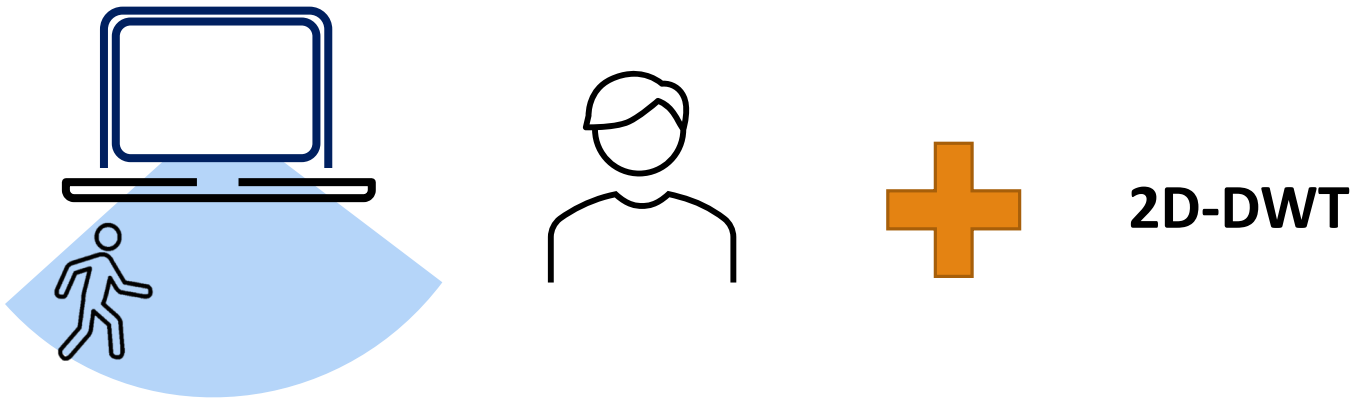
解放你的雙手

Wi-Fi Sensing 與臉部辨識在小波轉換(2D-DWT)之應用

R13943045 電子所碩一 林黃媛

Motivation

Wi-Fi Sensing



2D-DWT

Notebook WiFi module

- Limited computing ability
- Limited memory space

- **Small memory requirement**
- **Feature acquire efficiently**

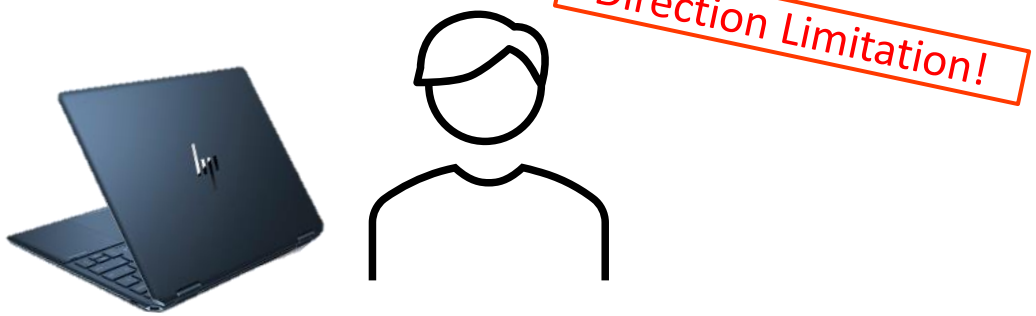
INC, HP, "Intelligence Facial Recognition over Wireless Radio Signal", Technical Disclosure Commons, (May 02, 2024)

Outline

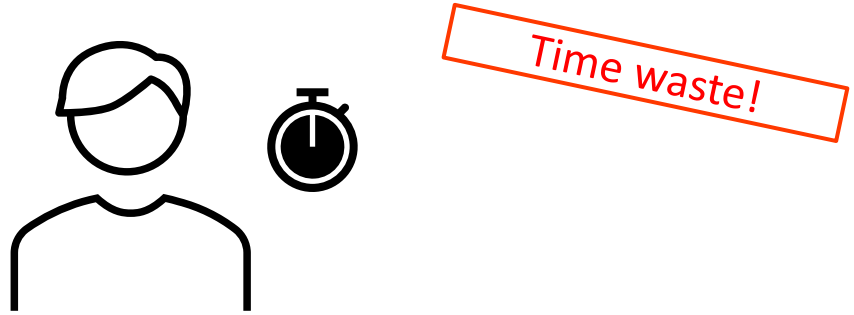
- Why we need Wi-Fi Sensing on Notebook for facial recognition?
- What is Wi-Fi Sensing?
- How can we utilize wavelet to help?

