INTRODUCTION OF APPLIED COMPUTING AND MULTIMEDIA LAB

ACM LABORATORY

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OUTLINE

- Introduction of ACM Lab
- Research Topics
- Introduction of Projects
- List of Projects
- International Laboratory Co-operation

INTRODUCTION OF ACM LAB

Current students
- 5 Master students
- 7 Undergraduate students

Graduated students
- 16 Master students
- 19 Undergraduate students

Taiwanese students

International students

Lab activities

Current students
- 1 Ph.D.
- 2 Master students (Vietnam)
- 1 Postdoctoral Fellow

Graduated students
- 2 Ph.D.s
- 5 Master students

OUTLINE

- Introduction of ACM Lab
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- Introduction of Projects
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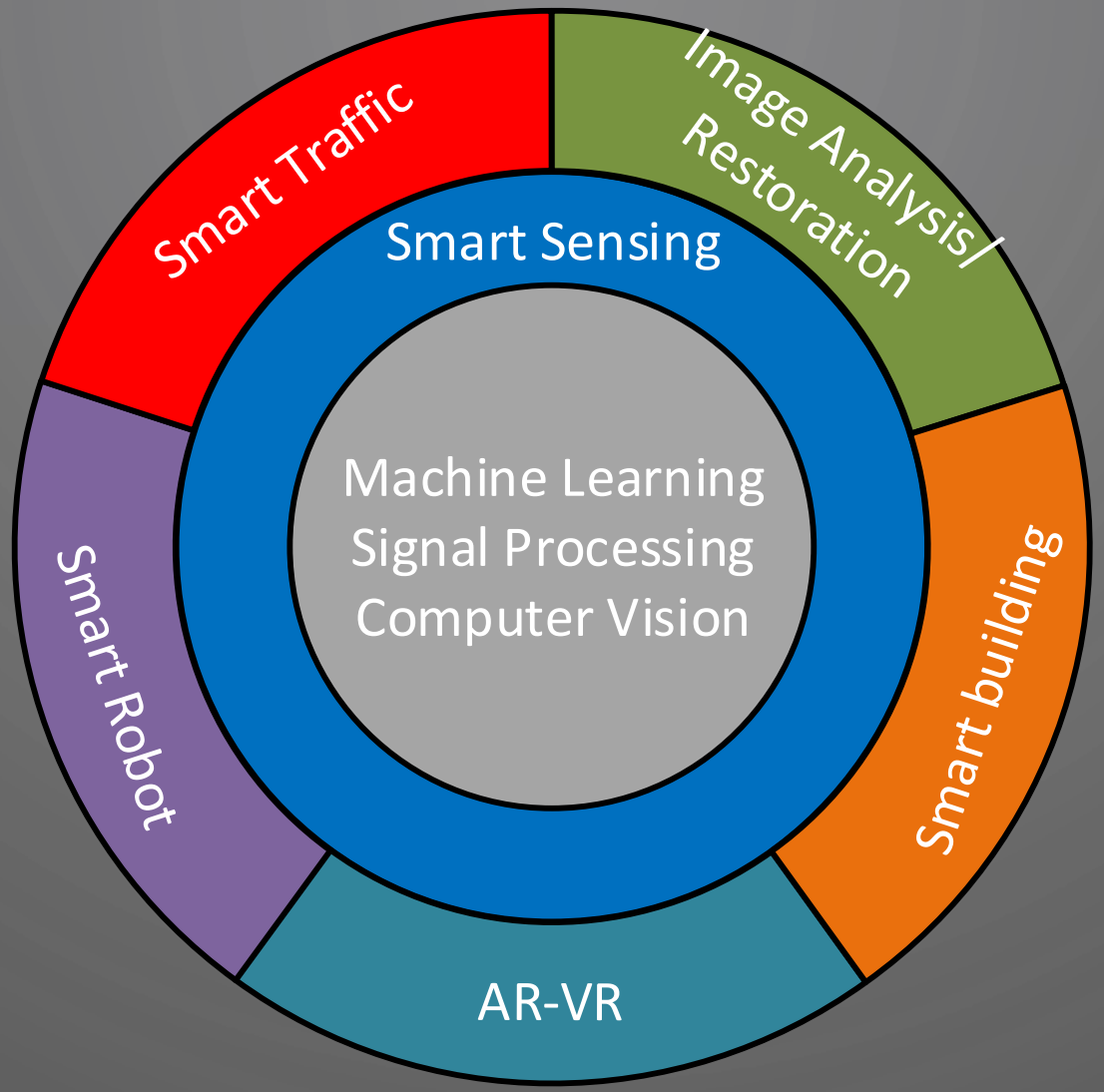
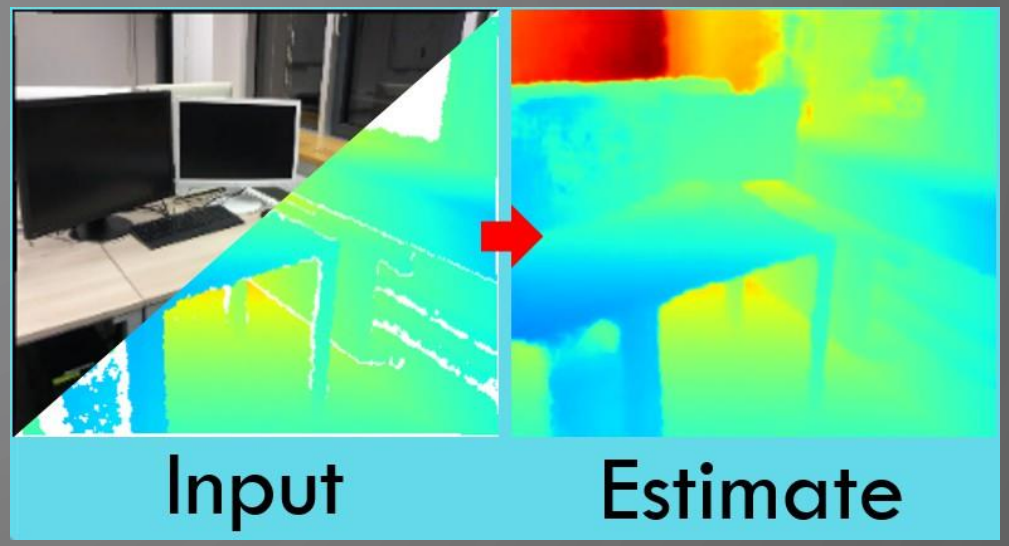
RESEARCH TOPIC



RESEARCH TOPIC

Autonomous Vehicle

2016 ~ 2017, 2018 ~

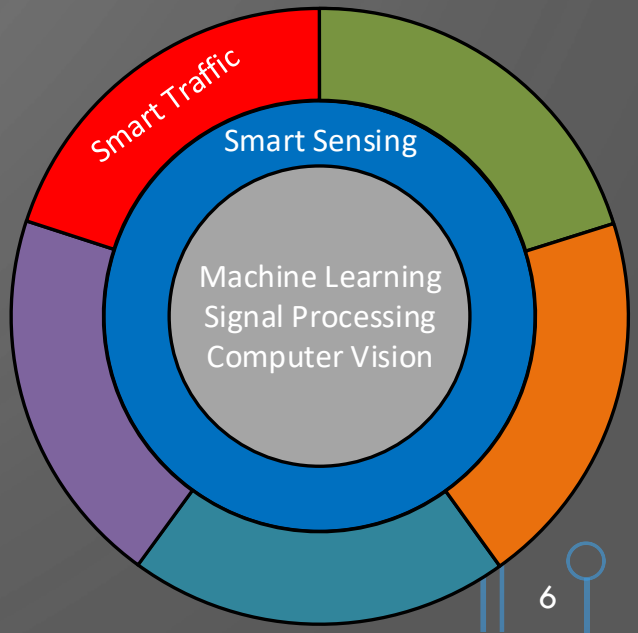


Depth Completion

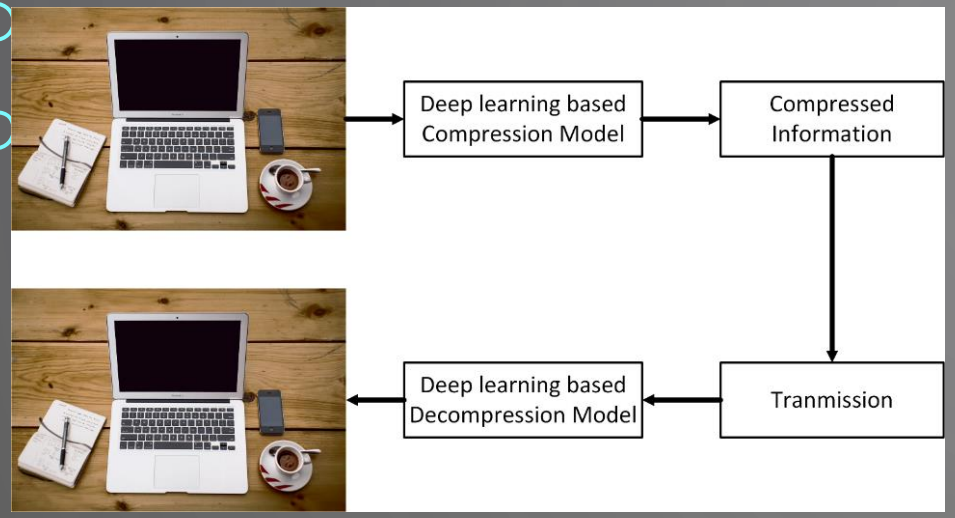
2018 ~

Parking Lot System

2013 ~ 2020



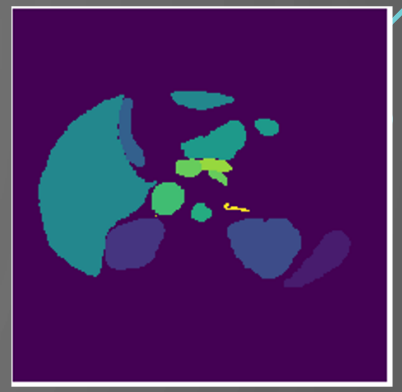
RESEARCH TOPIC



AI Video Compression
Image/Video Restoration
2018 ~ 2021

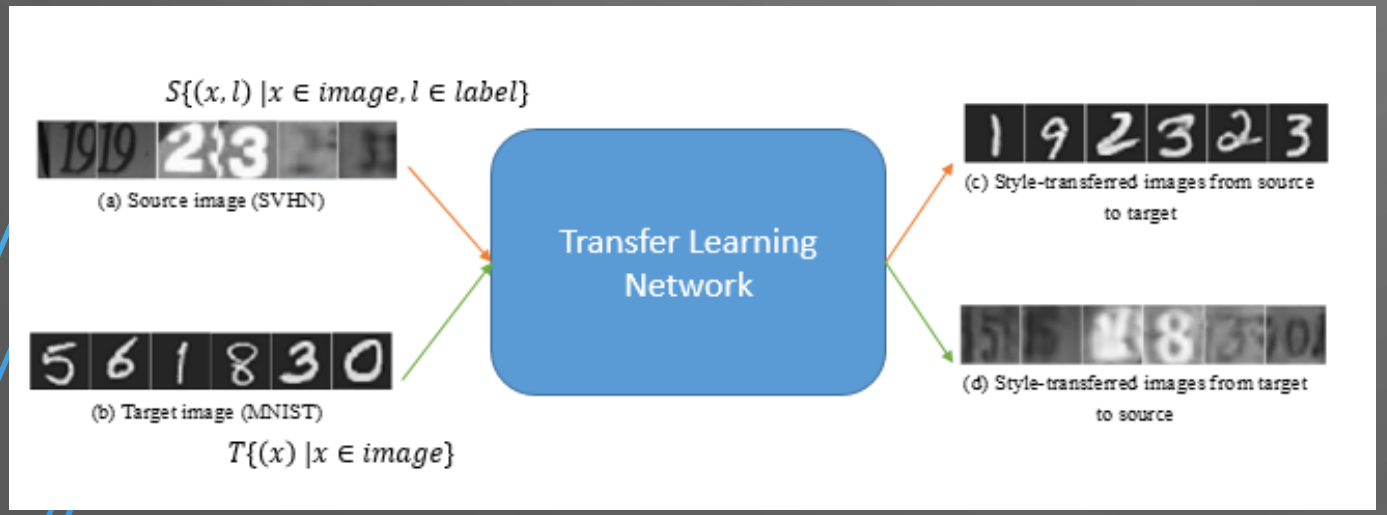
Input CT scan

deep learning model

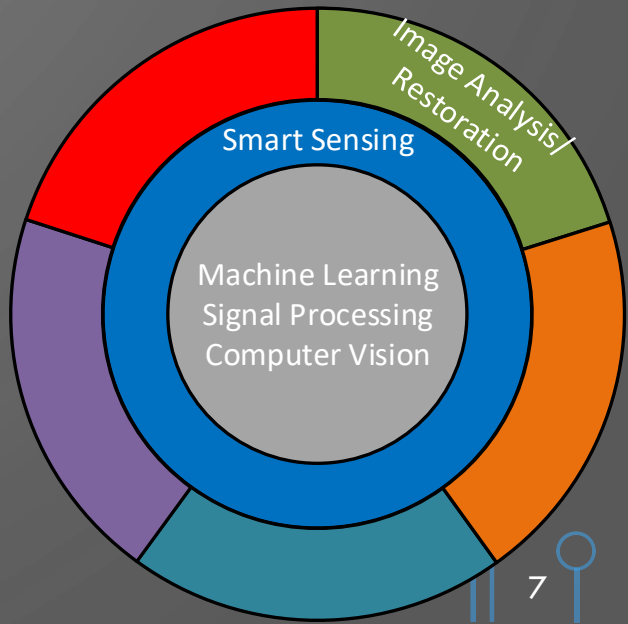


segmentation of abdominal organs

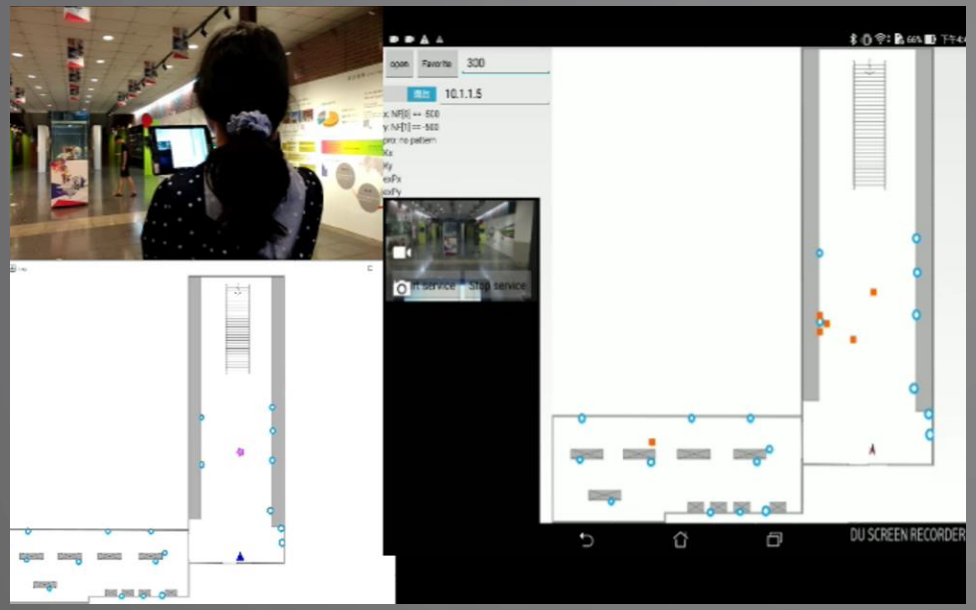
Medical Image Analysis
2018 ~



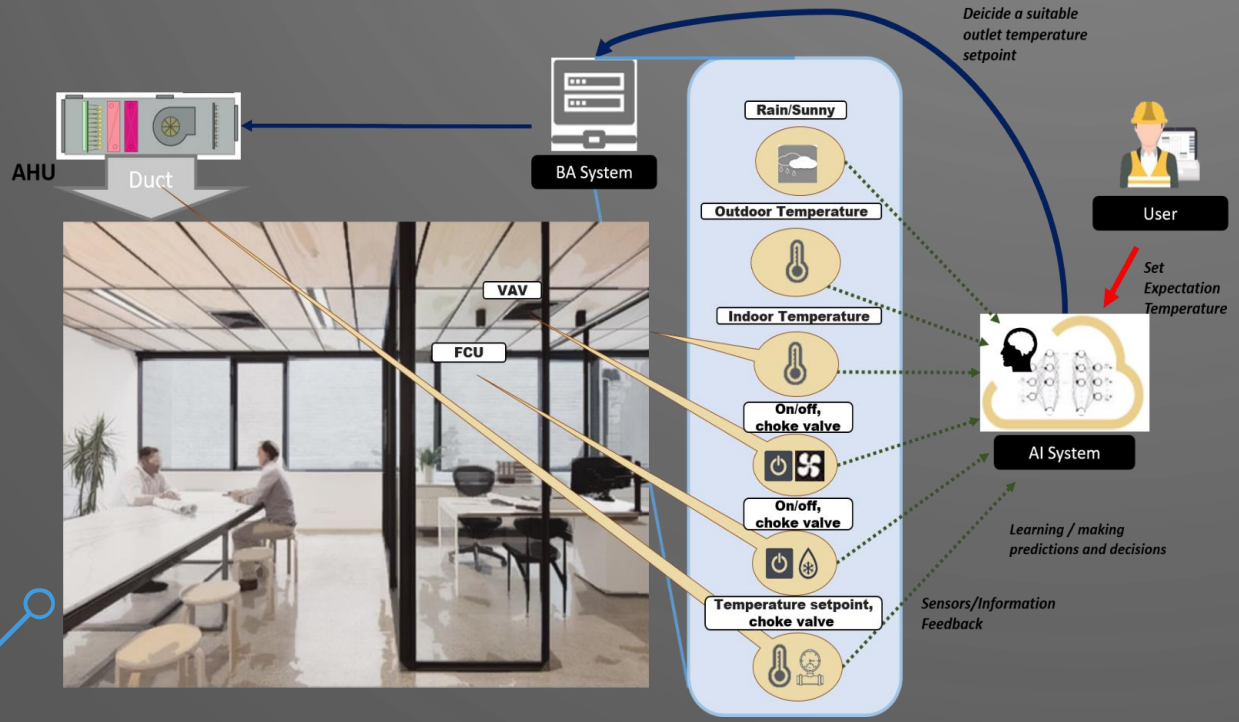
Transfer Learning
2018 ~



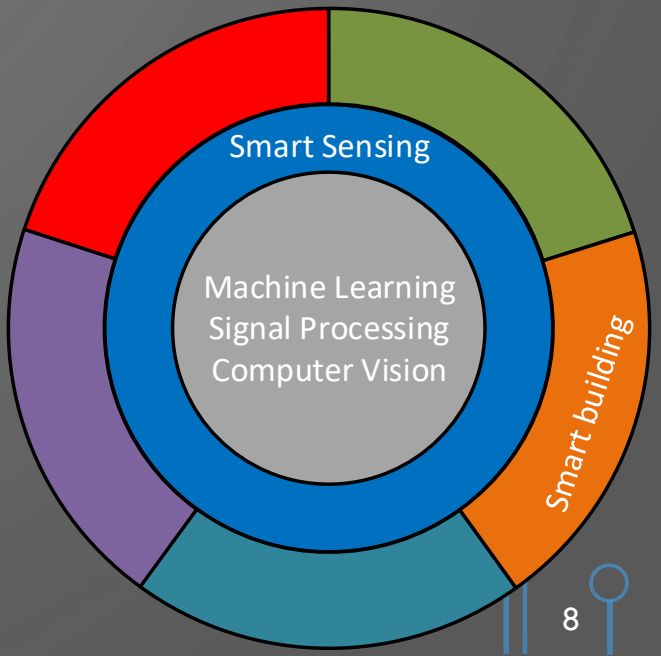
RESEARCH TOPIC



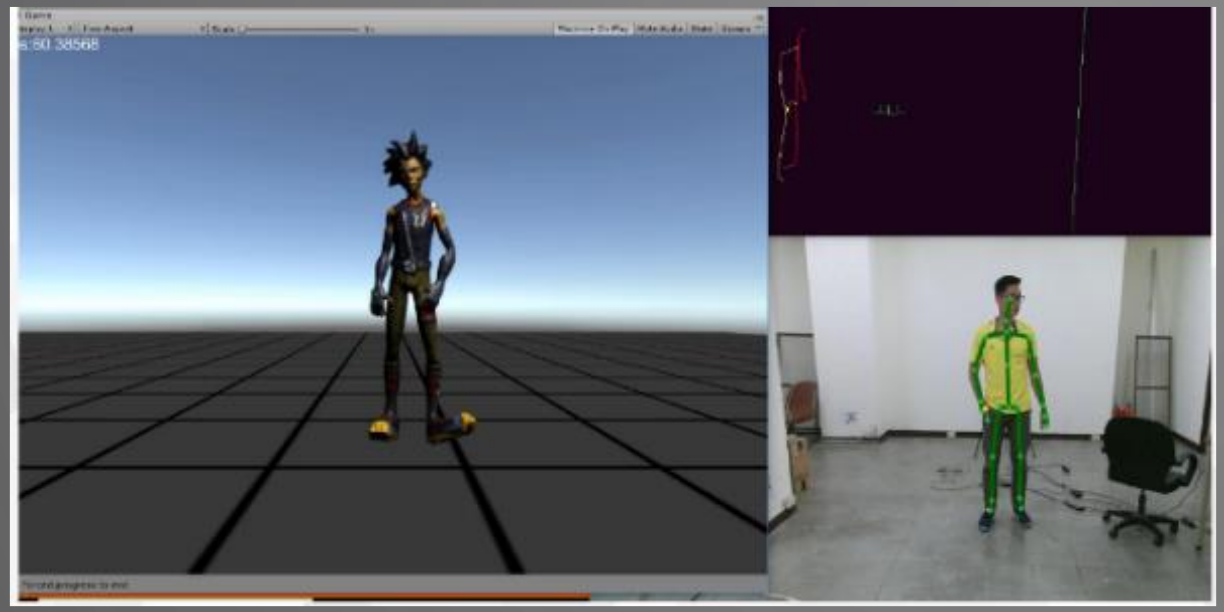
IoT Wearable Device for
Localization and Guidance System
2018 ~



