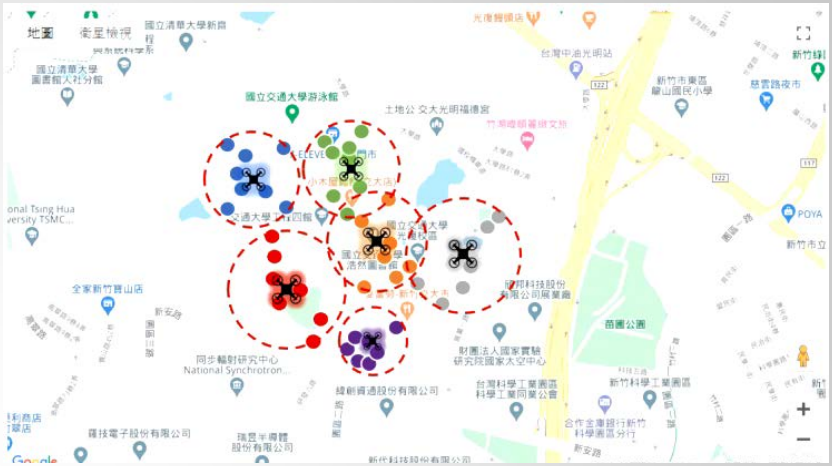
關鍵技術：

- Edge AI Wireless 3D無人機群部署
  - 結合分群與干擾感知的機器學習演算法

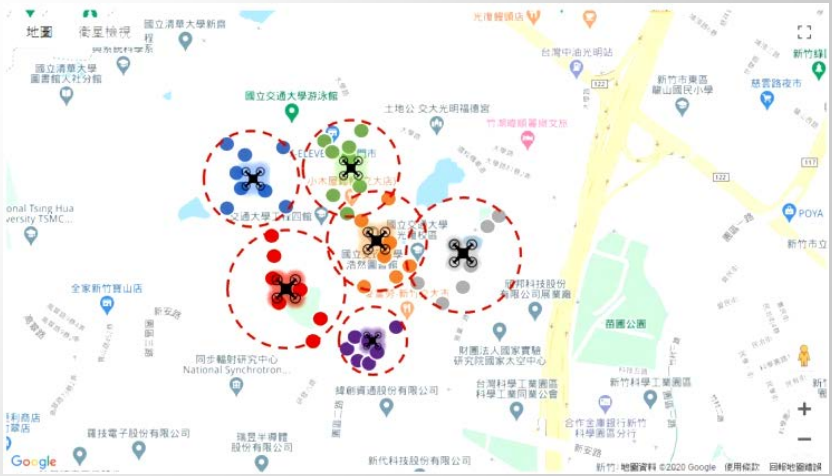
成效：

- 偵測不同用戶群並定位追蹤，動態部署無人機群，持續提供精準且穩定的通訊服務

The Coverage Overlapping Problem (COP)



Interference-Aware 3D UAV Placement



1. C.-C. Lai, L.-C. Wang, and Zhu Han, "The Coverage Overlapping Problem of Serving Arbitrary Crowds in 3D Drone Cellular Networks," to appear in *IEEE Transactions on Mobile Computing*. (SCIE, IF=5.112, Rank=18/156, Information Systems)