Pain Point

- Angle/Direction limitation



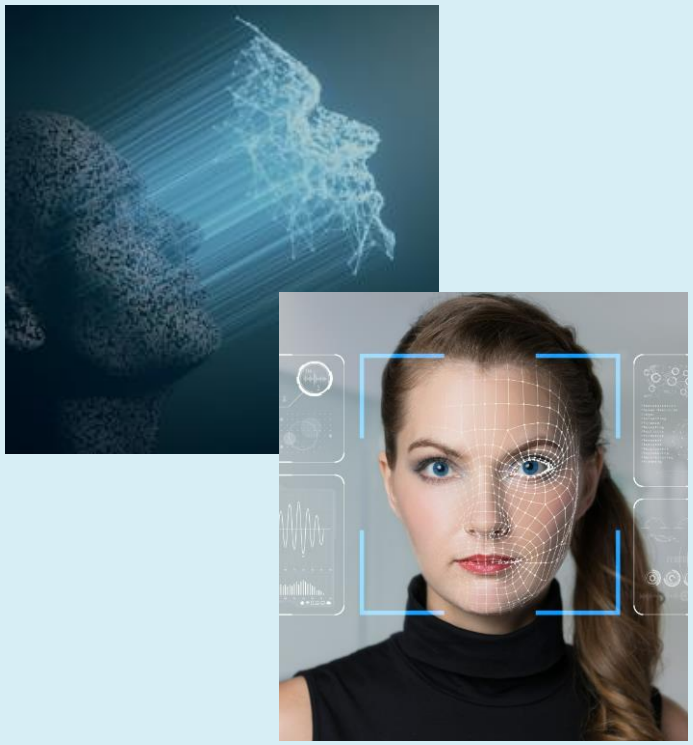
- Wait for facial recognition



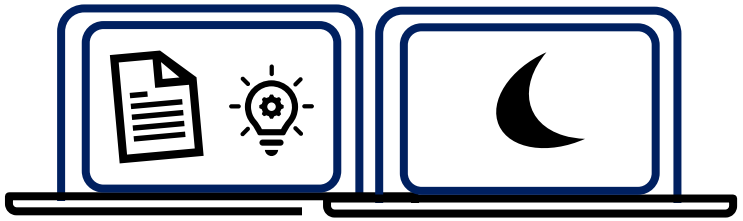
- Privacy concern

- Any object approaching to awake

Wireless innovation with AI - Defensive Idea