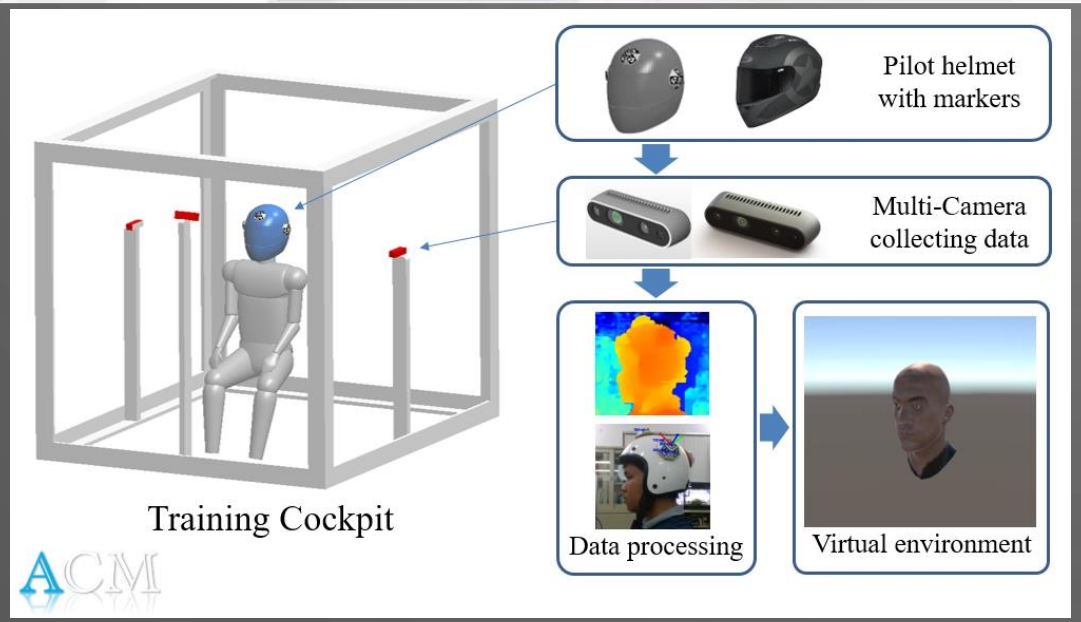
TSMC Smart Office
2018 ~



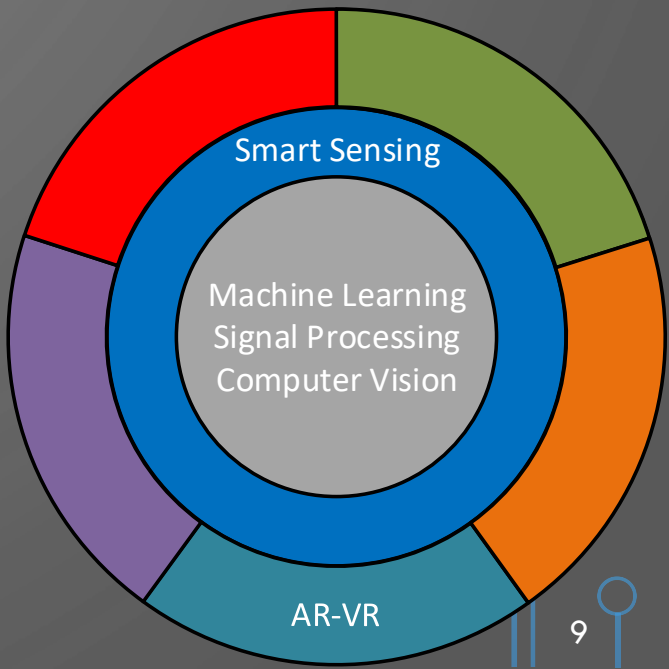
RESEARCH TOPIC



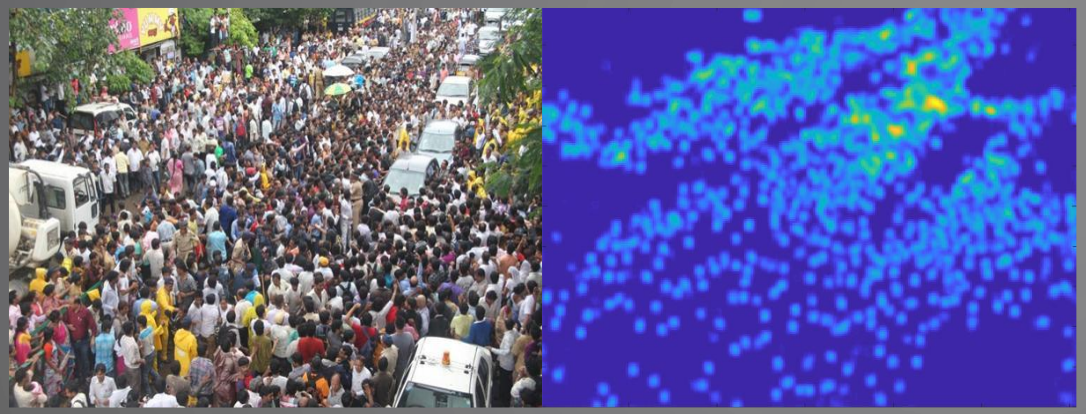
Skeleton-based Human-Computer Interaction
2018 ~



Pilot Training System
2018 ~



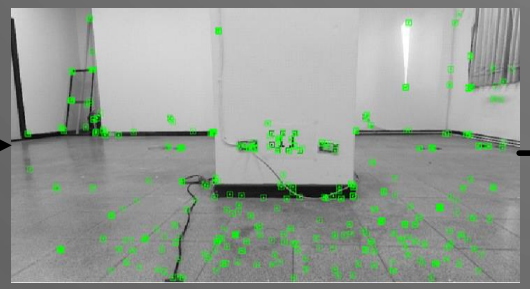
RESEARCH TOPIC



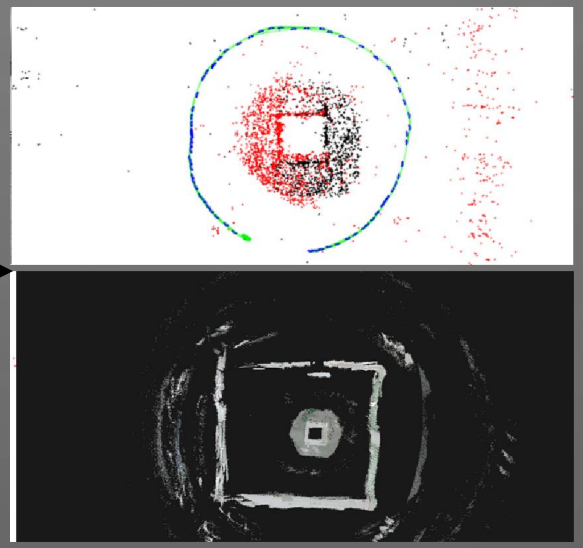
UAV-Density Estimation

2018 ~

Robot setup



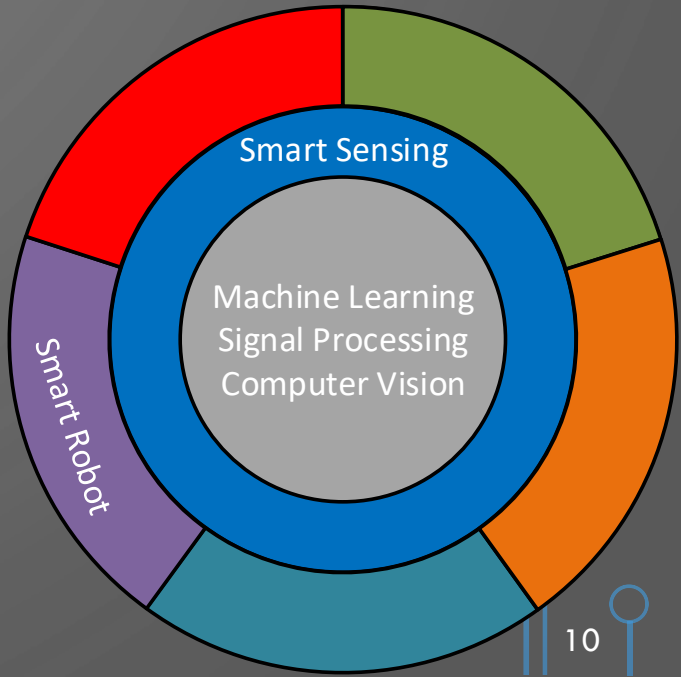
Environment Analysis



Environment Reconstruction

Cleaning Robot

2018 ~



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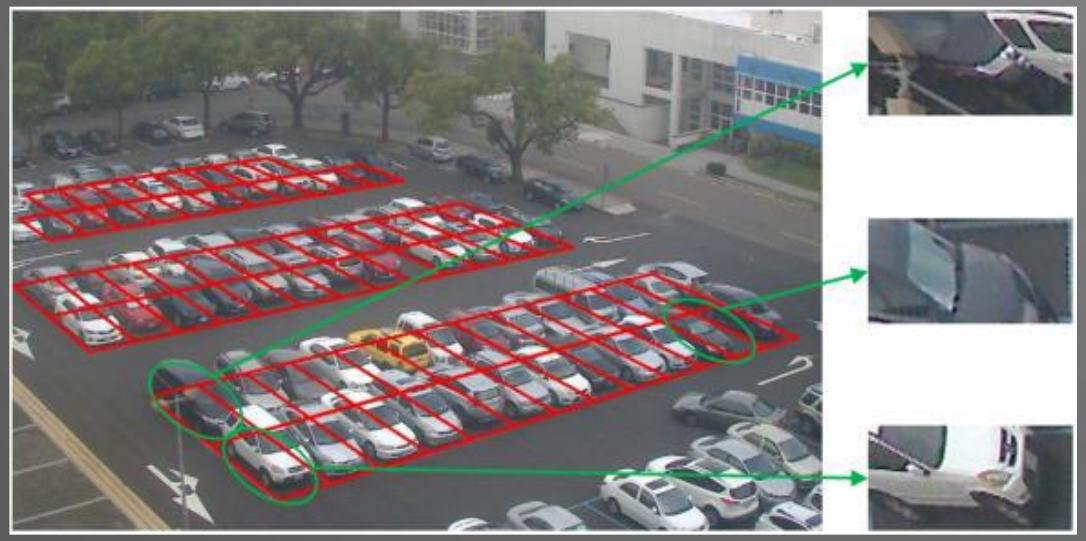
SMART TRAFFIC - PARKING LOT SYSTEM

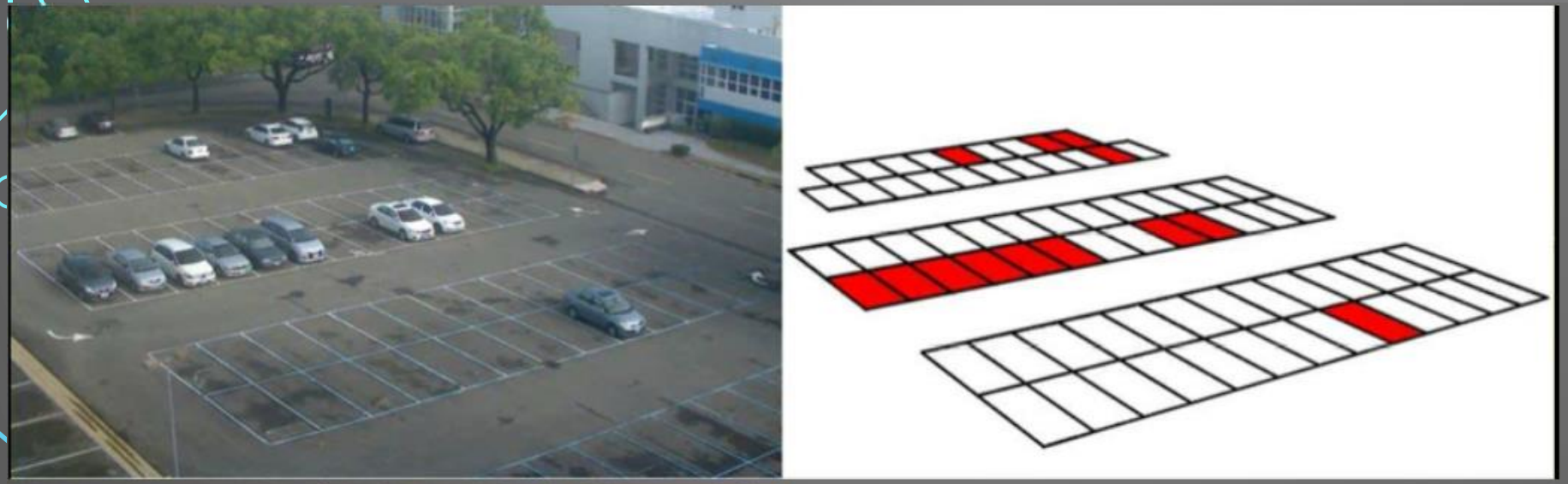
- Goal:
  - Use a camera (or multi-camera) to detect the entire parking space with deep learning method.

Project Name : 影像式戶外停車空位在席偵測系統 (MOST 105-2622-E-194 -008 -CC3)
Project Period : 2016/11/01 ~ 2017/10/31
Cooperation Vendors : 行政院科技部、歐特儀股份有限公司

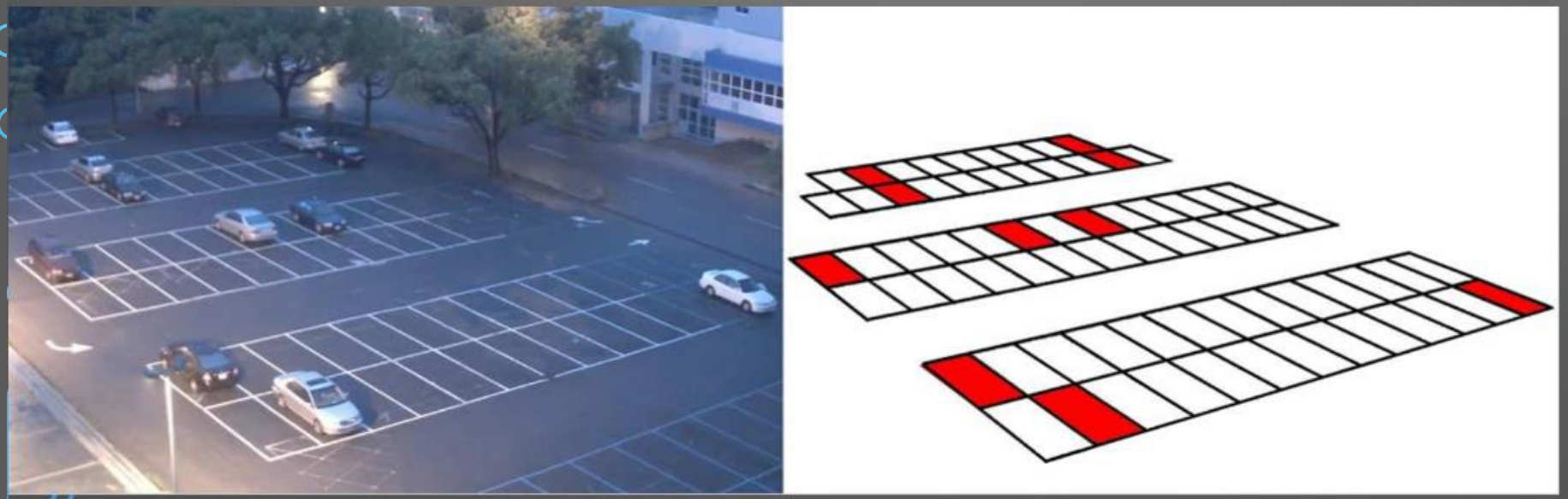
- Challenges :
  - Outdoor lighting variation, inter-object occlusion and perspective distortion.
  - Non-unified vehicle size and uncontrollable parking displacement.



- Result :



Parking lot system demo : Sunny



Parking lot system demo : Rain

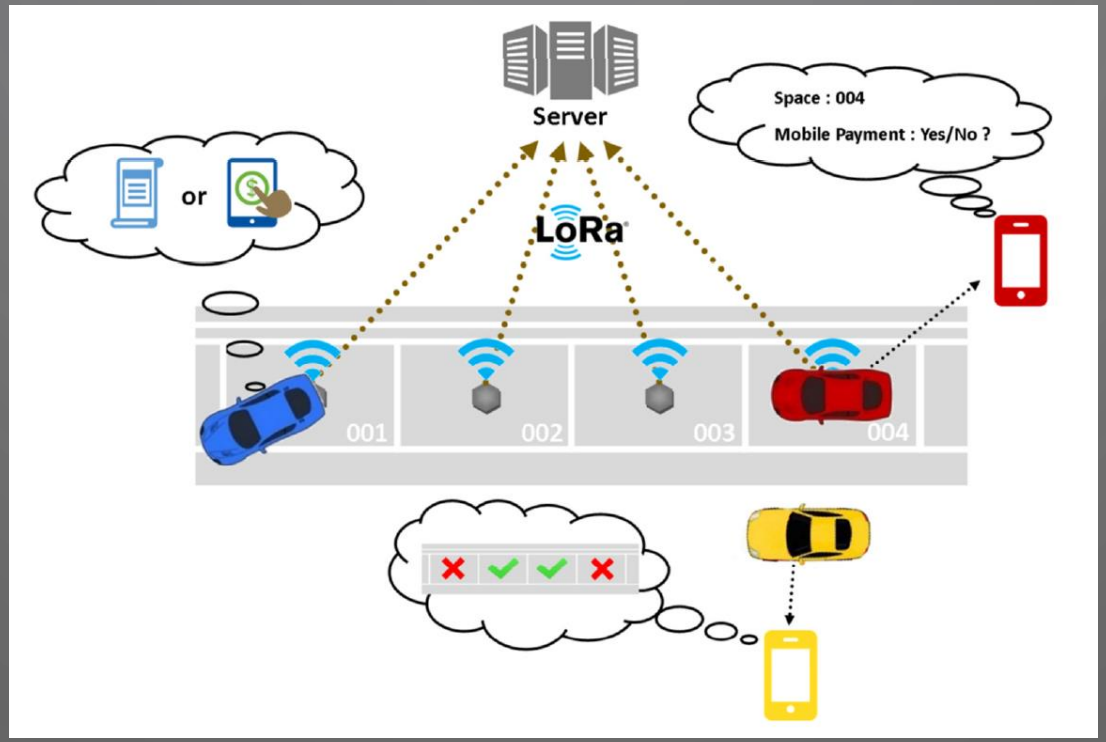
- Publication:
  - Hoang Tran Vu , and Ching-Chun Huang, "Parking Space Status Inference upon a Deep CNN and Multi-task Contrastive Network with Spatial Transform", Submitted to IEEE Transactions on Circuits and Systems for Video Technology. Accepted (April 2018)
  - Hoang Tran Vu, and Ching-Chun Huang, "A Multi-Task Convolutional Neural Network With Spatial Transform For Parking Space Detection", *IEEE International Conference on Image Processing (ICIP)*, Sep, 2017.
  - Ching-Chun Huang, and Hoang Tran Vu, "Parking Space Detection Based on a Multi-task Deep Convolutional Network with Spatial Transform ", *Computer Vision, Graphic and Image Processing (CVGIP)*, Aug, 2017.
  - Chingchun Huang and Hoang Tran Vu, "Vacant Parking Space Detection based on a Multi-layer Inference Framework," *IEEE Transactions on Circuits and Systems for Video Technology*, May, 2016.
  - Ching-Chun Huang, Yi-Ren Chen, and Hoang Tran Vu, "Vacant Parking Space Detection Based On A Hierarchical and Semantic Classifier", *Computer Vision, Graphic and Image Processing (CVGIP)*, Aug, 2015.
  - Ching-Chun Huang and Hoang Tran, "A Multi-layer Discriminative Framework for Parking Space Detection", *IEEE International Workshop on Machine Learning for Signal Processing*, Boston, USA, Sep, 2017.