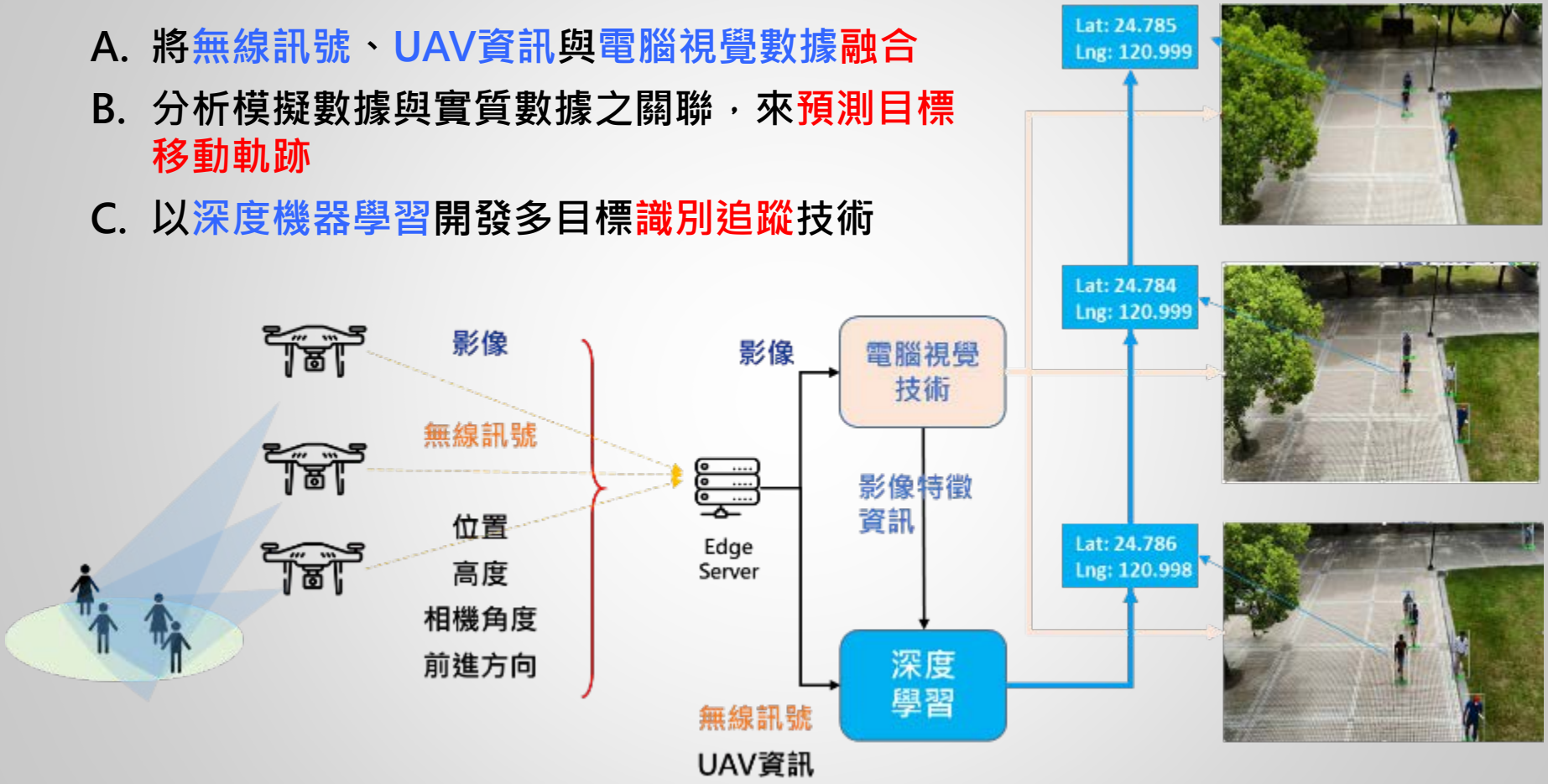
異質訊號融合定位追蹤技術

技術亮點：

A. 將無線訊號、UAV資訊與電腦視覺數據融合

B. 分析模擬數據與實質數據之關聯，來預測目標移動軌跡

C. 以深度機器學習開發多目標識別追蹤技術



- A. B. Adege, Y.-R. Li, H.-H. Shuai, H.-P. Lin, L.-C. Wang, "Improving UAV Personalized Tracking Services by Fusing Visual and Radio Data," to appear in *ICPAI 2020*.

AI FOR INDUSTRY 5.0

Challenges for Mechanical Industry

產學合作

技轉成效

- 基於深度壓縮感知之訊號來波角度估測使用於虛擬天線場景
- 智慧運輸管理之RFID偵測系統與車輛偵測系統時間數據分析模型平台建立之研究
- 基於機器學習之非焊錫性AOI辨別優化模型
- 基於機器學習之AOI辨別優化模型
- 適用於智能製造的資料分析平台之建置