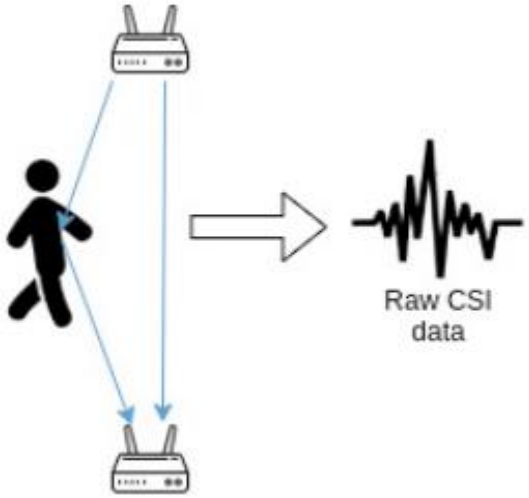


Wi-Fi Sensing

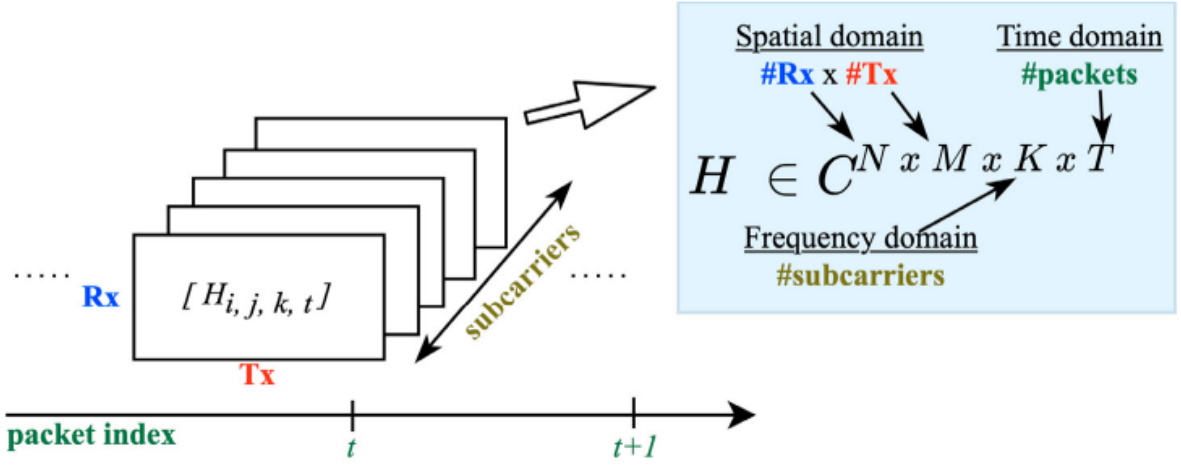


Title: Intelligence Facial Recognition over Wireless Radio Signal

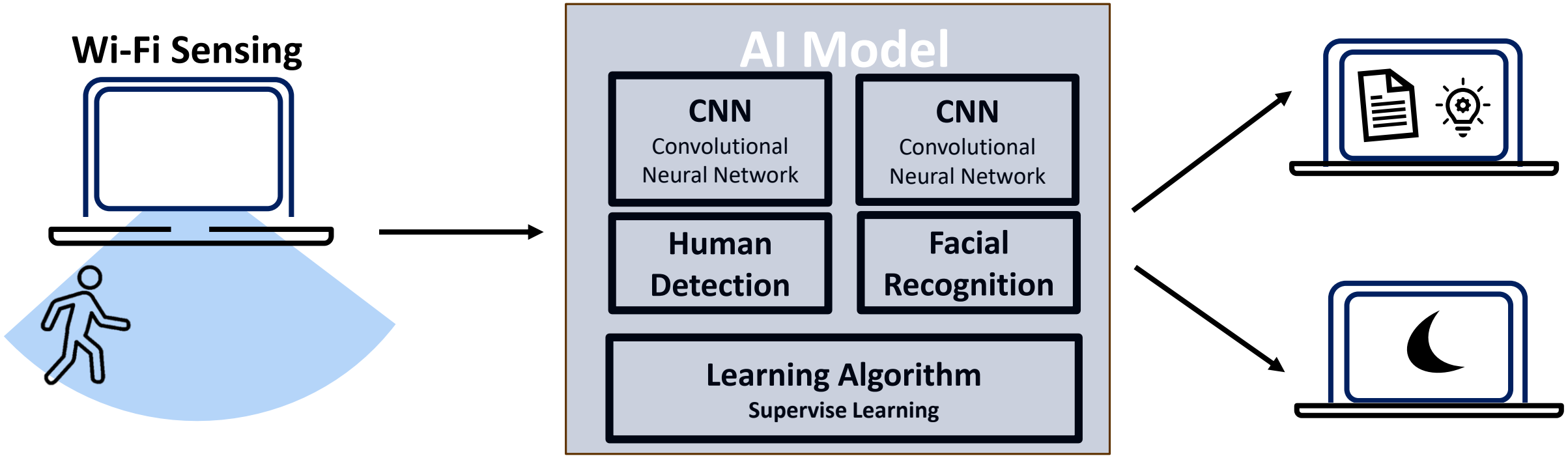
What is Wi-Fi Sensing?