- Publication:
  - Ching-Chun Huang, Hoang Tran Vu, and Yi-Ren Chen, “A multiclass boosting approach for integrating weak classifiers in parking space detection,” *IEEE International Conference on Consumer Electronics - Taiwan,* Taipei, Taiwan. Jun, 2015.
  - Ching-Chun Huang, Yu-Shu Tai, and Sheng-Jyh Wang, “Vacant Parking Space Detection Based on Plane-based Bayesian Hierarchical Framework,” *IEEE Transactions on Circuits and Systems for Video Technology*. 2013.
  - Ching-chun Huang, Yu-Shu Dai and Sheng-Jyh Wang, "A Surface-based Vacant Space Detection for an Intelligent Parking Lot", *IEEE International Conference on ITS Telecommunications (ITST)*, Taipei, Taiwan, Nov. 5-8, 2012. (EI)

SMART TRAFFIC - PARKING LOT SYSTEM

"AUTOMATIC MANAGEMENT OF ROADSIDE PARKING SPACES BASED ON DEEP LEARNING, GEOMAGNETIC SENSOR NETWORKS, AND LORA COMMUNICATION"

- Goal :
  - We are going to propose well-designed deep learning networks for recognizing the sequential patterns of magnetic signals.



Project Name : 應用深度學習、地磁感測網路、與LoRa物聯網通訊實現路邊停車格自動化管理技術研究 (MOST 106-2622-E-194 -006 -CC3)
Project Period : 2016/11/01 ~ 2017/10/31
Cooperation Vendors : 行政院科技部、歐特儀股份有限公司

- Challenges :
  - Environment noise.
  - The diversity of magnetic signals due to sensor locations.
  - The interruption from environment magnetic fields.
  - The variety of magnetic signals due to vehicle types
  - The interruption by moving vehicles.
  - The non-unified coordination of magnetic sensors.
  - The annoying magnetic responses caused by the status changing of neighboring spaces.

- Result:

Not occupied

Occupied

- Publication:
  - You-Feng Wu, Hoang Tran Vu, Ching-Chun Huang, "Semi-supervised and multi-task learning for on-street parking space status inference", Multimedia Analysis and Pattern Recognition (MAPR), May, 2019 (Best Paper Award)

SMART TRAFFIC – AUTONOMOUS VEHICLE

"LANE DETECTION"

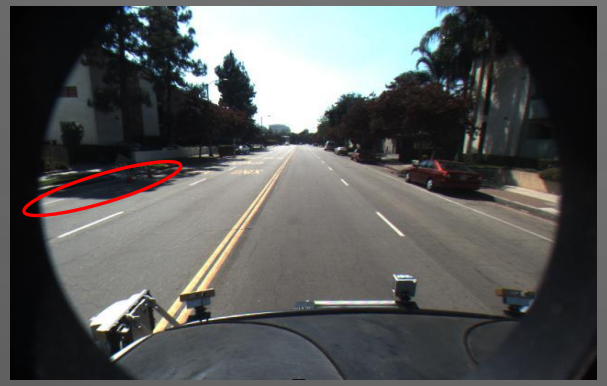
- Goal :
  - Create a robust vision-based lane detection and tracking in different scenarios.

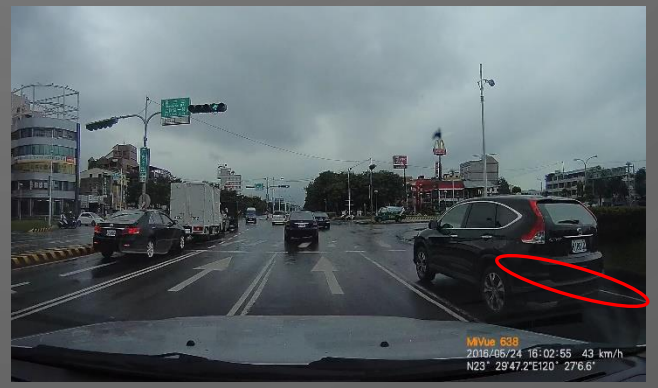
Front-view image

Lane detection result

- Challenges :
  - Noises from various lane marking
    - Texture marking, Zebra crossing, Crossroad signs, Intersection, Curve lane

  - Shadows cast from vehicle, tree and building





- Result :


Non-tracking Result
Tracking Result
Segmentation Result
Applied Computing and Multimedia Lab

- Publication:
  - Thanh-Phat Nguyen, Hoang Tran Vu, and Ching-Chun Huang, "Lane Detection and Tracking based on Fully Convolutional Networks and Probabilistic Graphical Models", IEEE International Conference on Systems, Man, and Cybernetics, Oct., 2018.
  - Thanh-Phat Nguyen, Hoang Tran Vu, Ching-Chun Huang, "A deep segmentation network and a probabilistic graphical models for lane detection and tracking", Computer Vision, Graphic and Image Processing (CVGIP), Aug., 2018. (Excellent Paper Award)
  - Chao-Yi Peng, Zhi-Yi Peng, Hoang Tran Vu, Nguyen Thanh Phat, Wei-Chen Chiu and Ching-Chun Huang , “A robust bottom-up framework for lane detection in urban streets”, Computer Vision, Graphics, and Image Processing (CVGIP), Aug., 2017.

SMART TRAFFIC – AUTONOMOUS VEHICLE

“TRAFFIC SIGN CLASSIFICATION”
“VEHICLE DISTANCE ESTIMATION”

- Goal :
  - Create system to detect the traffic sign on city street and estimate the distance between ego vehicle and other vehicles.

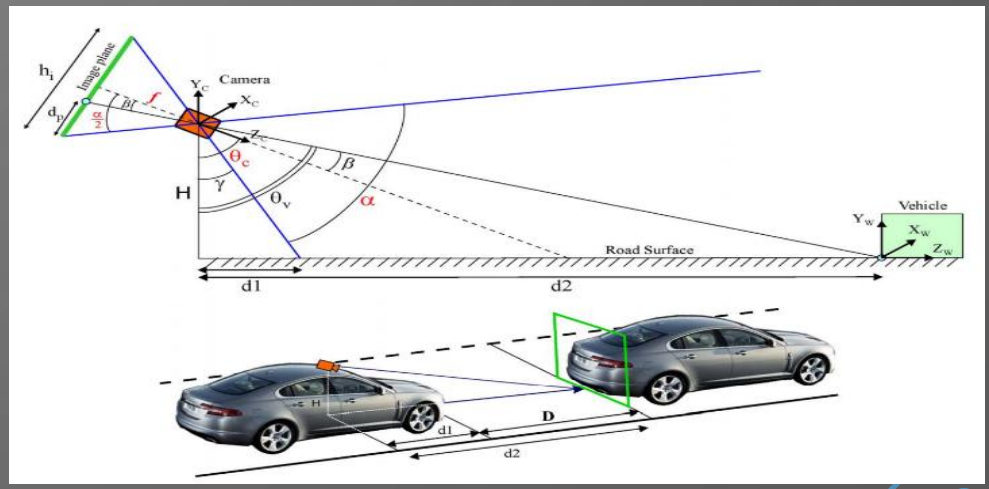
- Challenges :
  - Traffic Sign Classification
    - Illumination
    - Various poses and viewpoints
    - Occlusion


Illumination

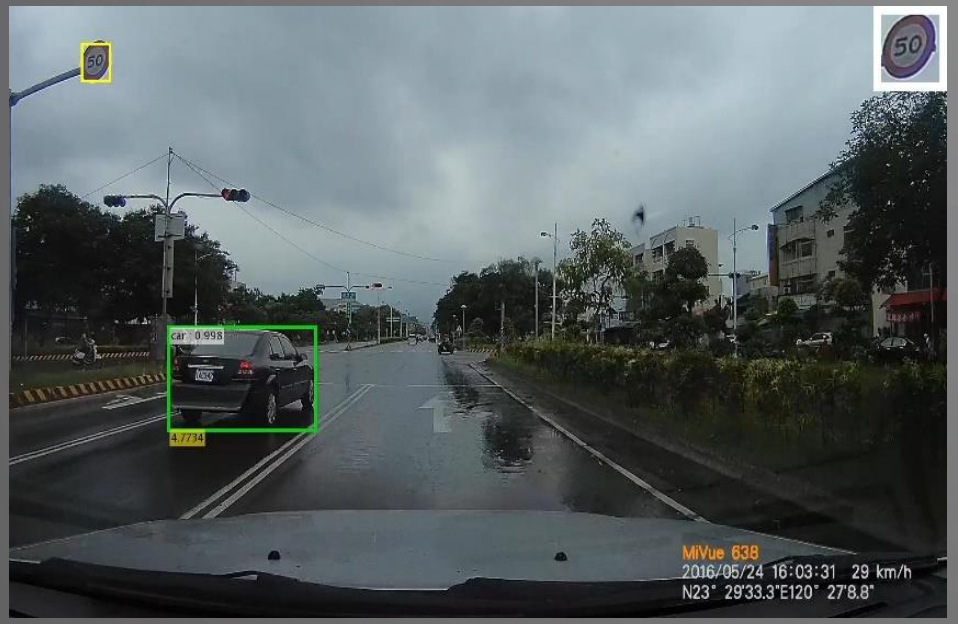
Various poses and viewpoints


Occlusion

- Distance Estimation
  - Occlusion from other vehicle
  - Various scale of vehicle from different distance



- Result:



Show the circle traffic sign in the first column

Show the triangle traffic sign in the second column

- Publication:
  - Zhi-Yi Peng, Hoang Tran Vu, Wei-Chen Chiu, Ching-Chun Huang, Chia-Wen Lin, "Traffic Sign Classification Based On Deep Convolutional Network With Domain Adaptation", Computer Vision, Graphic and Image Processing (CVGIP), Aug., 2017.

SMART TRAFFIC – AUTONOMOUS VEHICLE

“DEPTH COMPLETION”

- Goal :
  - Depth completion
    - Borrowing useful information from RGB image to complete the sparse depth image

- Challenges :
  - **Mixed depth pixels → Distorted and blurry edges** emerge in the depth maps
    - Solution: new depth representation, classification problem, cross entropy loss
  - **Excessively rich texture details** on color images cause undesired depth estimation results
    - Solution: disentangle only useful information from RGB image to complete depth
  - **Spatial-scale offset**
    - Solution: use both color image and sparse depth image

- Result:
  - Comparison with State-of-the-art Methods

Obs.	Method	REL↓	RMSE↓	tRMSE↓	1.25↑	1.25^2 ↑	1.25^3 ↑
B	Bilateral[27]	0.0844	0.4118	0.2539	0.9073	0.9412	0.9584
	Zhang et al.[13]	0.0877	0.3201	0.2284	0.9213	0.9588	0.9764
	Ours(GDC)	0.0748	0.3043	0.2195	0.9247	0.9621	0.9794
Y	Bilateral[27]	0.0494	0.2485	0.1710	0.9588	0.9757	0.9857
	Zhang et al.[13]	0.0490	0.2484	0.1709	0.9588	0.9757	0.9856
	Ours(GDC)	0.0470	0.2300	0.1636	0.9617	0.9786	0.9877
N	Bilateral[27]	0.2266	0.6974	0.4098	0.7560	0.8398	0.8781
	Zhang et al.[13]	0.2016	0.4714	0.3460	0.8113	0.9092	0.9492
	Ours(GDC)	0.1567	0.4574	0.3332	0.9160	0.9134	0.9551

Comparison against state-of-the-art algorithms on ScanNet dataset. (units in m)
(B: GDT>0, Y: GDT>0 & RAW>0, N: GDT>0 & RAW=0)

Best result show in yellow.

- Result:
  - Example depth completion results on ScanNet test set.

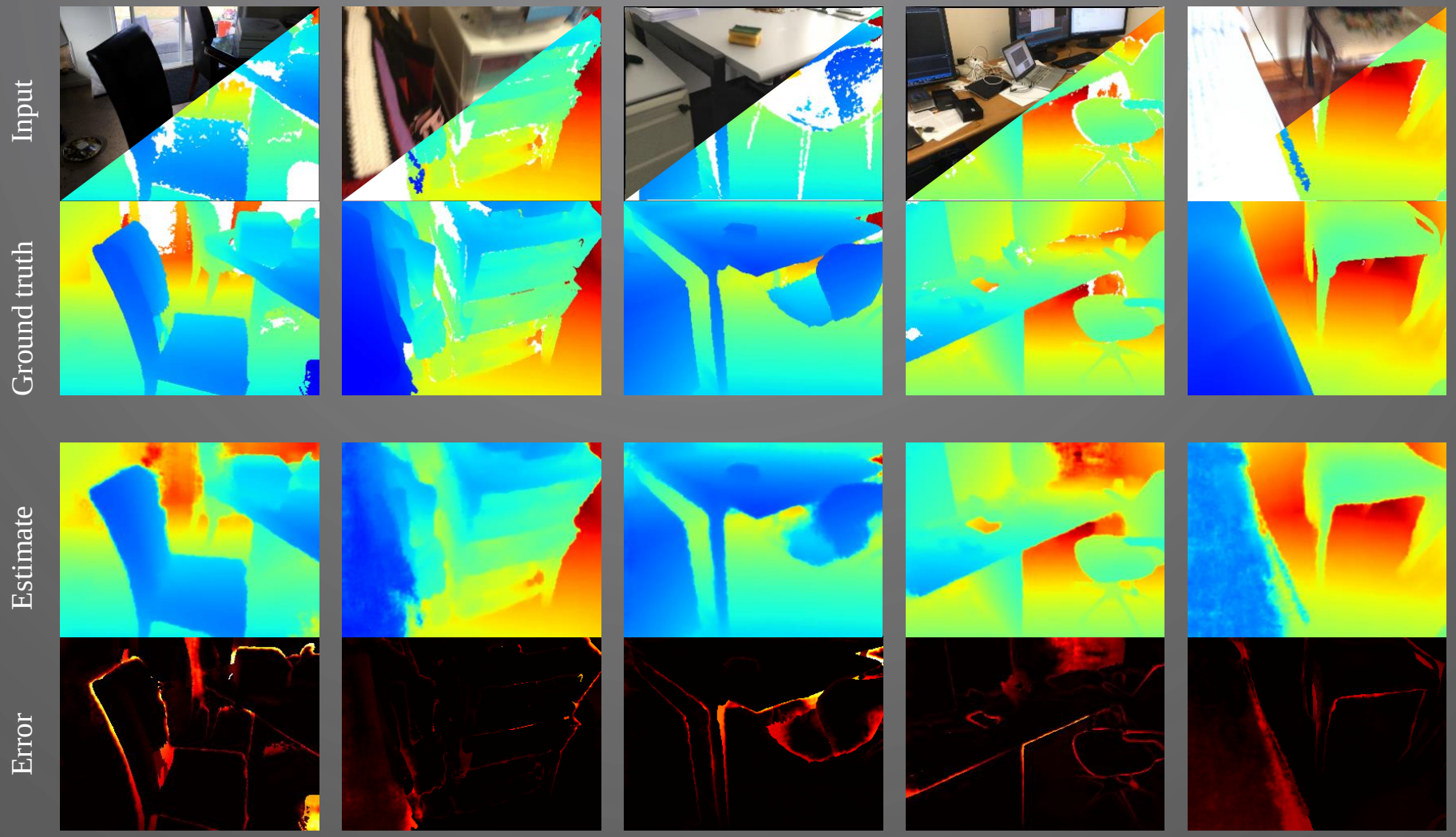
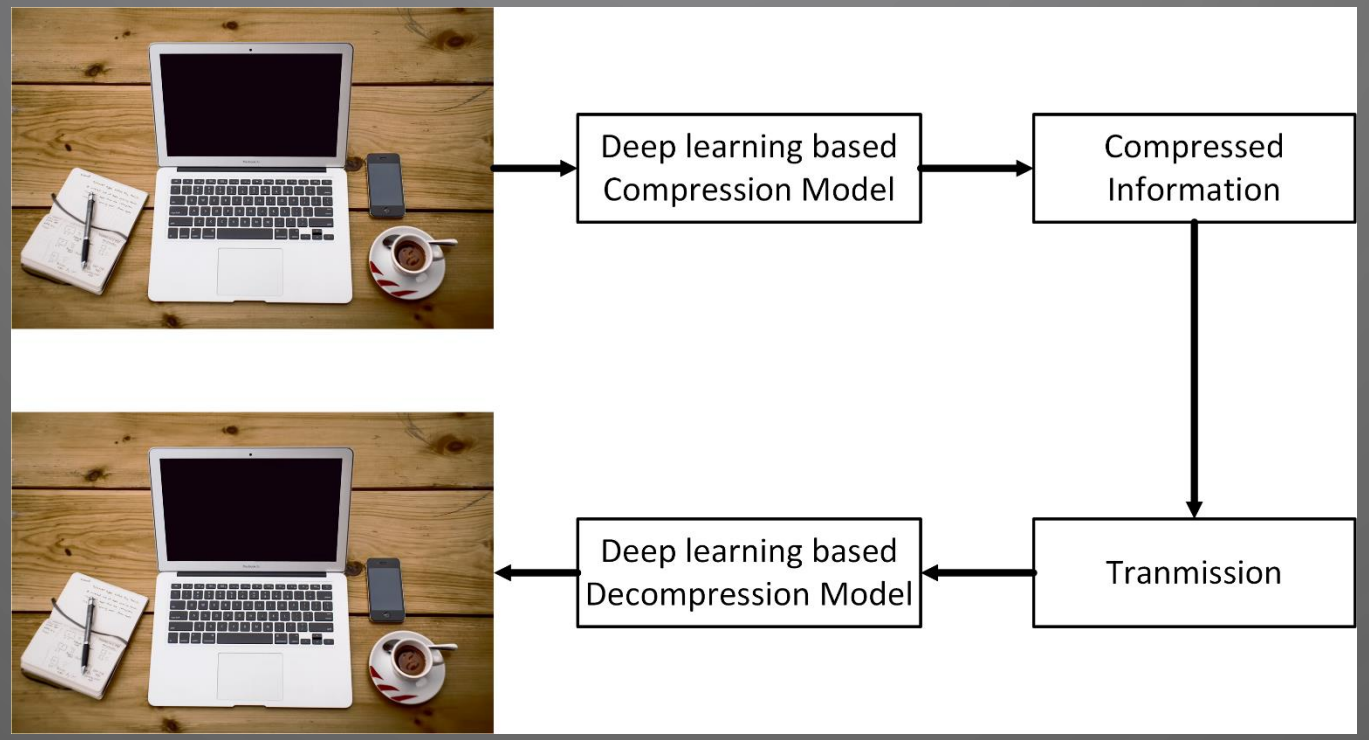


IMAGE ANALYSIS/RESTORATION – AI VIDEO COMPRESSION/IMAGE RESTORATION

- Goal :
  - Learn Deep Image Structure Prior for Ultra-Low Bit Rate Image Compression.