2020全國大專院校智慧創新暨跨域整合創作競賽數位永續科技組

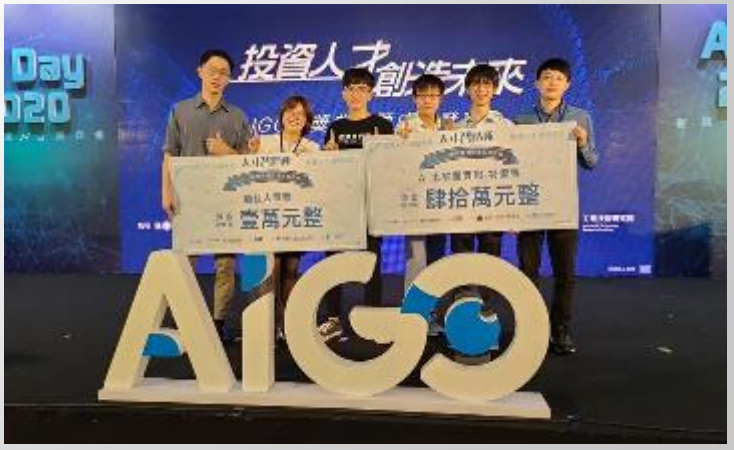
- 由教育部推動，國立中央大學主辦的2020全國大專院校智慧創新暨跨域整合創作競賽，學生表現優異獲得
  - 第三名
  - 值得注目獎

2020「資料創新應用競賽」

- 由台北市電腦公會主辦的2020資料創新應用競賽，學生表現優異獲得兩項獎項
  - 銅獎
  - 區塊鏈創新應用獎

AIGO-AI智慧應用新世代人才培育競賽

- 由經濟部主辦的AIGO-AI智慧應用新世代人才培育競賽，學生表現優異獲得
  - ＡＩ出解題實證 - 特優獎
  - 最佳人氣獎



AI FOR HEALTHCARE 4.0

Brain Research Center (BRC, NCTU)

- **The mission of NCTU BRC is to integrate bio-sensing technology, information technology, and cognitive neuroscience into basic and advanced neural engineering research.**

(1)「Establishment of NCTU-UCSD International Center of Excellence for Advanced Bioengineering Research」funded by Taiwan MOST (5 years, USD$ 6.65 million).
Topics: Neural Engineering, Translational Neuroscience, and Tele-Healthcare

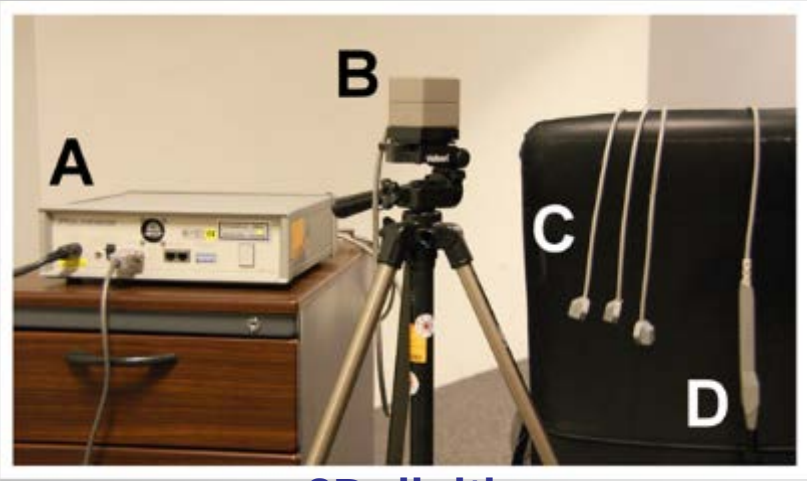
(2)「Cognition and Neuroergonomics Collaborative Technology Alliance (CTA)」funded by ARL of USA (10 years, USD$ 5.5 million).
Topics: Neurocognitive Performance, Computational Neuroscience,

Brain Research Center : Main Laboratories

Dynamic Virtual-Reality Lab.

Cognitive Behavior Lab.