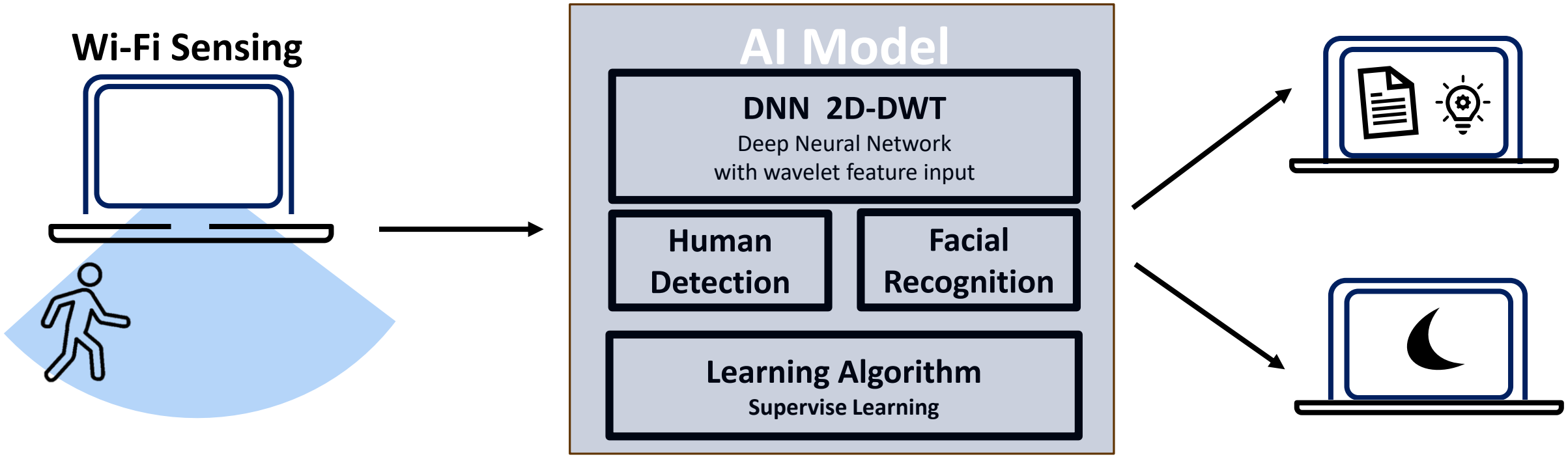
Channel State Information(CSI)



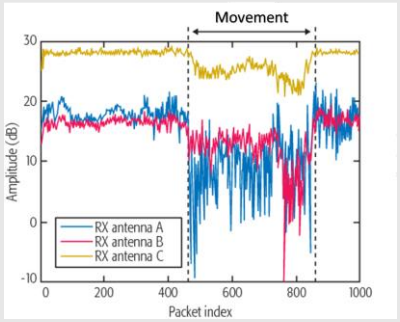
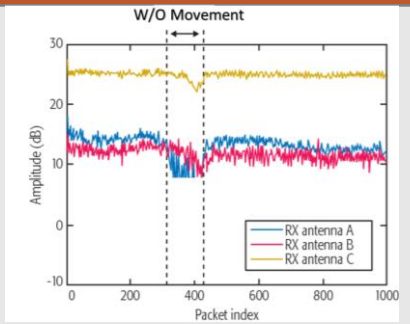
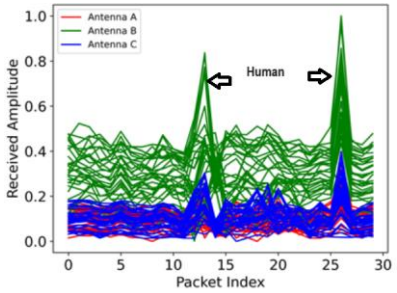
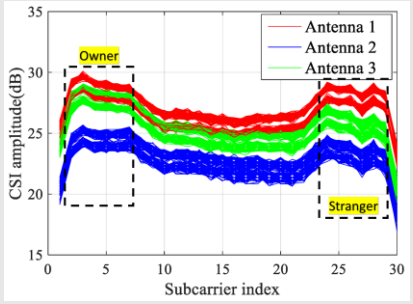
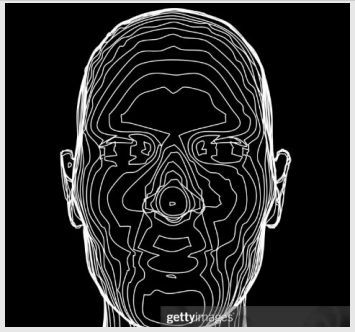
Original Innovation Solution Idea