- Challenges :
  - The image quality is usually degraded at very low bitrate.
  - How to find out that which necessary information should be transmitted and which prior information that deep learning model provides.

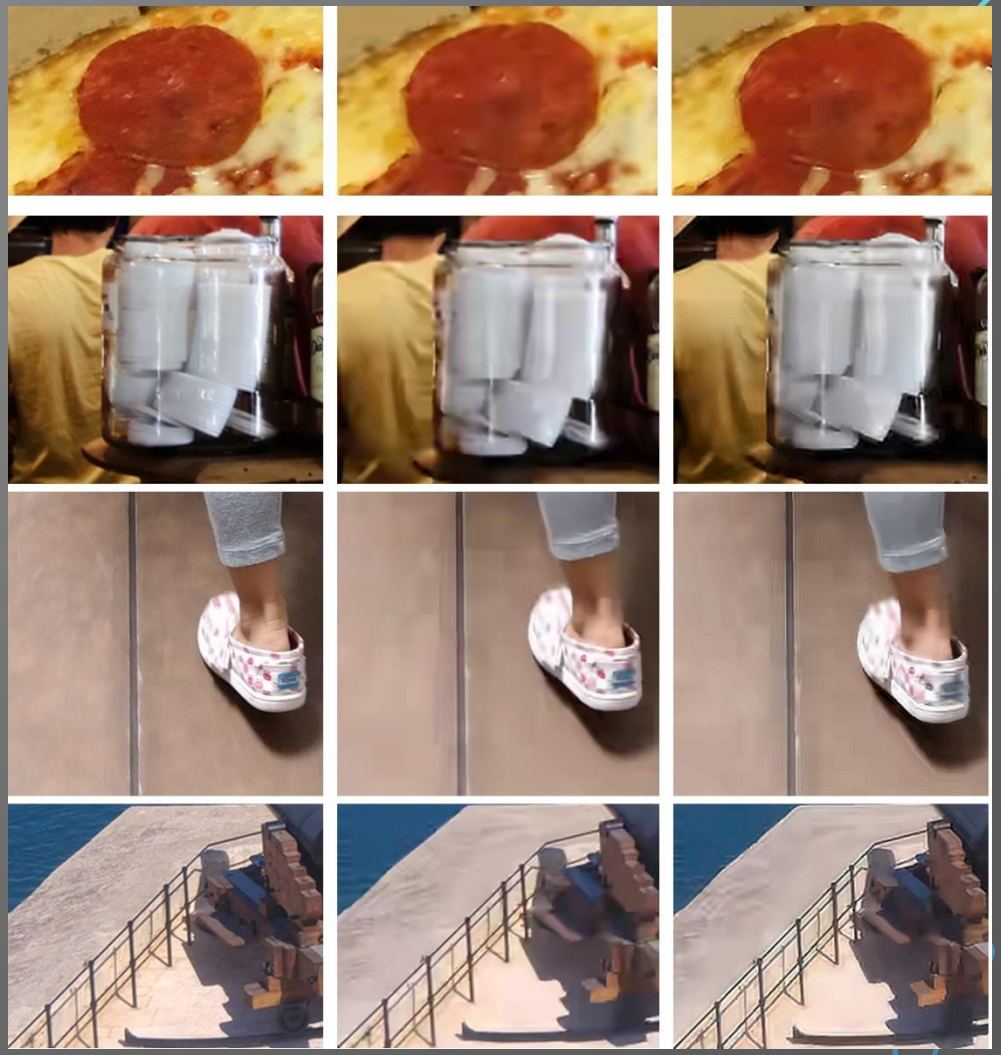
- Result:

Original Image

[7], BPP: **0.489**, MSE: 49.436, PSNR: 29.122, SSIM: 0.911, CMSSIM: 0.537, Lab: 2.903, RGB angle: 1.805.

Without fusion network, BPP: 0.577, MSE: 30.995, PSNR: 30.864, SSIM: 0.906, CMSSIM: 0.729, Lab: 2.45, RGB angle: 1.802.

With fusion network, BPP: 0.596, MSE: **28.503**, PSNR: **31.451**, SSIM: **0.911**, CMSSIM: **0.762**, Lab: **2.346**, RGB angle: **1.551**.



Original Image

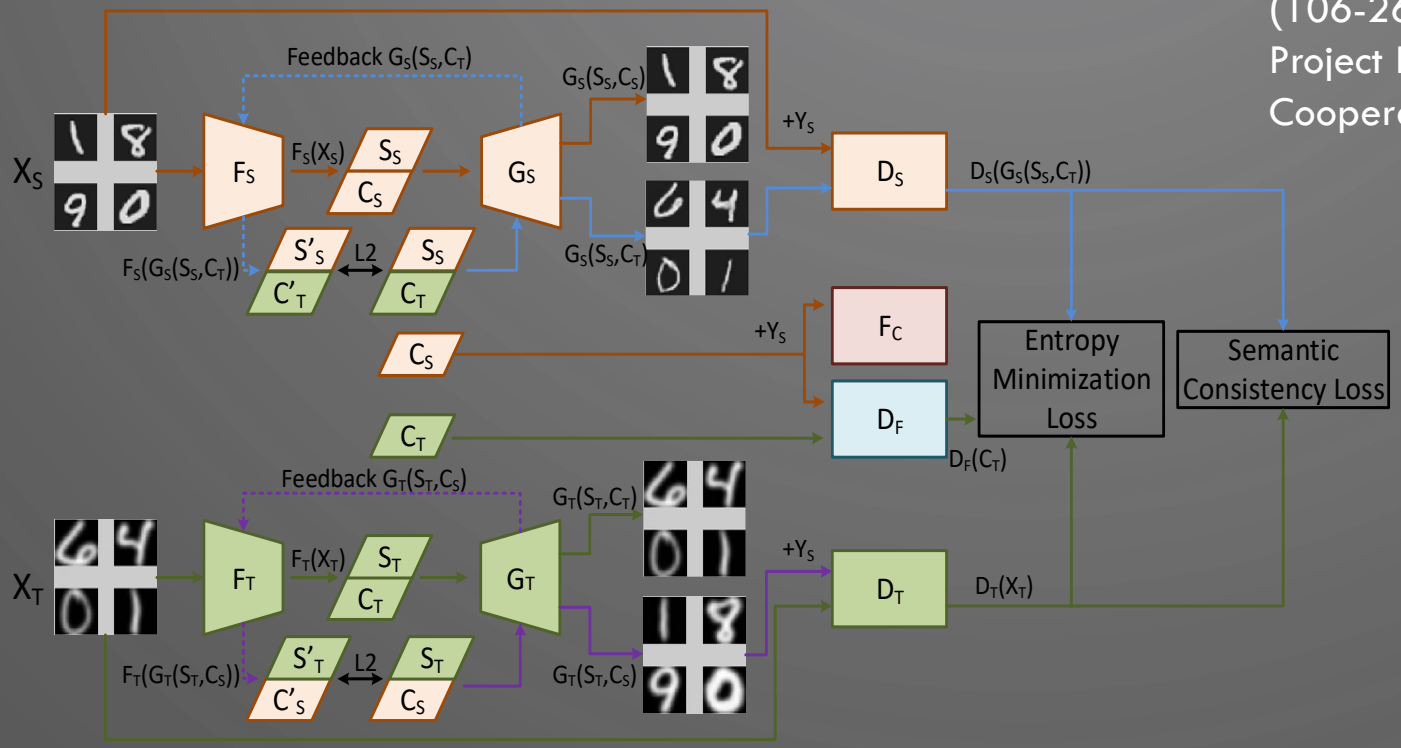
BPG Result

Our Result

- Publication:
  - Ching-Chun Huang, Thanh-Phat Nguyen and Chen-Tung Lai, "Learned Prior Information for Image Compression", Workshop and Challenge on Learned Image Compression (CLIC), in Conference on Computer Vision and Pattern Recognition (CVPR), 2019.
  - Ching-Chun Huang, Thanh-Phat Nguyen and Chen-Tung Lai, "Multi-channel Multi-loss Deep Learning Based Compression Model For Color Images", 2019 IEEE International Conference on Image Processing(ICIP), Sept. 2019.

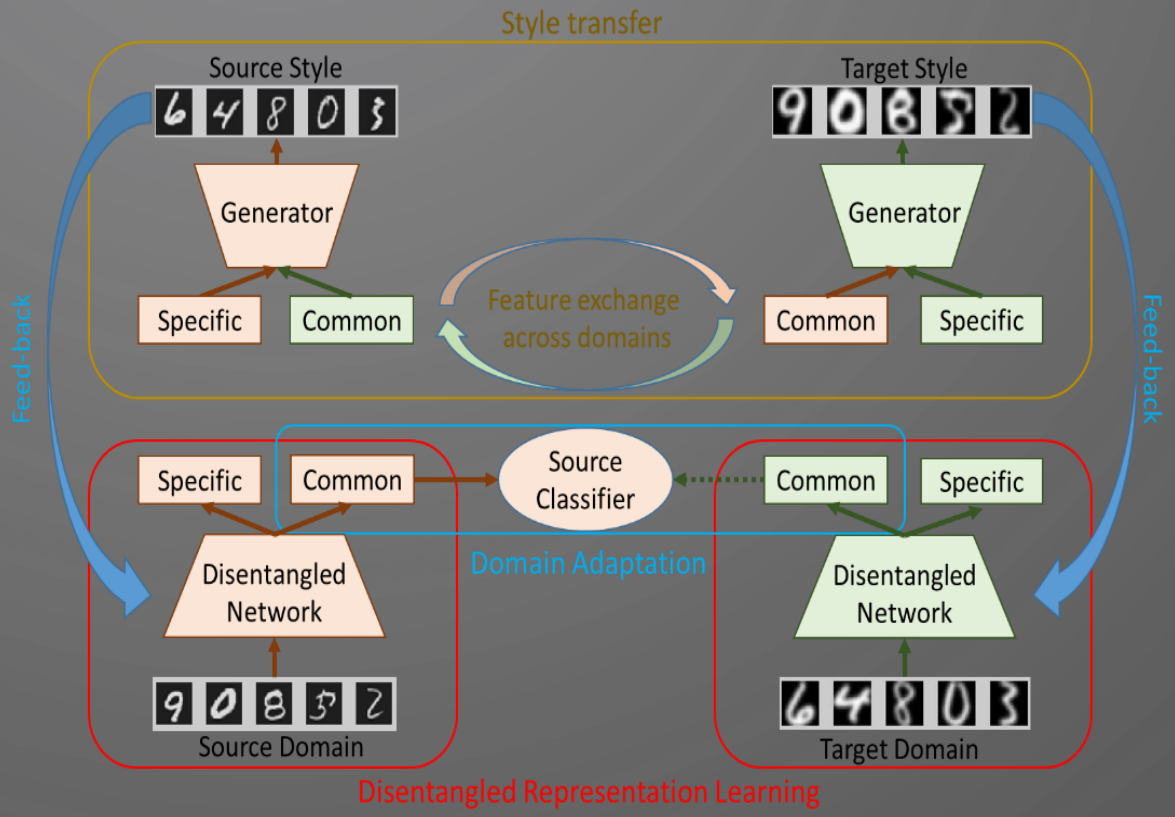
IMAGE ANALYSIS/RESTORATION – TRANSFER LEARNING

- Goal:
  - Use a deep learning framework to learn data relationship among different domains



Project Name :基於深度學習、異質資訊整合、與轉換學習之通用型停車場管理系統
(106-2628-E-194 -002 -MY3)
Project Period : 2017/08/01 ~ 2020/07/31
Cooperation Vendors : 行政院科技部

- Challenges :
  - Lack of training data for new domain
  - Transfer label and knowledge across domains
  - The negative transfer
  - Partial transfer learning



- Result:

(a) Source image (SVHN)

(b) Target image (MNIST)

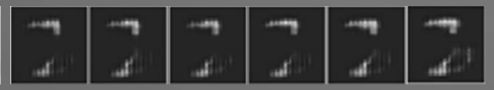
(c) Style-transferred images from source to target

(d) Style-transferred images from target to source

(e) Source's common part

(f) Target's common part

(g) Source's specific part



(h) Target's specific part

SVHN→MNIST

(a) Source image (Syn. Signs)

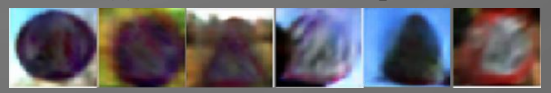
(b) Target image (GTSRB)

(c) Style-transferred images from source to target

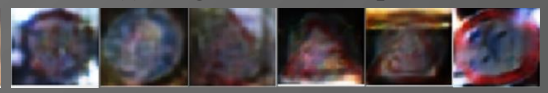
(d) Style-transferred images from target to source

(e) Source's common part

(f) Target's common part



(g) Source's specific part



(h) Target's specific part

Syn-Signs→GTSRB

- Result:

	MNIST → USPS	SVHN → MNIST	Syn. Signs → GTSRB
Source only	78.9	60.1 ± 1.1	79.0
CORAL (ICCV 2016)	81.7	63.1	86.9
MMD (arXiv 2014)	81.1	71.1	91.1
DANN (JMLR 2016)	85.1	73.9	88.7
DSN (NIPS 2016)	91.3	82.7	93.1
CoGAN (NIPS 2016)	91.2	No converge	
ADDA (CVPR 2017)	89.4	76.0	
GenToAdapt (CVPR 2018)	92.5	84.7	
DRCN (ECCV 2016)	91.8	82.0	
Our method	**94.14**	**90.23**	**94.66**

Experimental results on unsupervised adaptation

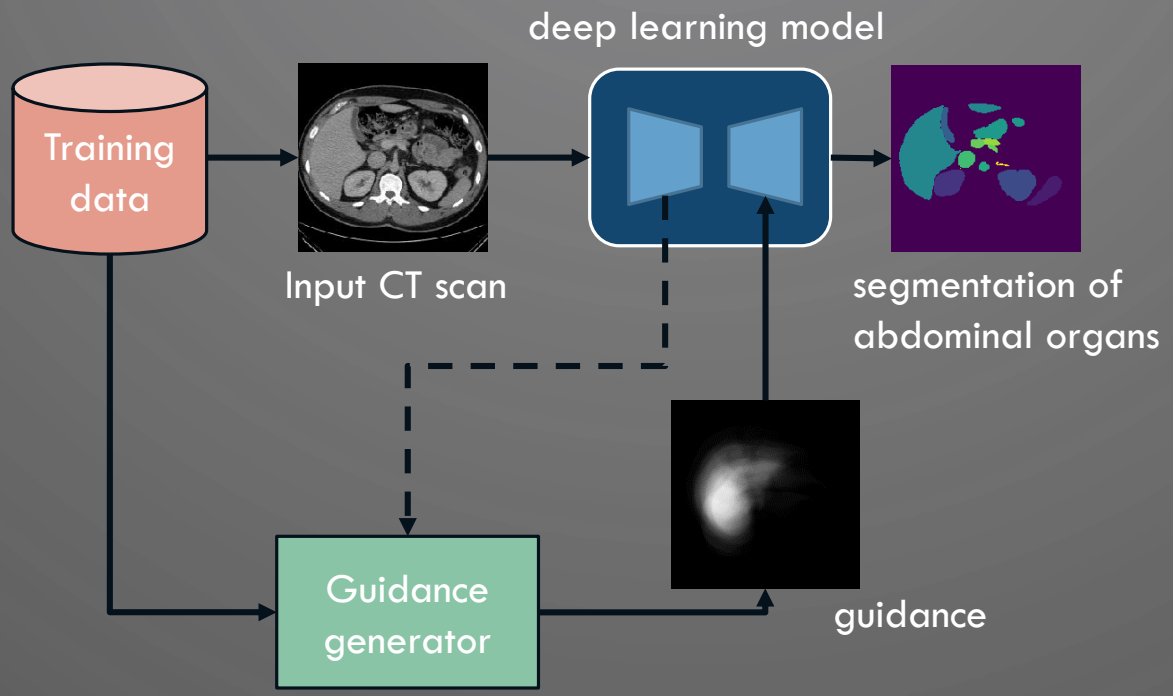
	MNIST → USPS
Without $L_{feedback}$ and $L_{Entropy}$	75.22%
Without $L_{Entropy}$	89.50%
Proposed method	94.78%

Experimental results on partial transfer learning between MNIST and USPS

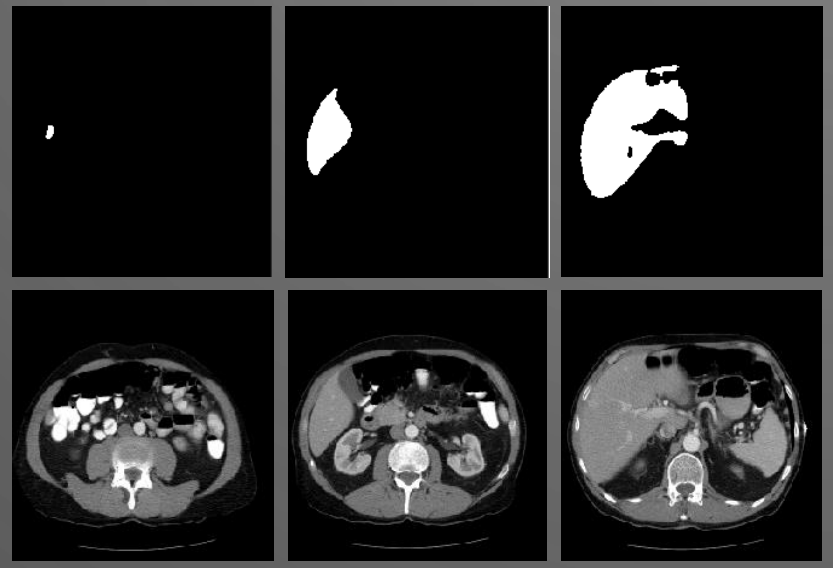
- Publication:
  - Vu-Hoang Tran, and Ching-Chun Huang, "Domain Adaptation Meets Disentangled Representation Learning and Style Transfer", IEEE International Conference on Systems, Man, and Cybernetics, 2019.