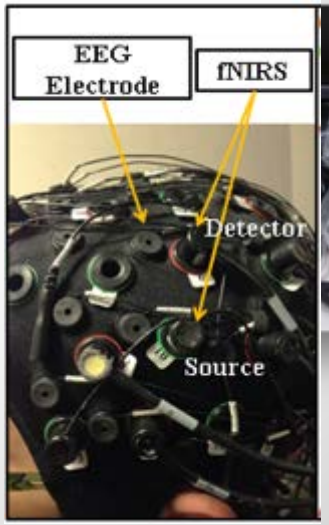
Brain measuring instruments



3D digitizer

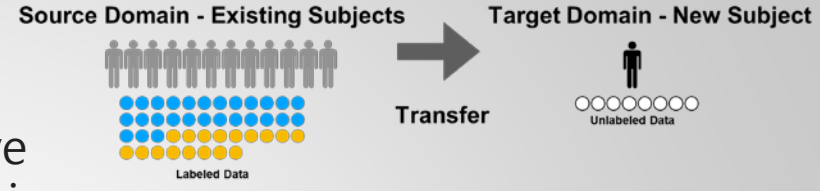
Nu-Amp

SynAmps2

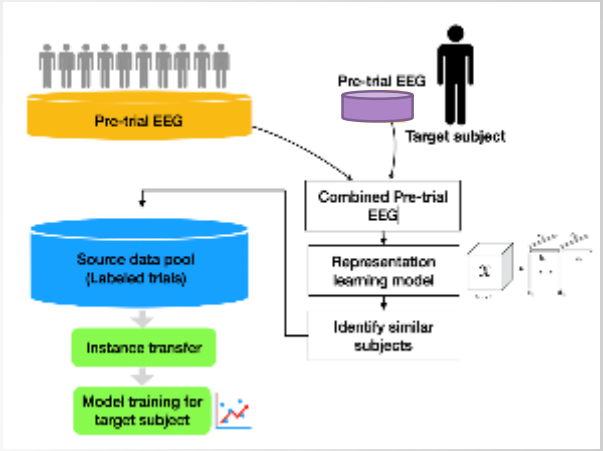


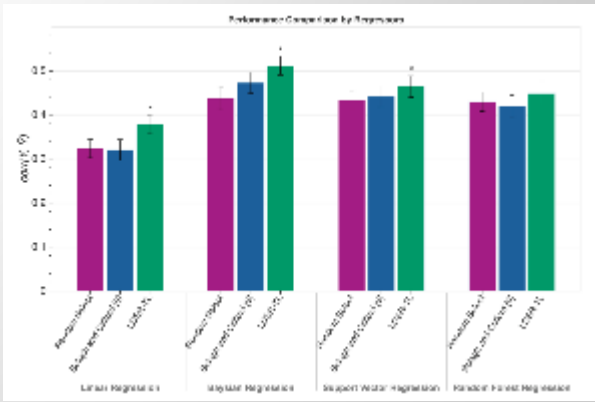
fNIRS

Low-Dimensional Subject Representation-based Transfer Learning in EEG Decoding



- Motivation:
  - Different user generates different brain wave signals while doing the same activity, which is referred to as the cross-subject learning problem.
  - Because of this problem, the performance of brain-computer interface(BCI) will decreases.
- Goal:
  - We propose a transfer learning framework to mitigate the performance degradation caused by the cross-subject learning problem.
- Gain:
  - Our proposed subject-transfer framework outperformed the state-of-the-art methods by up to 16%.





- P. -Y. Jeng, C. -S. Wei, T. -P. Jung and L. -C. Wang, "Low-Dimensional Subject Representation-based Transfer Learning in EEG Decoding," to appear in *IEEE Journal of Biomedical and Health Informatics*. doi: 10.1109/JBHI.2020.3025865

Intelligent Communications and Computing Lab

Welcome to visit us

CONTACTS

Li-Chun Wang 王蒞君

Chair Professor, IEEE Fellow

Dept of Electrical and Computer Engineering, NCTU

https://wang.web.nycu.edu.tw (介紹網站)

https://scholar.google.com/citations?user=dtD-PIAAAAAJ&hl=en (Google Scholar)

wang@nycu.edu.tw

蔡昂勳 Ang-Hsun Tsai

Assistant Research Fellow

anghsun@nctu.edu.tw

專長: 無線通訊，無線資源管理

賴傳淇 Chuan-Chi Lai

Assistant Research Fellow

cclai1109@nctu.edu.tw

專長: 智慧計算、物聯網應用

If you are interested in joining our labs please send email contacts us.