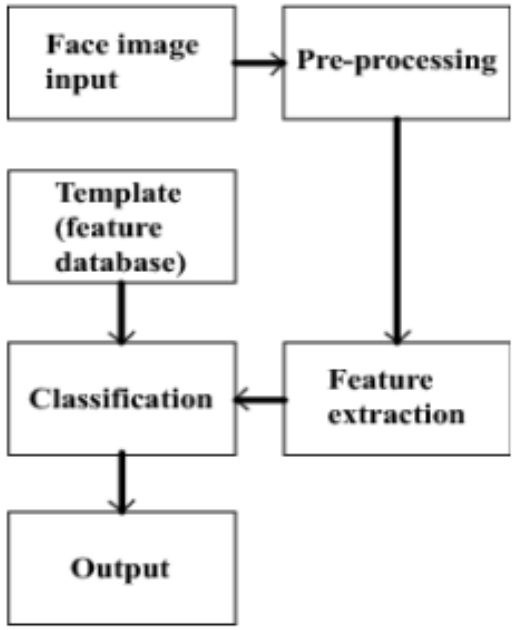
Integration Innovation Solution Idea

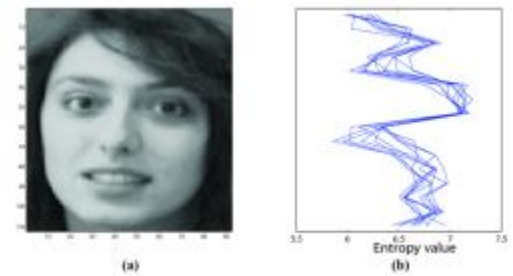


Technique innovation in WiFi Sensing Idea

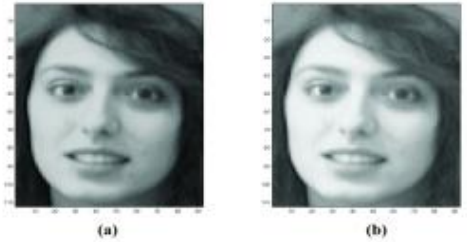
Model	Packet v.s Amplitude Raw Data
Movement Detection	 
Human Body	
Facial Recognized	 