IMAGE ANALYSIS/RESTORATION – MEDICAL IMAGE ANALYSIS

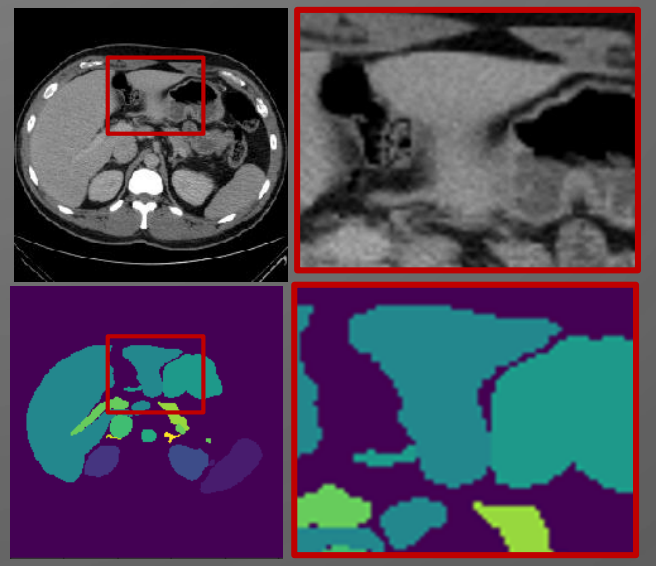
- Goal:
  - Build up a deep learning model for accurate and robust segmentation of abdominal organs on CT scan



- Challenges :
- Segmentation difficulty in CT-scanned data
  - Weak boundaries of organs, Clustering background, High appearance similarity between organ and tissue and Appearance variation caused by external factors
- Large variation of organ
  - Large variation of organ size and shape through the longitudinal axis

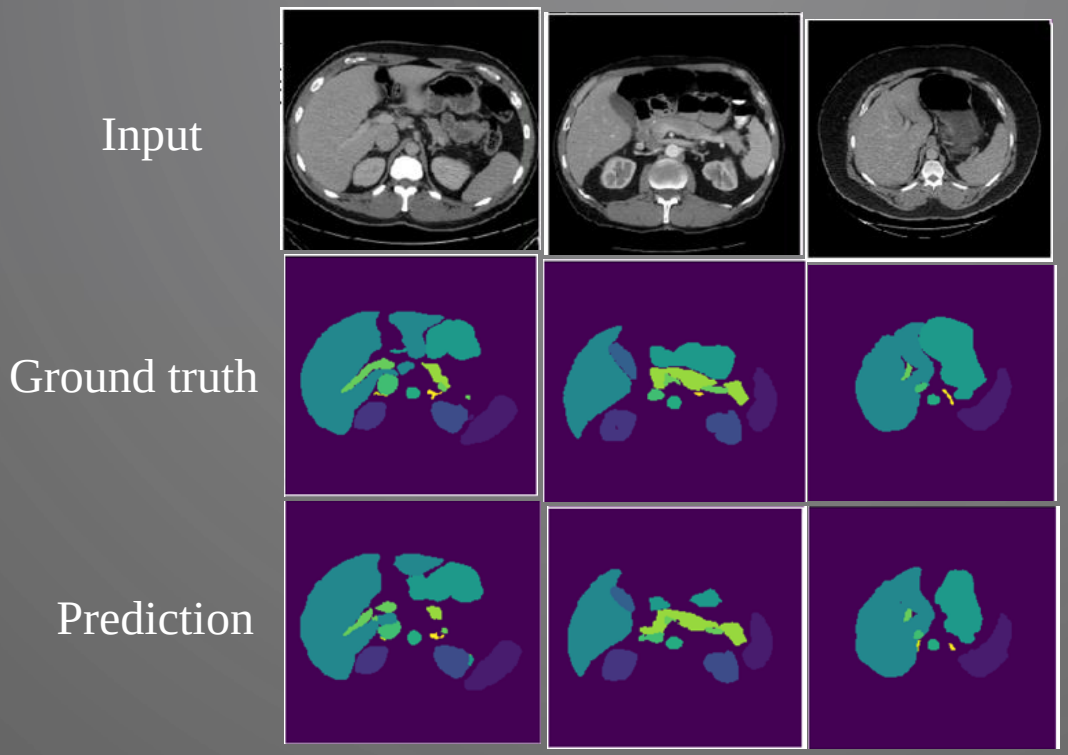


Large variation of organ



weak boundaries of organs

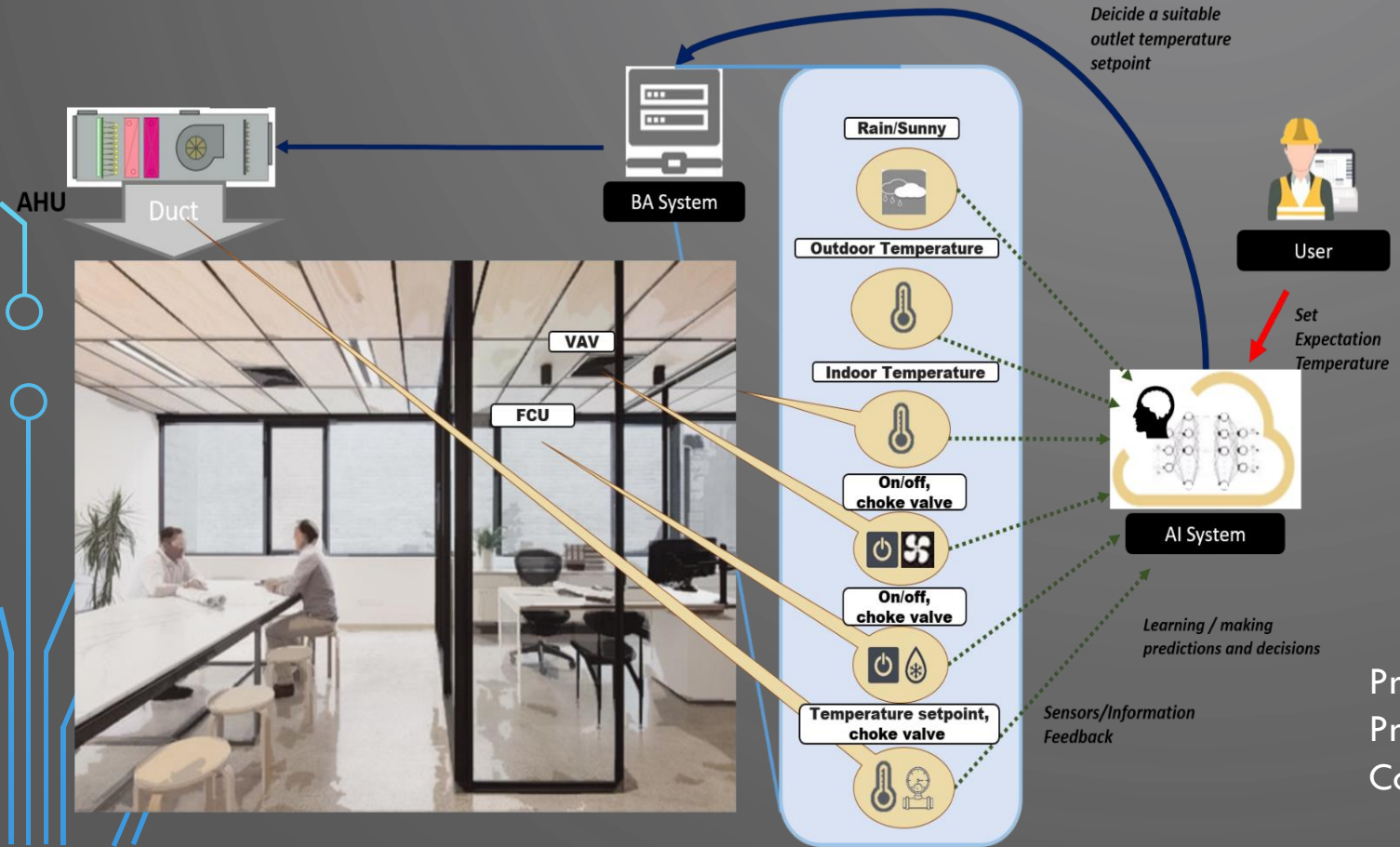
- Result:



Background	Spleen	Kidney (R)	Kidney (L)	gallbladder	esophagus
liver	stomach	aorta	IVC	PV & SV	pancreas
adrenal gland (R)	adrenal gland (L)				

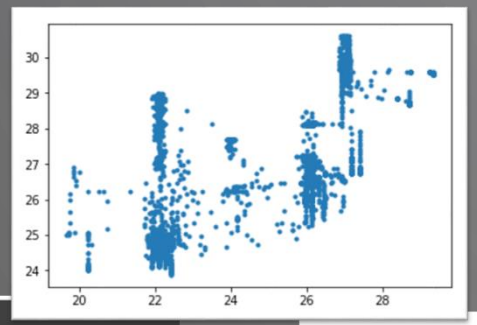
SMART BUILDING – TSMC SMART OFFICE

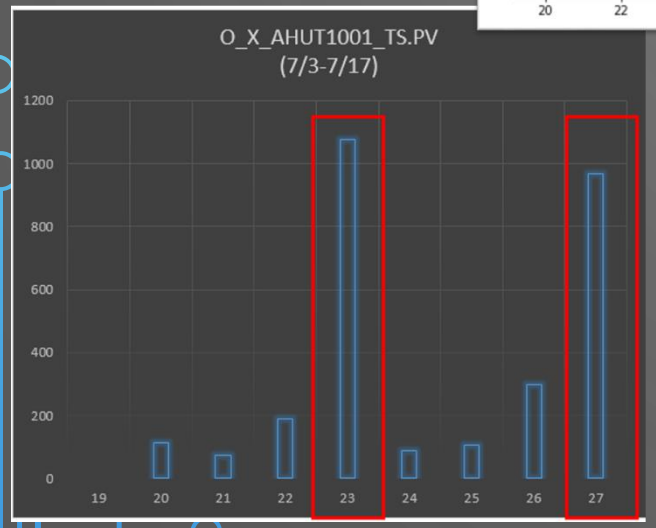
- Goal :
  - This system can automatically generate the parameter settings of AHU to lower the power consumption and satisfy the expected setting at the same time. Besides, this system could improve itself using reinforcement-learning.

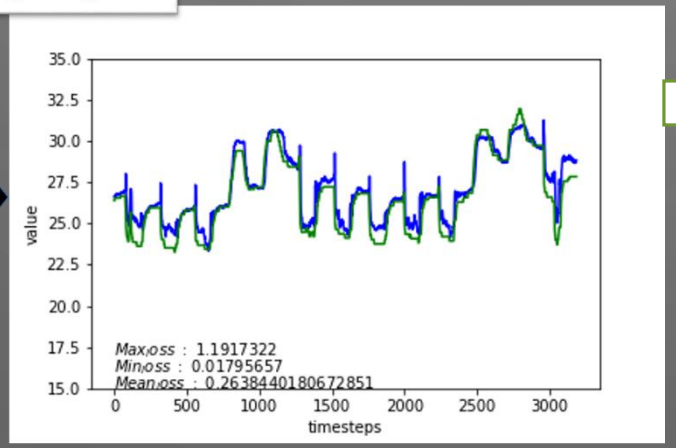


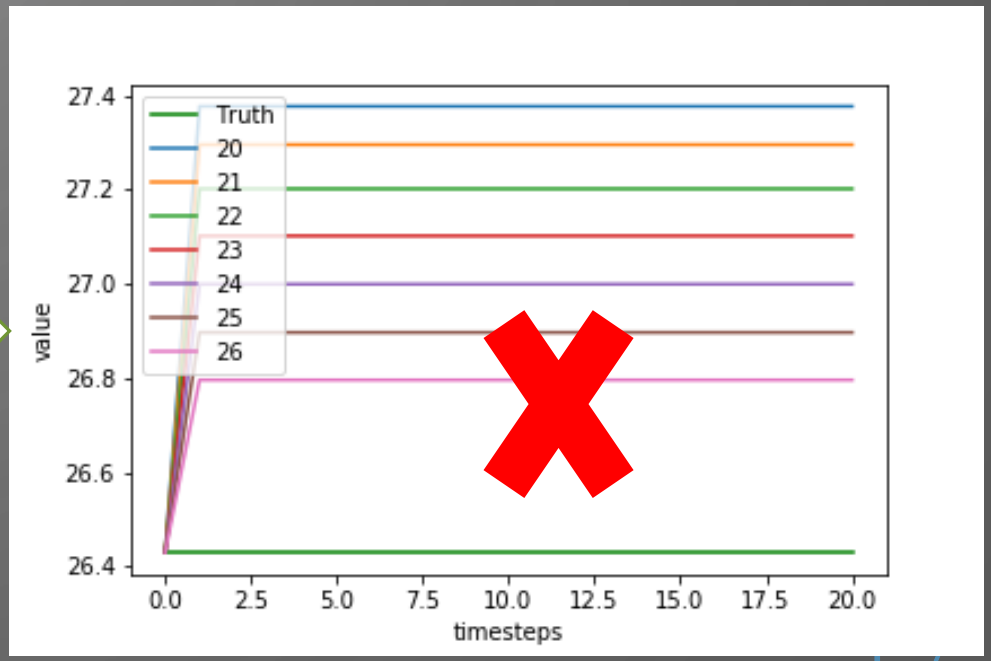
Project Name : Smart building system
Project Period : 2018
Cooperation Vendors : 臺灣積體電路製造股份有限公司

- Challenges :
  - The extreme and rare dataset problem
    - The network tend to fit data with wrong tendency



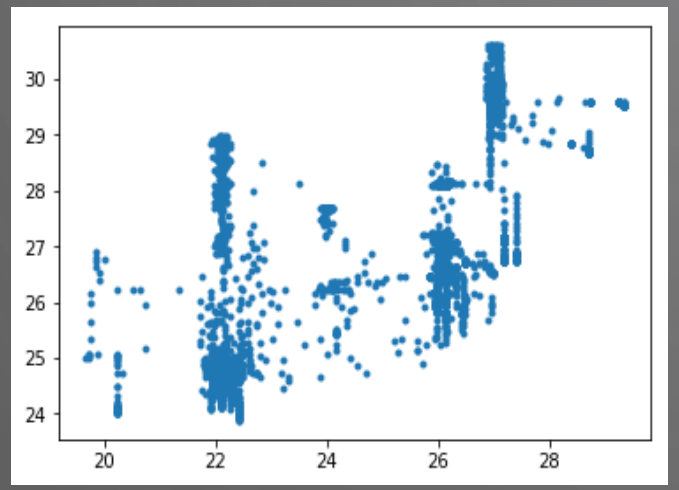


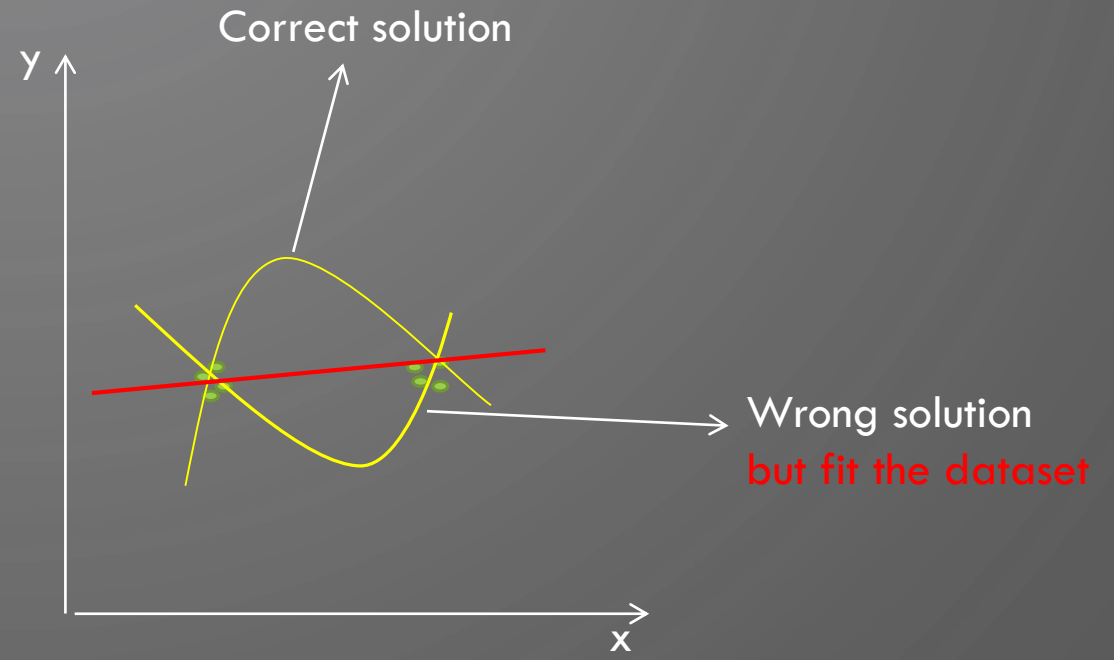




Fix environment, compare with different set points.

- Challenges :
  - The extreme and rare dataset problem
    - Rare and extreme data may leave too much uncertain space for the network

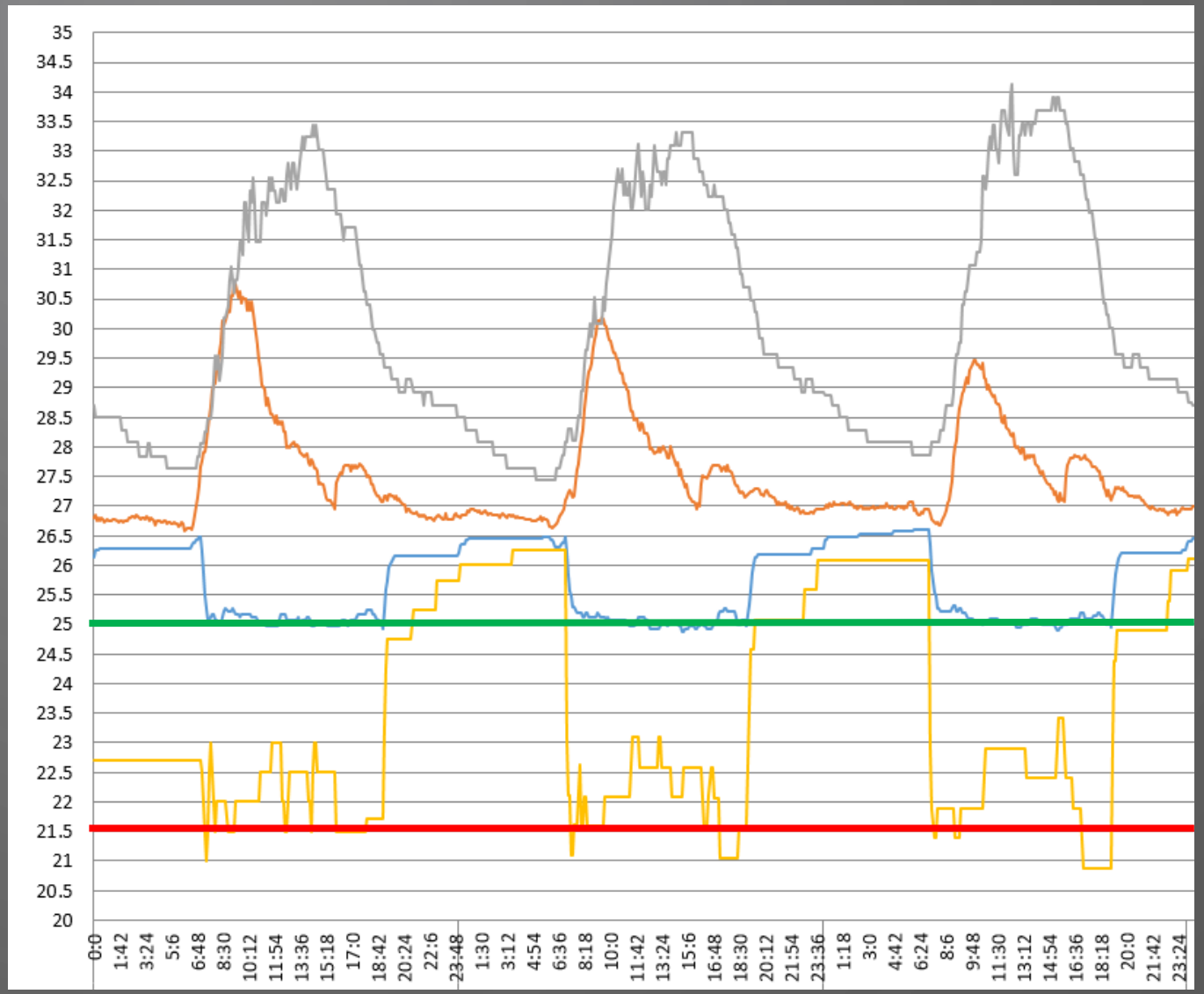




- Result:
  - Learning Property

Mean error: +- 0.125 degree

- expectation : 25
- original setpoint
- AI setpoint
- out door temperature
- temperature near by window
- indoor temperature



