Tzu-Yin Chao

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Research Interests

I'm broadly interested in diverse machine learning topics, including learning from imperfect data, decision-making, multi-media applications, and multi-modal matching problems. My goal is to develop machine learning systems that can operate reliably and unbiasedly even under challenging conditions. Along with the research directions, I am interested in and have conducted researches on zero-shot learning, reinforcement-learning, and intelligent-building-related real-world applications.

Education

National Chung Cheng University — **Chiayi, Taiwan**
M.S. of Electrical Engineering — *Feb. 2018 – Jan. 2020*
- Thesis: Online Self-learning for Smart HVAC Control

National Chung Cheng University — **Chiayi, Taiwan**
B.S. of Electrical Engineering — *Sep. 2013 – Jun. 2017*

Publications

- **Make an Omelette with Breaking Eggs: Zero-Shot Learning for Novel Attribute Synthesis** | Paper |
  Yu Hsuan Li*, *Tzu-Yin Chao**, *Ching-Chun Huang, Pin-Yu Chen, Wei-Chen Chiu*
  [Submitted to CVPR'22]
  - Derived zero-shot learning for attribute detectors for annotating attribute labels for the dataset automatically to reduce the expensive manual cost.
  - Various generalized zero-shot classification algorithm trained using our annotated dataset can achieve comparable or even better performance compared with that trained using manual annotations.

- **Vacant Parking Space Detection based on Task Consistency and Reinforcement Learning** | Paper |
  Manh-Hung Nguyen, Tzu-Yin Chao, Ching-Chun Huang
  [ICPR'20, poster]
  - Utilized an existing source task model to guide the training process of the vacant-space detector (target task model) in a new parking lot via reinforcement learning.
  - Devising a novel training scheme that is both source domain data-free and target domain label-free, i.e., it only requires the source task model.

- **Online self-learning for smart HVAC control** | Paper |
  Tzu-Yin Chao, Manh-Hung Nguyen, Ching-Chun Huang, Chien-Cheng Liang, Chen-Wu Chung
  [SMC'19 (IEEE International Conference on Systems, Man and Cybernetics), oral presentation]
  - Adjusted parameters of the HVAC system to stabilize the temperature of a large office in real-world buildings by the model predictive control system with a dynamic learning environment model.
  - The system can start up with rare and biased data while keeping the setting stable during its exploration in the early stage.

Projects

- **Transferable and Fast Adaptive Agent for HVAC Control**
  [Partnership] *Taiwan Semiconductor Manufacturing Company, Ltd. (TSMC)*
  [Status] *In progress.*
  [Goal] To transfer an existing well-performing HVAC (large air conditioning) control agent to another building with a different sensor deployment (i.e., different types and numbers of sensors) and lack of data.

- **Low-Cost Setup for Learning-Based Vacant Parking Space Detection Model**
  [Status] *Applied in National Yang Ming Chiao Tung University, Hsinchu, Taiwan.*
  [Publication] *"Vacant Parking Space Detection based on Task Consistency and Reinforcement Learning", ICPR'20*
  [Patent] *TW Patent Pending 110129963*
  [Goal] To develop a mechanism for training a vacant parking space detection model in a new parking lot without manually annotating or storing data from another parking lot for transfer learning.

- **Human Occupancy Estimation for Smart Building Management**

[Partnership] *Taiwan Semiconductor Manufacturing Company, Ltd.* (*TSMC*)
[Status] *Applied in TSMC*
[Award] *Gold Award* (*Against the competitors from industry, including ASUS Inc.*), 13^{th} *Intelligent Living Space Design Competition, Taiwan.*
[Goal] To infer the occupancy based on multiple non-image-based sensor values as the indicator for decision-making in building equipment control.

- **Intelligent Control for HVAC**
  [Partnership] *Taiwan Semiconductor Manufacturing Company, Ltd.* (*TSMC*)
  [Status] *Applied in TSMC.*
  [Publication] *"Online self-learning for smart HVAC control", SMC'19 oral*
  [Patent] *TW Patent I746087*
  [Award] *Silver Award* (*Against the competitors from industry, including ASUS Inc.*), 11^{th} *Intelligent Living Space Design Competition, Taiwan.*
  [Goal] To accurately stabilize the temperature in a large-scale office at the user's expected by automatically adjusting the control parameter of HVAC in a building with rare and biased data.

Teaching Experiences

Teaching Assistant, National Chung Cheng University — **Chiayi, Taiwan**
Introduction to Computer Science — *2019 Spring*

Teaching Assistant, National Chung Cheng University — **Chiayi, Taiwan**
Machine Learning — *2018 Fall*

Working Experiences

Applied Computing and Multimedia Lab., National Yang Ming Chiao Tung University — **Hsinchu, Taiwan**
Research Assistant — *Mar. 2020 -*

- Advisor: Professor Ching-Chun Huang.
- Co-advisors: Professor Wei-Chen Chiu and MIT-IBM Watson AI Lab Researcher Pin-Yu Chen.
- Initiated research projects on zero-shot learning.
- Led a seven-people group to devise machine learning solutions for real-world smart building applications.

Awoo Inc. — **Chiayi, Taiwan**
Student Intern — *Apr. 2017 - Jul. 2017*

- Handled backend development for websites.

Patents

- **HVAC control method - TW Patent I746087** — *Nov. 2021*
- **Vacant parking space detection method and system - TW Patent Pending 110129963** — *Aug. 2021*

Awards

- **Gold Award** (**Against the competitors from industry, including ASUS Inc.**), 13^{th} Intelligent Living Space Design Competition, Taiwan. — *Nov. 2020*
- **Silver Award** (**Against the competitors from industry, including ASUS Inc.**), 11^{th} Intelligent Living Space Design Competition, Taiwan. — *Nov. 2018*

Skills

- **Python: Proficient** (PyTorch, TensorFlow, Keras)
- **C: Proficient**
- **Matlab: Basic**
- **JAVA: Basic**
- **PHP: Basic**