FACE RECOGNITION SCHEME USING WAVELETBASED

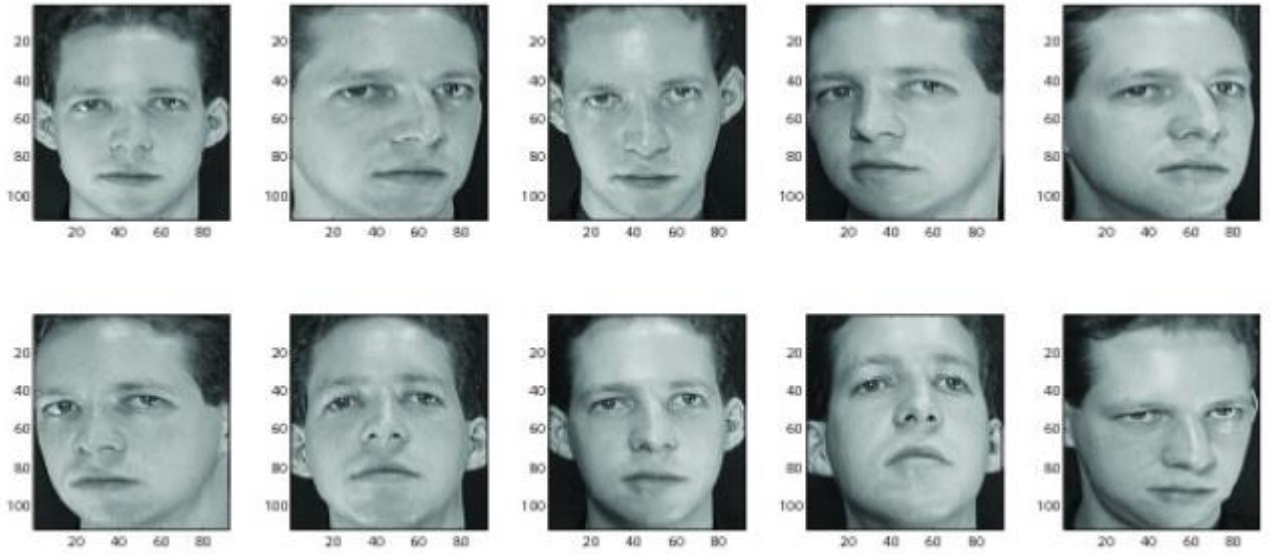




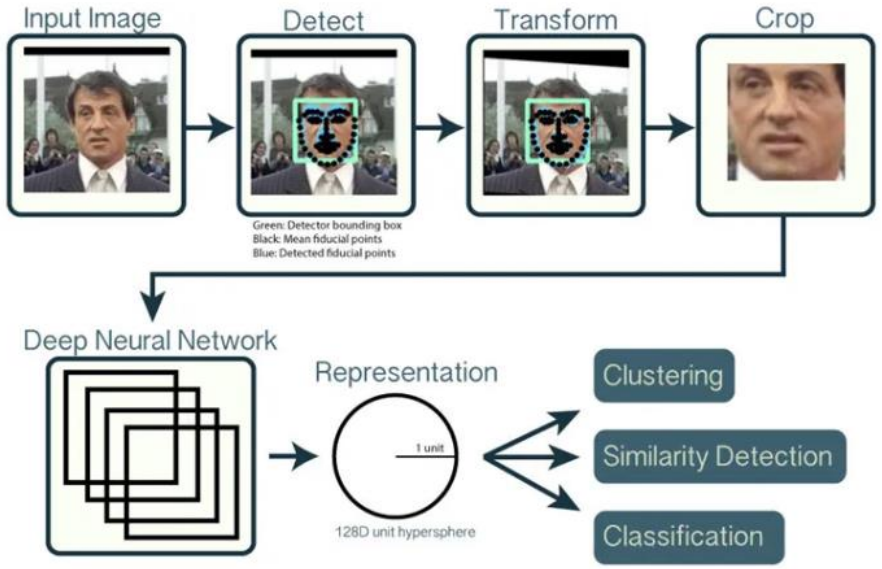
Light change:

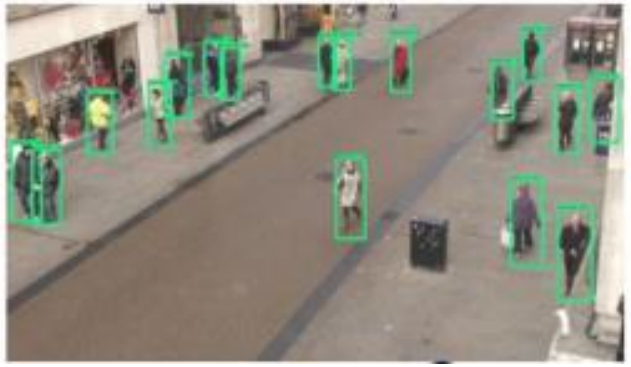


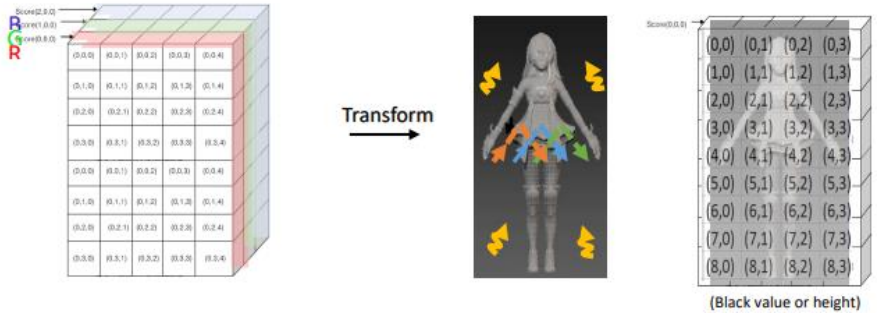
Direction change:

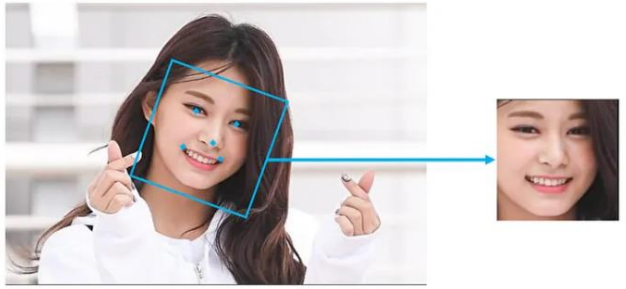


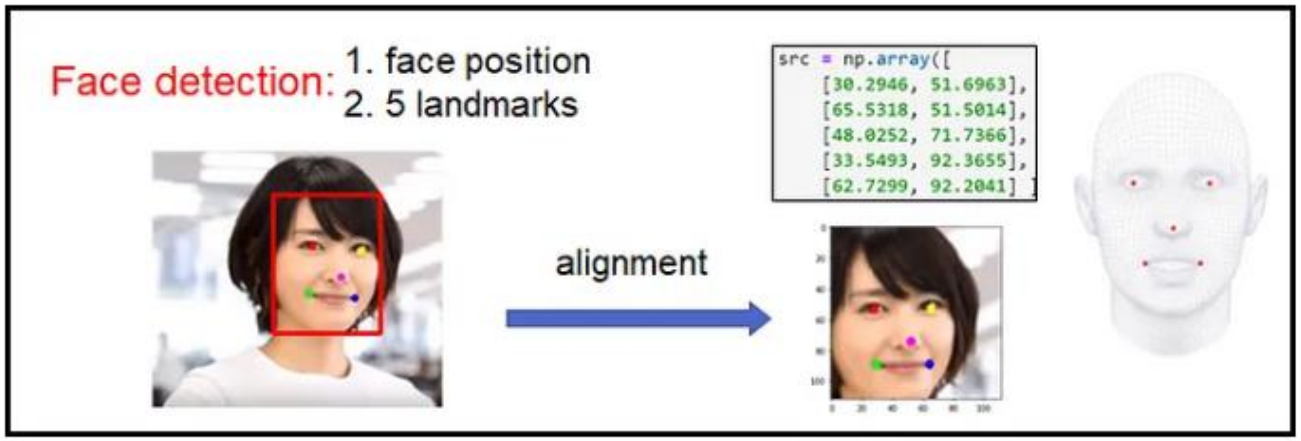
Traditional v.s. Wi-Fi Sensing Information Process AI Model



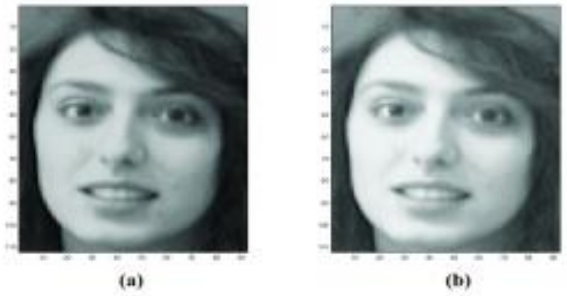


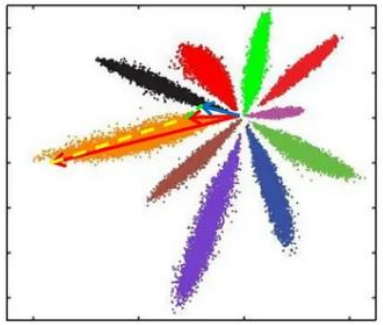






1.Illumination adjustment





Embedding

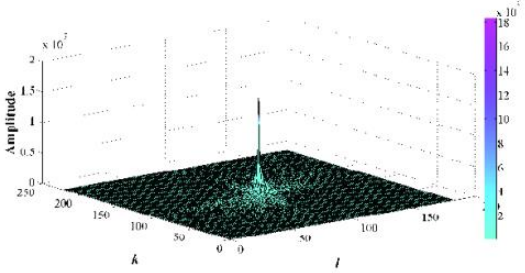


Figure 4: Correlation of the 2D-DWT approximate coefficients of the sample images: no illumination adjustment