- Result:
  - Learning Property

・We change the expectation temperature from 25 → 25.25

Mean error: +- 0.25 degree

energy saving mode expectation : 25.25 degree(C)

original energy saving mode setpoint

indoor temperature

simulation model based AI setpoint

- Result:
  - Learning Pr

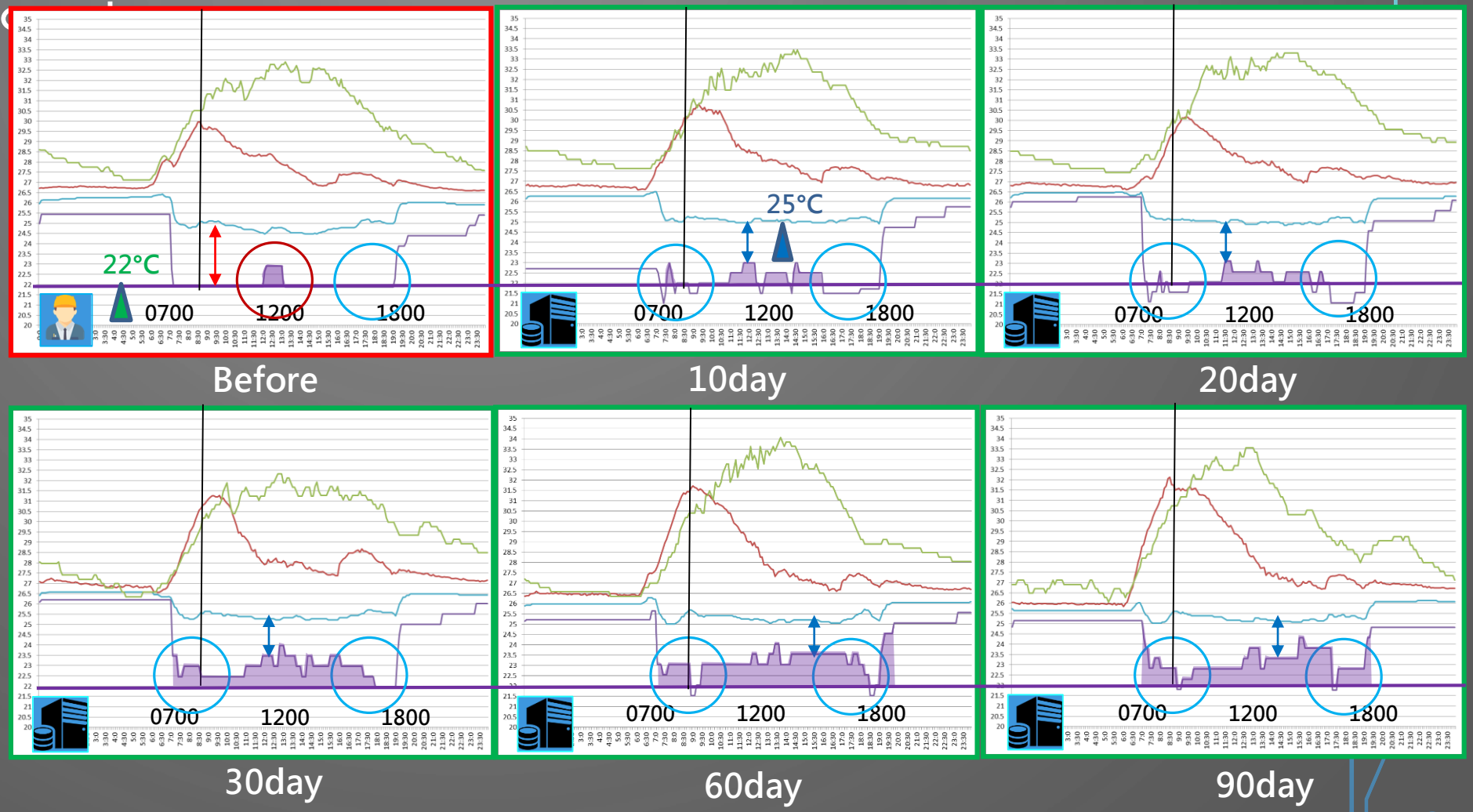
Mean error: +- 0.25 degree

temperature setpoint
out door temperature
temperature by the window
indoor temperature
positive correlation
to energy saving

expert controlling

AI controlling

The heat load increasing moment / switch to working mode



- Publication:
  - Tzu-Yin Chao, Manh Hung Nguyen, Ching-Chun Huang, CHIEN-CHENG LIANG, Chen-Wu Chung, “Online Self-Learning for Smart HVAC Control”, 2019 IEEE International Conference on Systems, Man and Cybernetics.

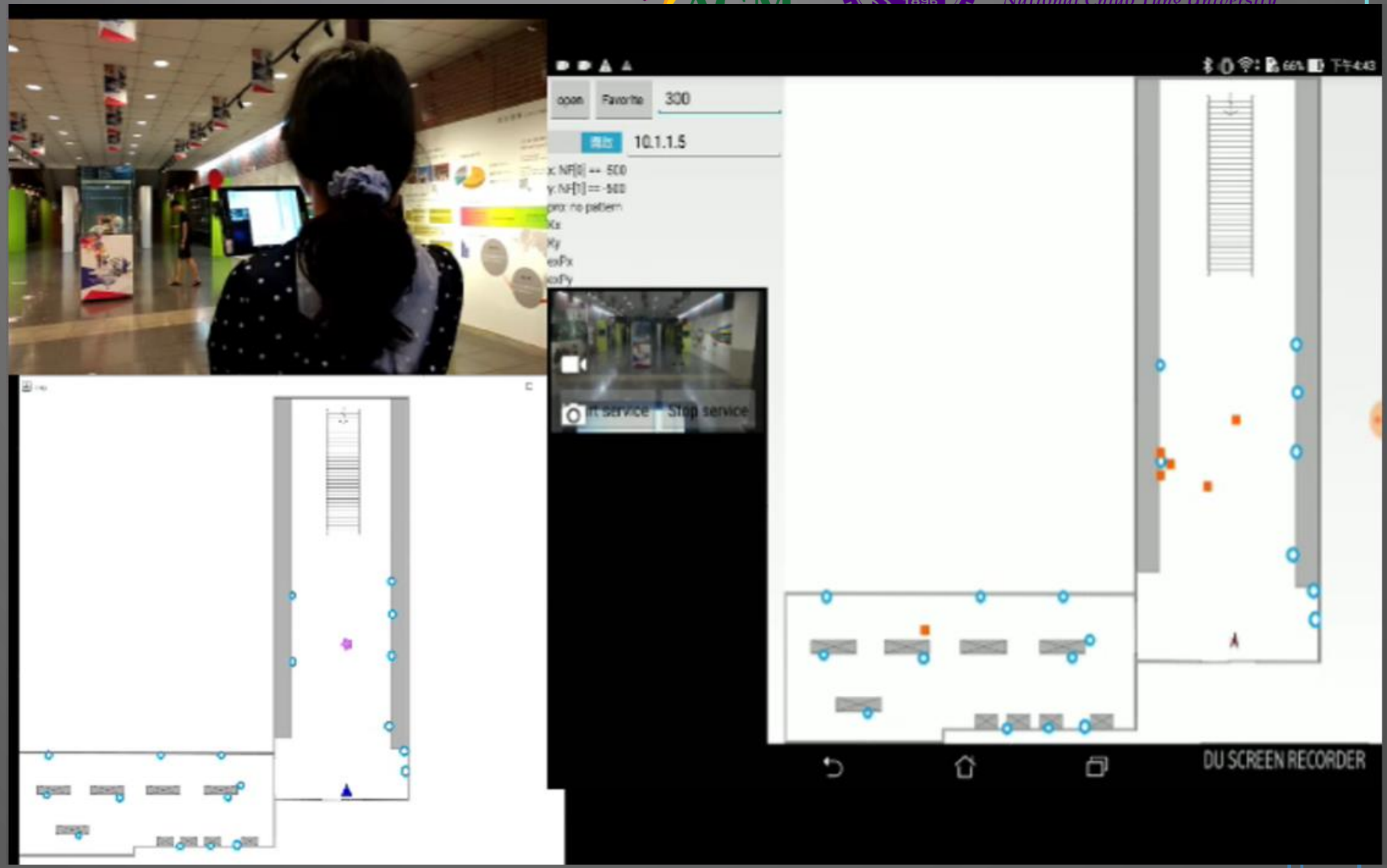
SMART BUILDING – MUSEUM GUIDANCE SYSTEM

- Goal :
  - Achieve personalized guidance.
  - Improve the efficiency and the quality of the museum services.

Project Name : 應用多重感測器整合於銀髮族長期照護系統之監控技術--子計畫二：應用無線訊號於健康照護之室內人物追蹤研究 (MOST 104-2221-E-194 -044 -MY2)
Project Period : 2015/08/01 ~ 2017/10/31
Cooperation vendors : 行政院科技部

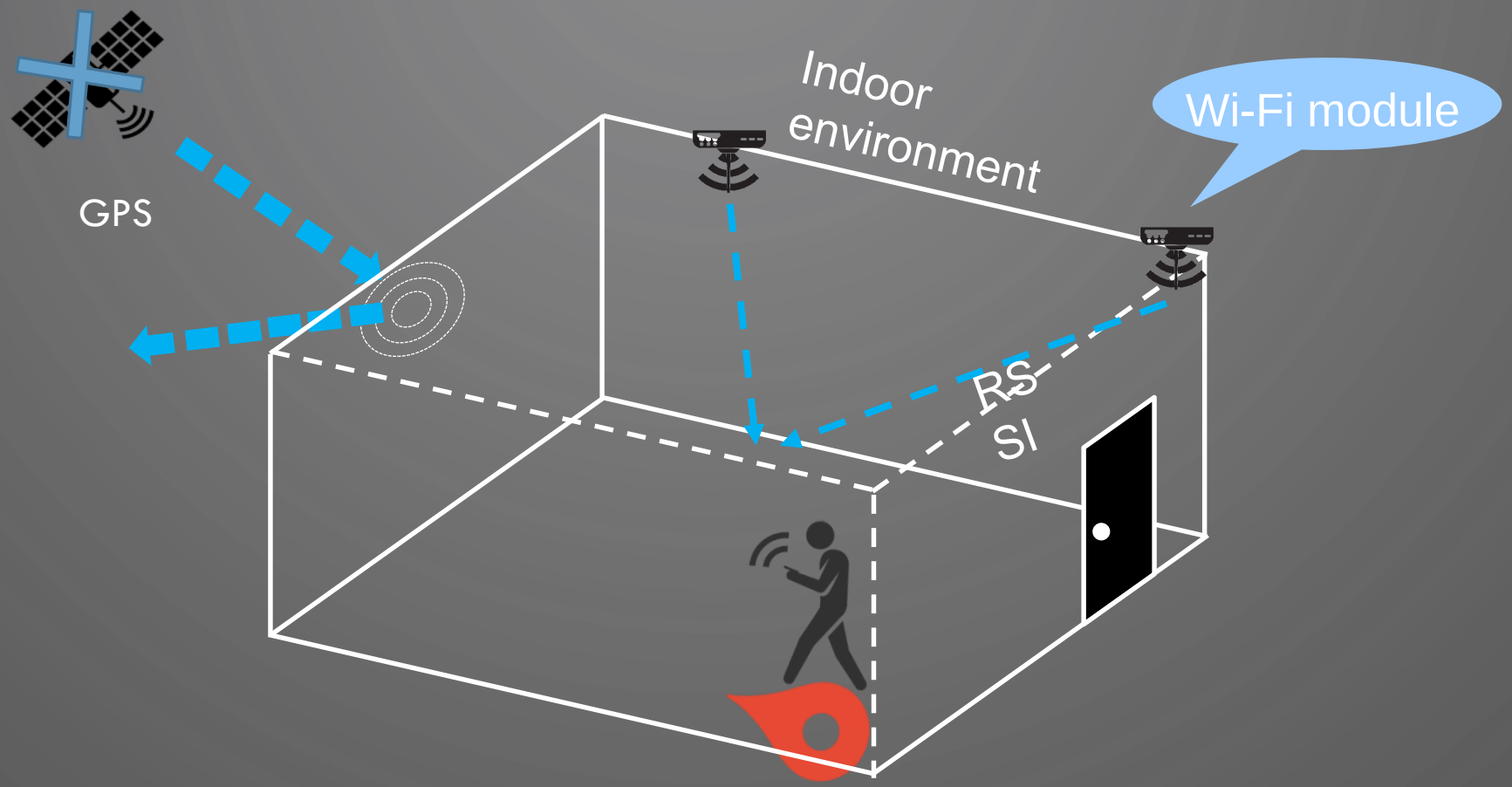
- Challenges :
  - Indoor localization under large scenes.
  - Need to consider user requirement and environmental conditions.

- Result :



SMART BUILDING – INDOOR LOCALIZATION

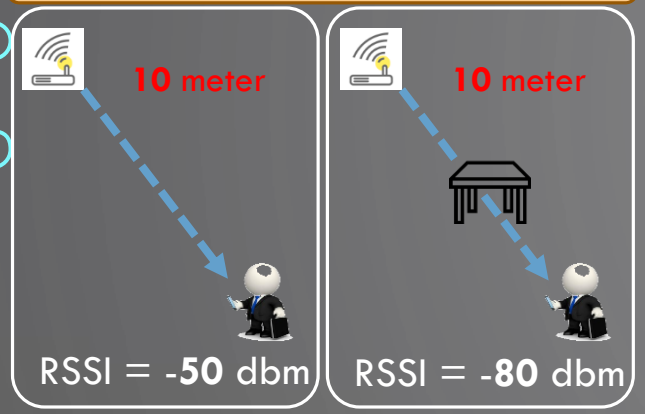
- Goal :
  - Wi-Fi signal based Indoor Localization.



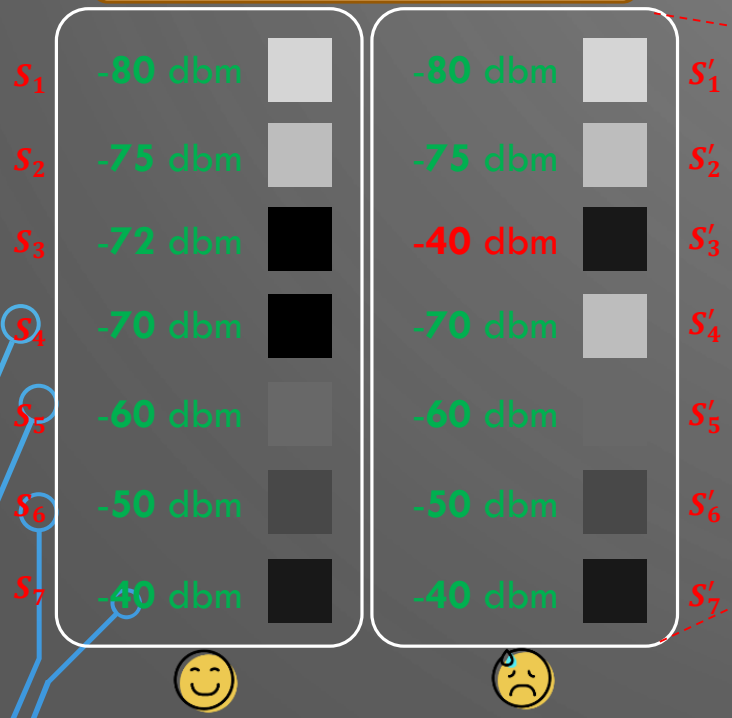
RSSI: Received Signal Strength Indicator (unit: dbm)

• Challenges :

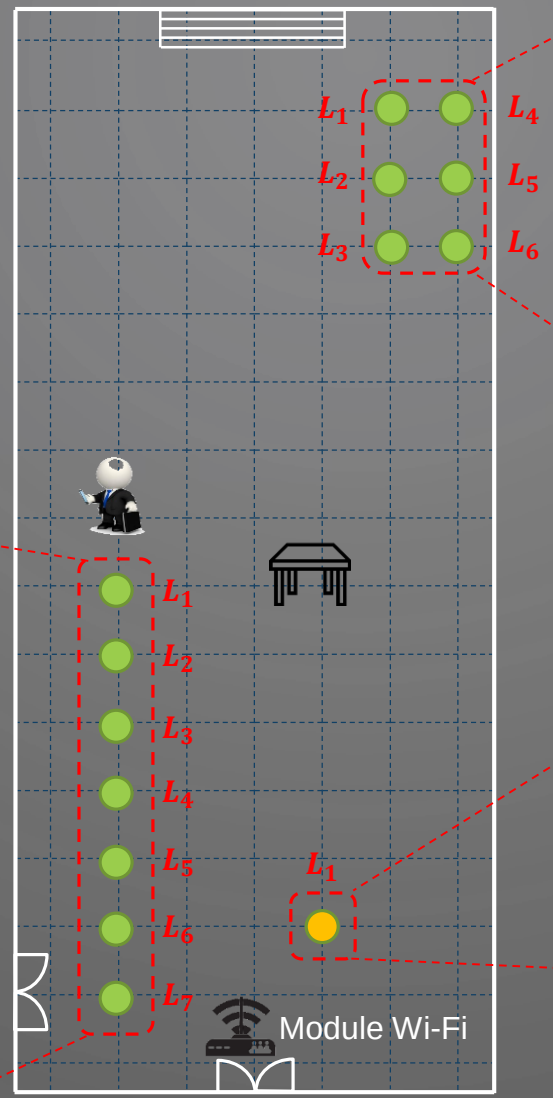
Occlusion effect



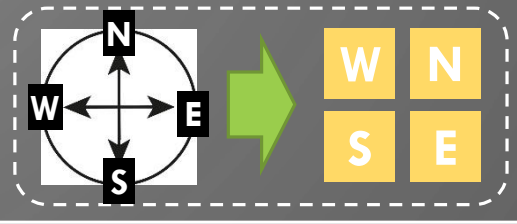
Similarity Inconsistency

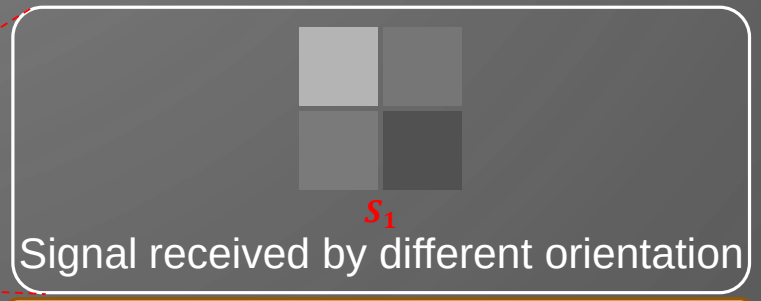


Indoor Environment



Device diversity





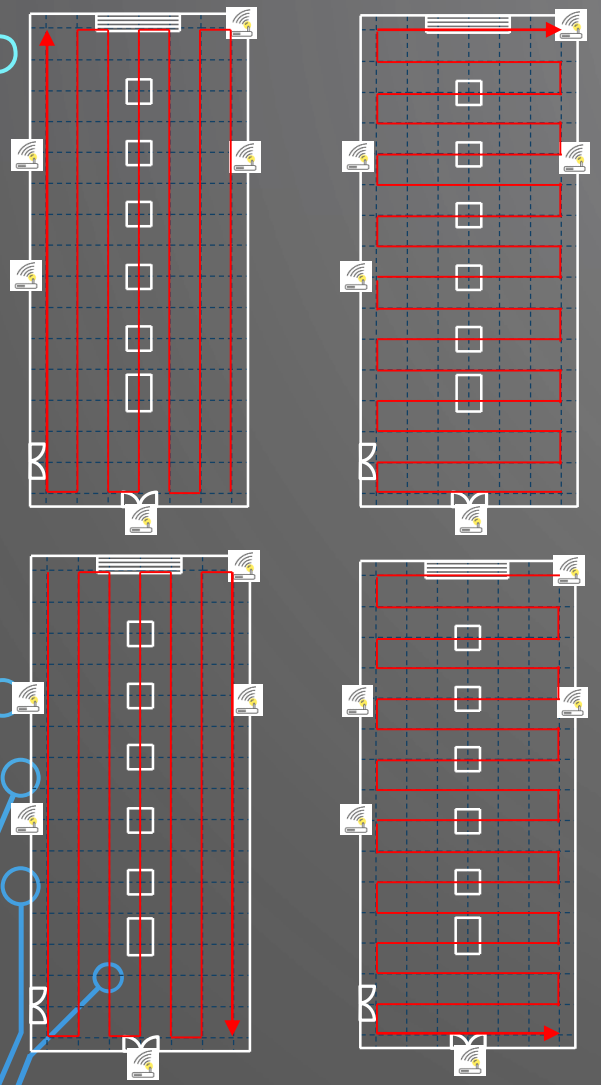
Signal variant with orientation

S Signal strength received at location L - 40 dbm - 120 dbm

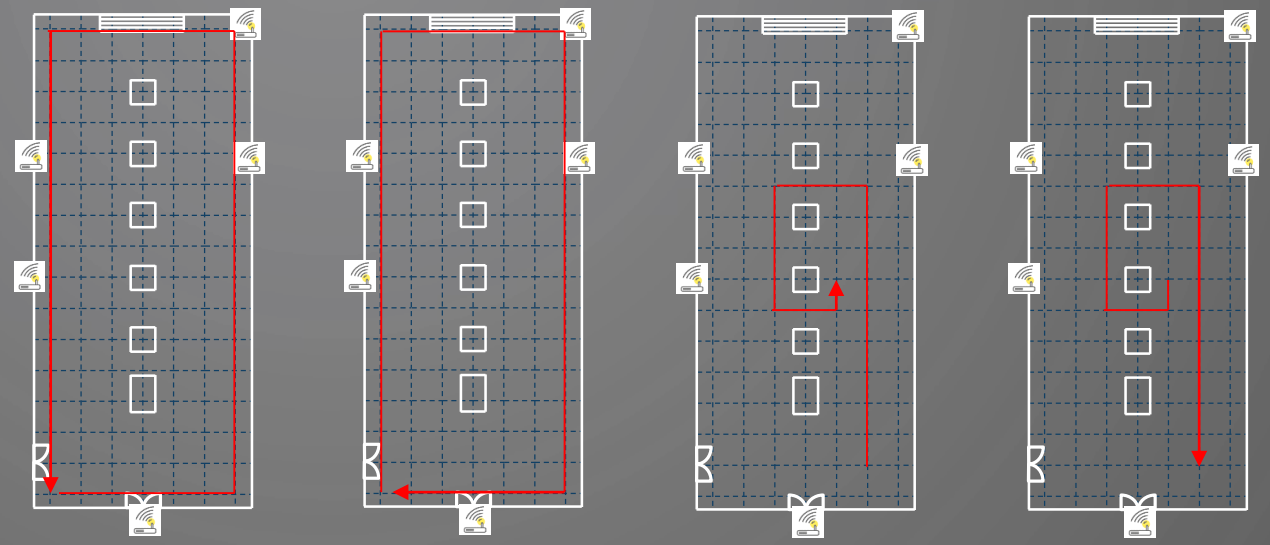
Comparisons on multiple devices

- **Multiple devices** (Training device: **Asus, Lenovo** – Testing device: **Asus, Lenovo, Samsung**)

Training (60 samples/location)



Testing (20 samples/location)



- Result:
  - **Multiple devices** (Training device: **Asus, Lenovo** – Testing device: **Asus, Lenovo, Samsung**)

Localization performance of comparison methods on testing round

Device	Evaluation (meter)	DNN	Deep-Fi	Multi-task	MGCN-LSTM
Asus	MED	3.679	4.285	2.672	**2.038**
	MaxED	16.450	18.175	7.011	**6.502**
	VED	3.535	9.106	1.742	**1.537**
Lenovo	MED	3.291	4.005	2.684	**2.334**
	MaxED	12.168	16.108	7.033	**6.945**
	VED	2.259	6.812	2.298	**1.984**
Samsung	MED	4.220	5.200	2.739	**2.278**
	MaxED	16.262	16.875	8.189	**7.304**
	VED	5.496	9.442	1.976	**1.642**

- Publication:
  - Wei-Yuan Lin, Ching-Chun Huang, Hung Nguyen Manh and Nguyen Tran Duc, "Wi-Fi Indoor Localization based on Multi-Task Deep Learning", IEEE International Conference on Digital Signal Processing, Nov., 2018.
  - Hoang Tran Vu, Hung Nguyen Manh, Wei-Chi Chang, Wei-Yuan Lin, Hung-Sheng Cheng, Yi-Ning Chuang and Ching-Chun Huang, “A Hybrid Method for Visitor Localization and Tracking in a Museum Environment,” The 9th IEEE International Conference on Ubi-Media Computing, Moscow, Russia. , Aug. 2016.
  - 陳信燕, 莊依寧, 林瑋淵, 黃敬群, " 應用於互動式教學導覽之室內定位與路徑規劃 ", 2017全國製造工程研討會, 臺灣, 台南, 11, 2017.

SMART BUILDING – SKELETON-BASED HUMAN-COMPUTER INTERACTION

- Goal :
  - Create a motion tracking system with multiple Kinects to track the user in 360 degree (marker-free system).

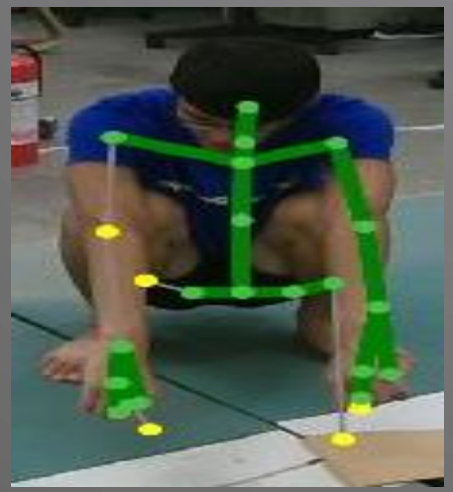
- Skeleton from each camera

- Fused the information

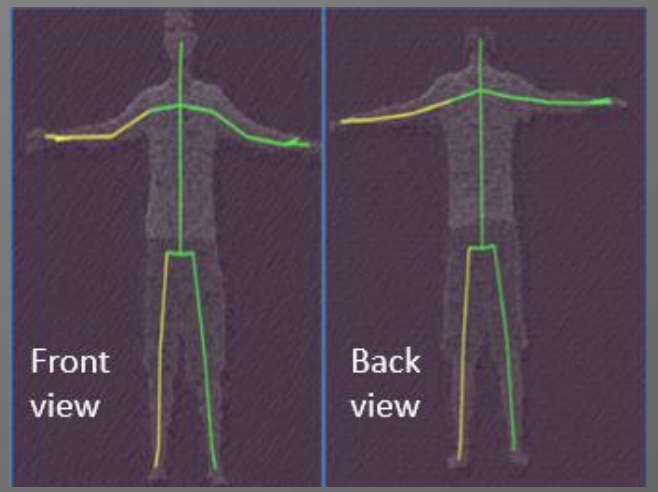
- Control the 3D model

Project Name : 複雜背景下融合多深度攝影機的士兵骨架辨識系統
Project Period : 2018/4/6 ~ 2018/12/10
Cooperation Vendors : 國家中山科學研究院

- Challenges :
  - Solve the self-occlusion problem.
  - Solve left-right problem.

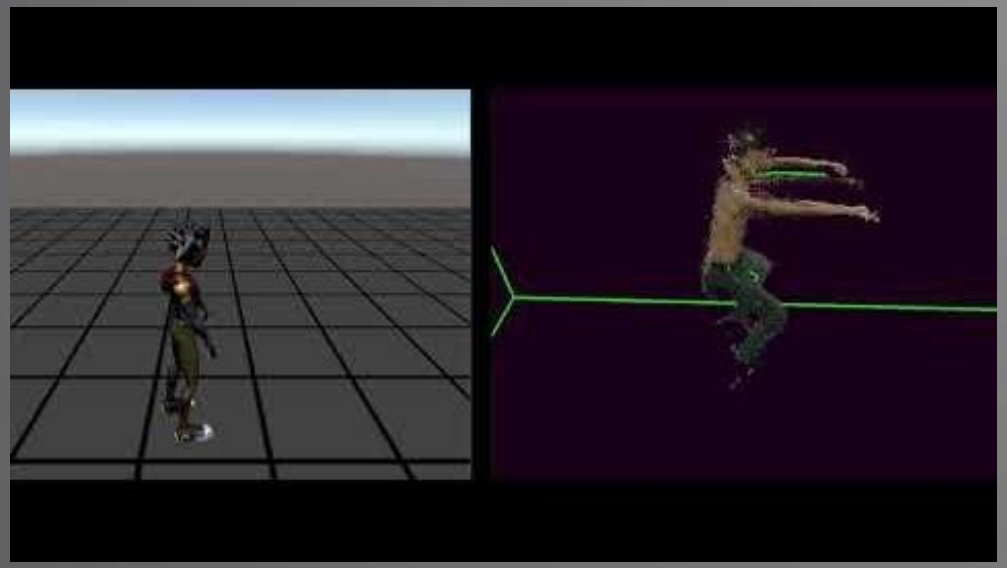
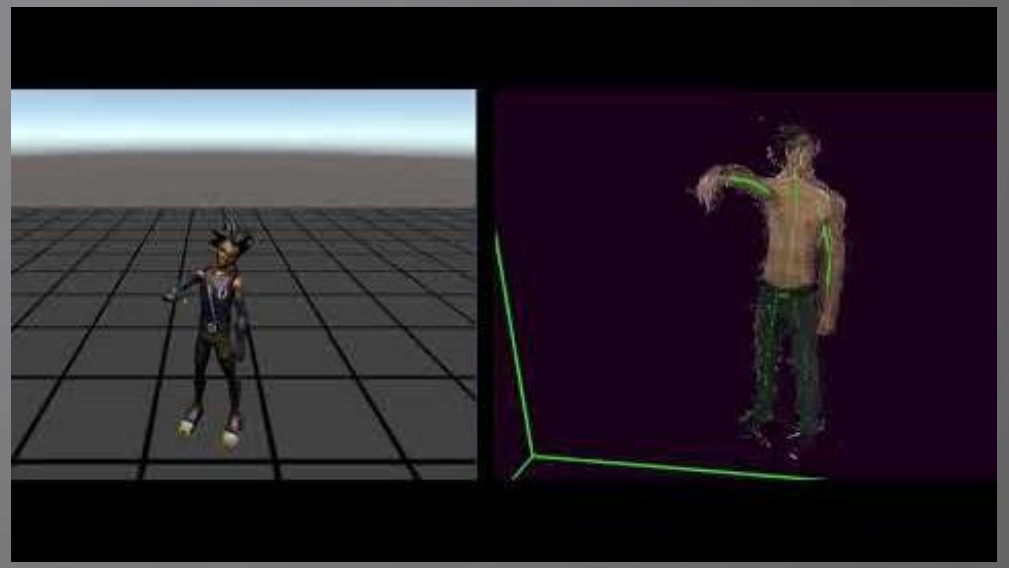
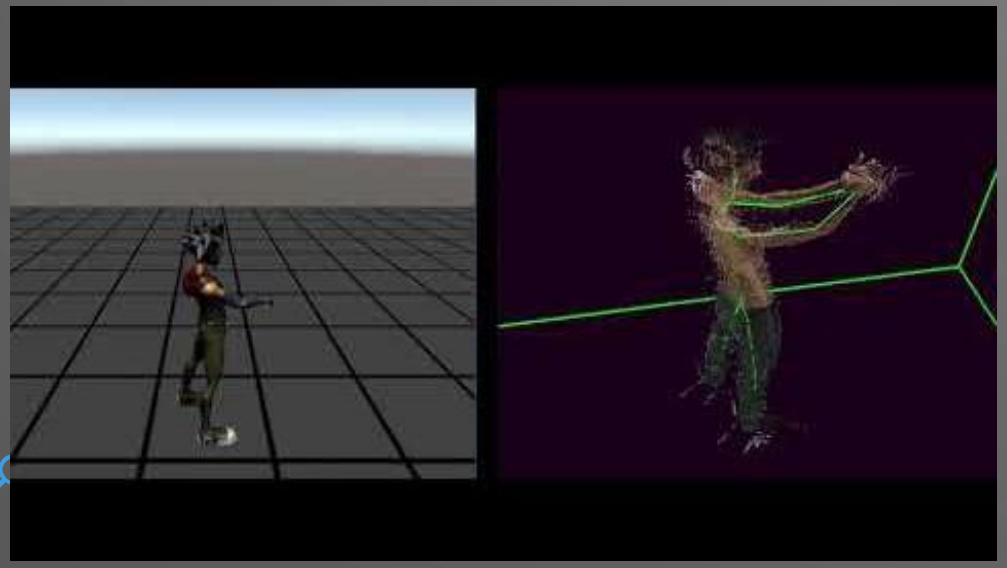
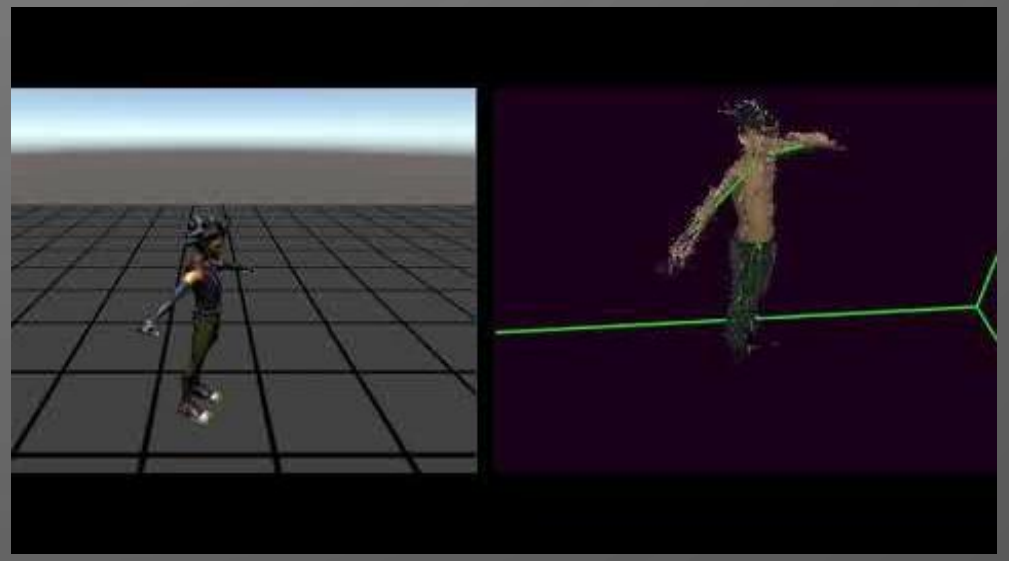


Occlusion problem



Left-right problem

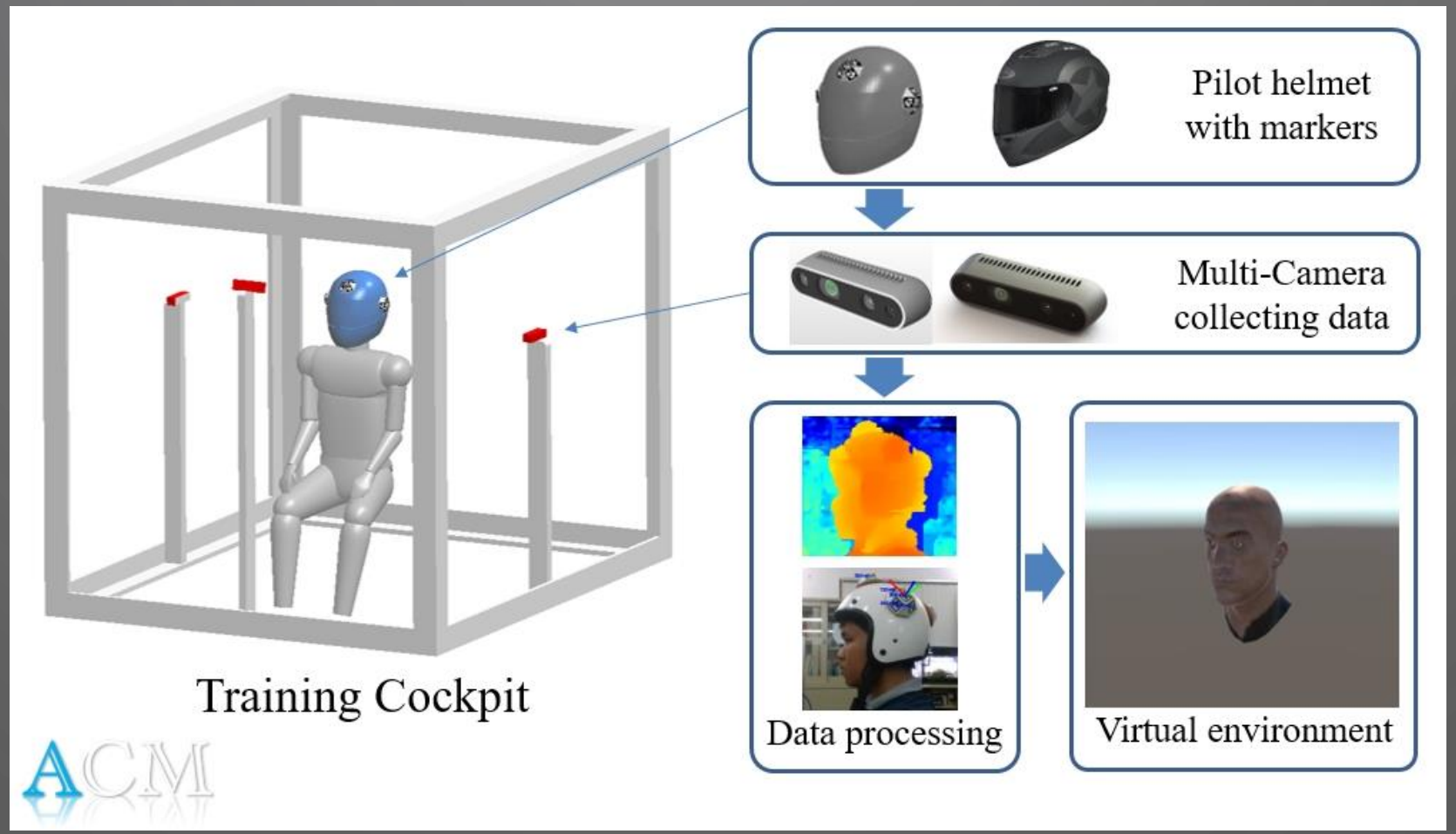
- Result:

- Publication:
  - Ching-Chun Huang and Manh Hung Nguyen, "**Robust 3D Skeleton Tracking based on OpenPose and a Probabilistic Tracking Framework,**" IEEE International Conference on Systems, Man, and Cybernetics (SMC), 2019.