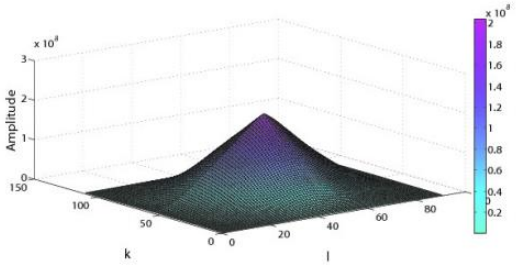
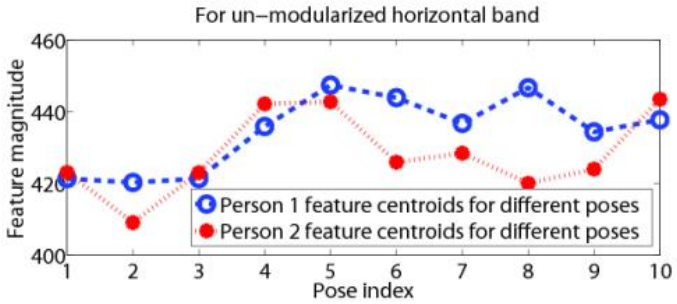


Figure 5: Correlation of the 2D-DWT approximate coefficients of the sample: illumination adjusted

2. Modularized horizontal band



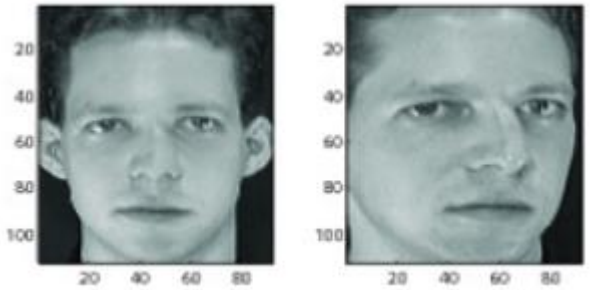


Figure 7: Feature centroids of different poses for un-modularized horizontal band

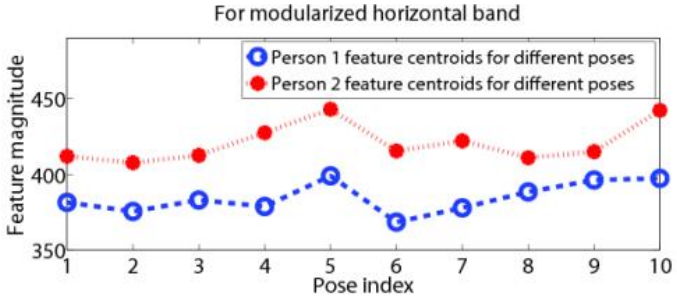


Figure 8: Feature centroids of different poses for modularized horizontal band

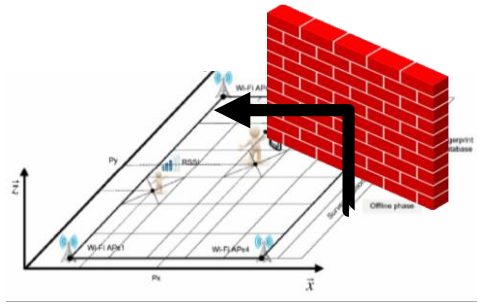
Table 1: Comparison of recognition accuracies

Method	Yale database	ORL database
Proposed method	98.71%	99.75%
Method [10]	98.18%	99.00%
Method [6]	97.70%	N/A

Advantages of Wifi Sensing Application

Beyond wireless communication
Ex: privacy element

Without angle limitation, privacy concern



Add on user benefit of wake on open
Ex: automotive auto sensing , thief detection

Reference

[1]:INC, HP, "Intelligence Facial Recognition over Wireless Radio Signal", Technical Disclosure Commons, (May 02, 2024)

[2]:Imtiaz, H., & Fattah, S. A. (2011). A face recognition scheme using wavelet based dominant features. arXiv preprint arXiv:1110.1485. Retrieved from https://arxiv.org/abs/1110.1485

[3]:Zhuravchak A., Kapshii O., Pournaras E., Human activity recognition based on Wi-Fi CSI data - A deep neural network approach, Procedia Comput. Sci. 198 (2022) 59–66

- 使用深度學習進行人臉辨識: Triplet loss, Large margin loss(ArcFace)
- 用MTCNN挑戰最簡單的Face Alignment

Thank you!