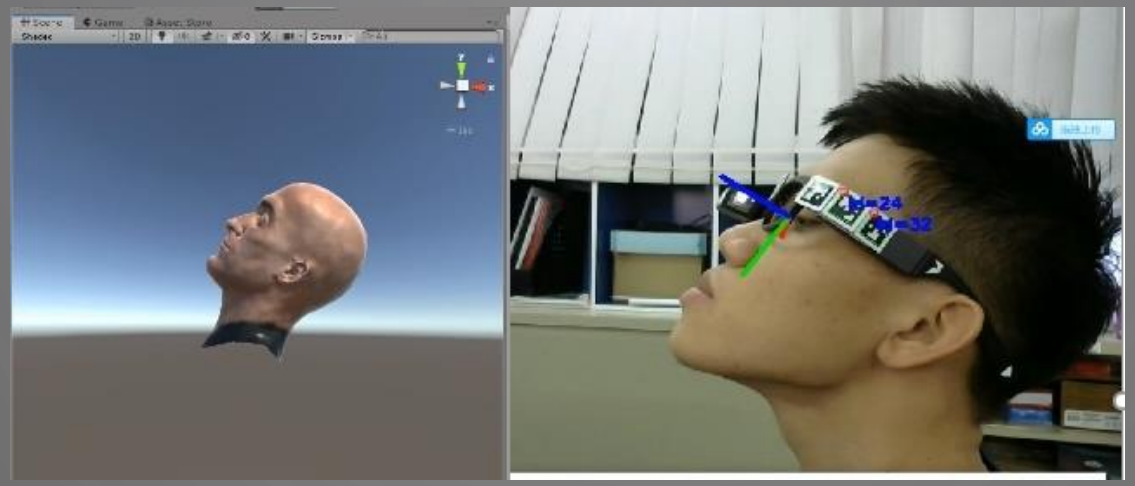
SMART BUILDING – PILOT TRAINING SYSTEM (HEAD POSE ESTIMATION)

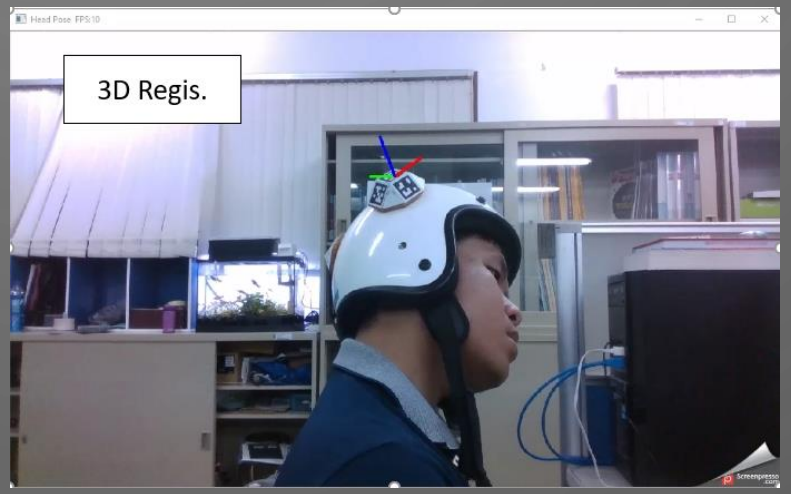
- Goal :
  - Estimate head position and rotation using code/marker based localization



- Challenges :
  - High refresh rate estimation
  - Multi-cameras data fusion
  - Wide range operation of human head

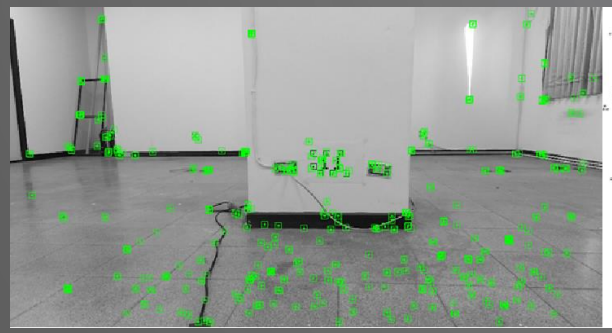
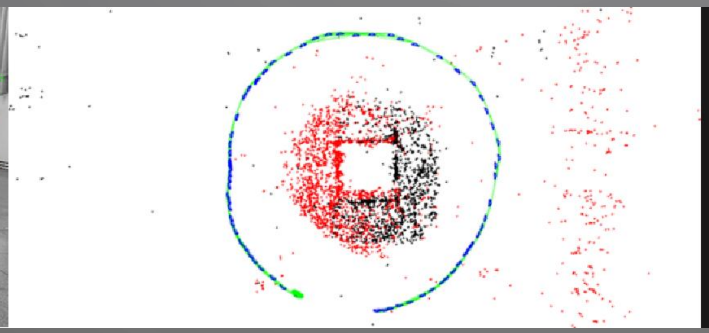
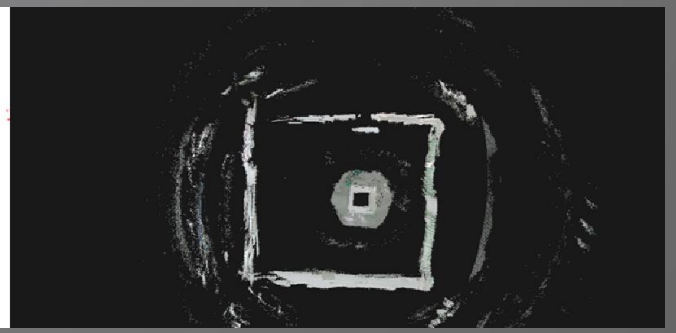
- Result:

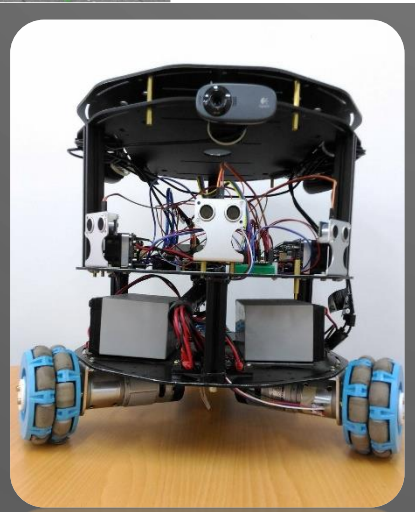




SMART ROBOT – CLEANING ROBOT

- Goal :
  - Simultaneous Localization and Mapping (SLAM)
    - Automatically build a 3D map of the mobile robot's surroundings.
    - Simultaneously localize the robot.

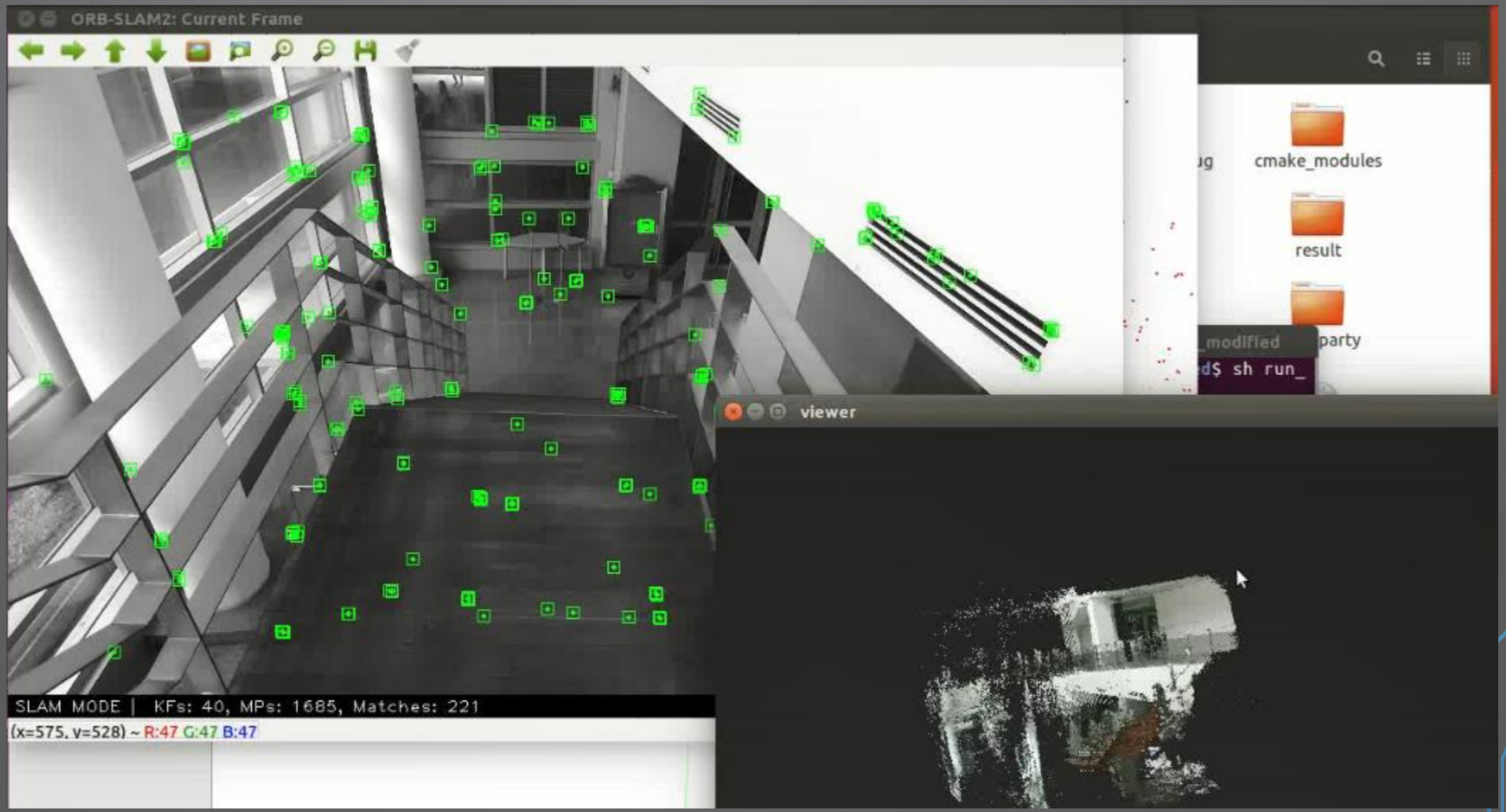




Project Name：探討全景攝影機於掃地機器人自主同時定位與圖資建立之研究
(MOST 104-2622-E-194 -011 -CC3)
Project Period : 2015/11/01 ~ 2016/10/31
Cooperation Vendors ：行政院科技部、恆準定位股份有限公司

- Challenges :
  - Quickly extract the landmarks and build 3D map
  - Quickly estimate robot location

- Result:


ORB-SLAM2: Current Frame
cmake_modules
result
party
modified
$ sh run_
viewer
SLAM MODE | KFs: 40, MPs: 1685, Matches: 221
(x=575, y=528) ~ R:47 G:47 B:47

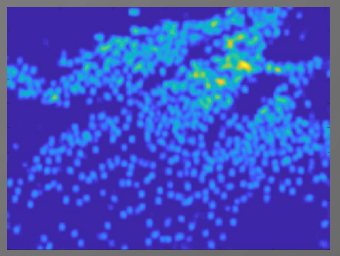
SMART ROBOT – UAV BASED DENSITY ESTIMATION

- Goal :
  - Given the crowd image, we build the Deep Learning model to estimate the crowd density map and count number of people.

Crowd images

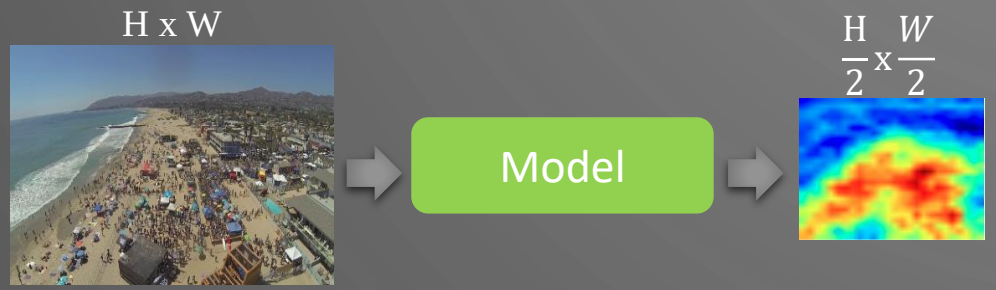
Deep Learning Model

Full-resolution density map and crowd counting



Number of people = 1095 individuals

- Challenges :
  - The significant scale variation in highly congested crowd
  - The estimated density map has low resolution

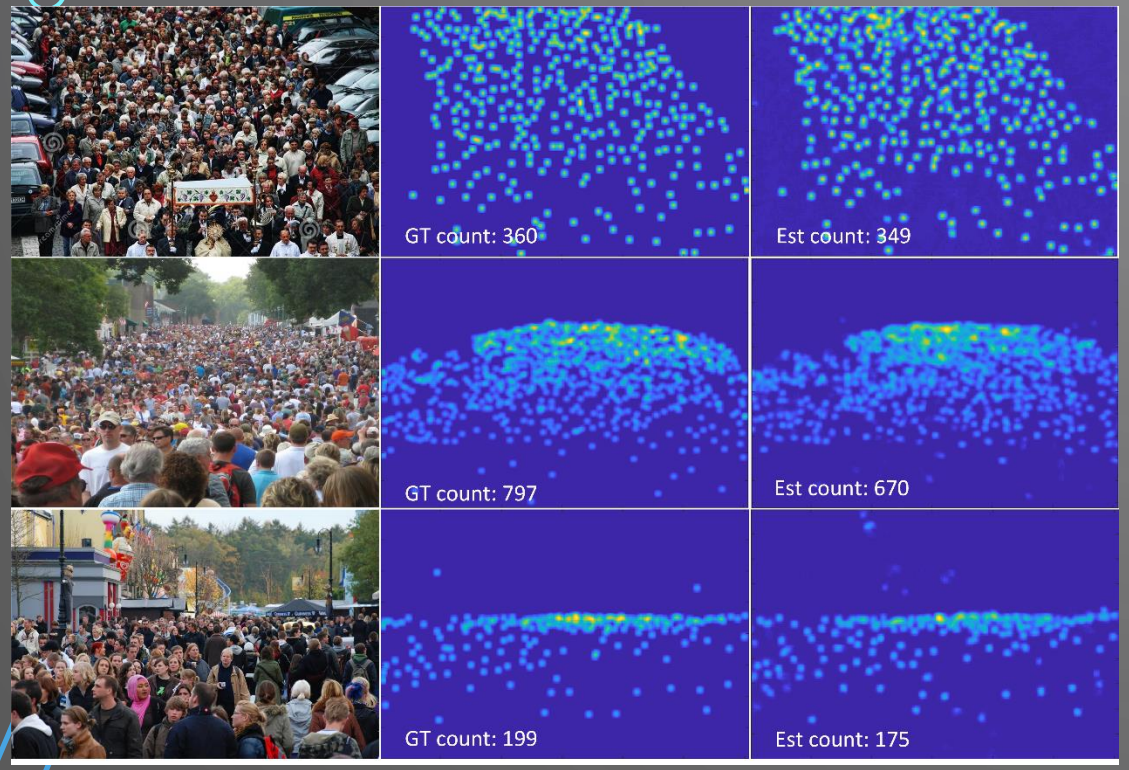


Example of low-resolution density map

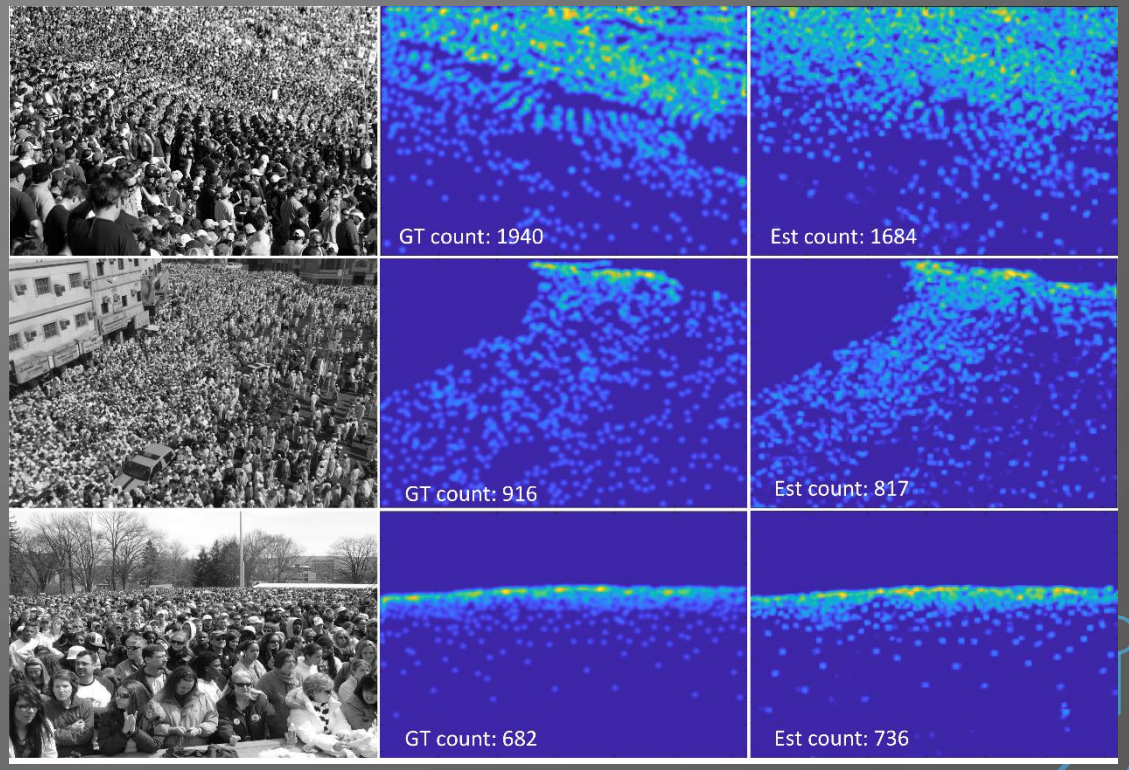
Examples of high crowd density

- Result:

The illustration on ShanghaiTech dataset



The illustration on UCF_CC_50 dataset



- Publication:
  - Van-Su Huynh, Vu-Hoang Tran, and Ching-Chun Huang, "IUMI: Inception U-net Based Multi-task Learning For Density Level Classification And Crowd Density Estimation", IEEE International Conference on Systems, Man, and Cybernetics (SMC), 2019.
  - Van-Su Huynh, Vu-Hoang Tran and Ching-Chun Huang , "DaNet: Depth-aware Network For Crowd Counting", 2019 IEEE International Conference on Image Processing(ICIP), Sept. 2019.

LIST OF PROJECTS

序號	計畫名稱	執行時間	職務	補助機關
1	自駕車之深度學習智能感知與情境理解系統技術	2018/12/01 ~ 2021/07/31	共同主持人	行政院科技部
2	應用於高性能戰機模擬器之三維頭部姿態即時定位系統	2019/02/01 ~ 2019/11/31	主持人	中山科學研究院
3	應用多樣性環境感測大數據於智慧建築管理	2019/03/01 ~ 2023/01/31	主持人	教育部(建築研究所)
4	機器學習於建築溫度環境感測大數據分析應用之研究	2019/01/01 ~ 2019/12/31	主持人	內政部(建築研究所)
5	基於生成模型的視訊壓縮	2018/01/01~ 2021/12/31	共同主持人	行政院科技部
6	機器手臂之Eye-in-hand 智慧視覺技術開發與應用	2018/03/01 ~ 2018/10/31	共同主持人	中部科學工業區
7	基於深度學習之物聯網大數據分析	2018/01/01 ~ 2018/12/31	主持人	台灣積體電路製造股份有限公司
8	智慧制空飛行無人機:基地台通訊計網路技術	2018/01/01 ~ 2018/12/31	共同主持人	行政院科技部
9	建立仿真實紋理的肝臟三維模型並實現網路架構下的擴增實境應用	2018/01/01 ~ 2018/08/31	主持人	行政院科技部
10	複雜背景下融合多深度攝影機的士兵骨架辨識系統	2017/01/01 ~ 2017/08/31	技術開發	中山科學研究院
11	基於深度學習、異質資訊整合、與轉換學習之通用型停車場管理系統	2017/08/01 ~ 2020/07/31	主持人	行政院科技部
12	自動駕駛車輛之深度學習行駛系統	2016/08/01 ~ 2017/10/31	共同主持人	行政院科技部、清華大學
13	影像式戶外停車空位在席偵測系統	2016/11/01 ~ 2017/10/31	主持人	行政院科技部、歐特儀股份有限公司
14	標記式內視鏡微創手術器械三維姿態定位研究	2016/08/01 ~ 2017/07/31	主持人	行政院科技部
15	大腸鏡影像之三維腫瘤重建技術	2015/08/01 ~ 2017/07/31	主持人	行政院科技部
16	應用無線訊號於健康照護之室內人物追蹤研究	2015/08/01 ~ 2017/07/31	主持人	行政院科技部
17	具互動功能之穿戴式行動學習系統(1/2~2/2) (群體型)	2015/08/01 ~ 2017/07/31	共同主持人	行政院科技部

LIST OF PROJECTS

序號	計畫名稱	執行時間	職務	補助機關
18	探討全景攝影機於掃地機器人自主同時定位與圖資建立之研究	2015/11/01 ~ 2016/10/31	主持人	行政院科技部、恆準定位股份有限公司
19	考量裝置差異性下提升無線訊號室內定位準確度之研究	2014/11/01 ~ 2015/10/31	主持人	行政院科技部、恆準定位股份有限公司
20	停車場空位管理系統	2013/01/01 ~ 2013/06/30	技術委託	台彩科技
21	適應性壓縮式感測取樣於感知無線電網路之研究	2012/08/01 ~ 2013/7/31	主持人	行政院科技部
22	應用於無人飛行監控器之影像式定位技術	2011/09/01 ~ 2011/12/15	主持人	工業技術研究院

OUTLINE

- Introduction of ACM Lab
- Research Topics
- Introduction of Projects
- List of Projects
- International Laboratory Co-operation

INTERNATIONAL LABORATORY CO-OPERATION

- Internship program. (Co-advising)
  - Duration : 3 – 6 months
  - Number of applicants: 2-10 persons/year
  - Participants: senior undergraduate student, master student
- Master/PhD program. (Co-advising)
  - Number of applicants: 2 – 3 persons/year
- Visiting program.
  - Duration : 3 – 6 months
  - Number of applicants: 2 – 3 persons/year
  - Participants: Lecturer

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