Tzu-Yin Chao

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Research Interests

I'm broadly interested in machine learning for control and multimedia applications. My goal is to develop machine learning systems that can learn from few data but operate reliably and unbiased 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 (CCU)   **Chiayi, Taiwan**
M.S. of Electrical Engineering   *Feb. 2018 – Jan. 2020*
- Thesis: Online Self-learning for Smart HVAC Control

National Chung Cheng University (CCU)   **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**
Tzu-Yin Chao*, Yu Hsuan Li*, Ching-Chun Huang, Pin-Yu Chen, Wei-Chen Chiu
[Submitted to CVPR'22]
- We derive zero-shot learning for attribute detectors and use them to automatically annotate the dataset.
- The given annotations are from a human-like perspective as that in 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]
- We utilize 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.
- The training process is both source domain data-free and target domain label-free, which requires the source task model only.

○ **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]
- We adjust 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]
- 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 (The 1st real-world application project, against the competitors from industry, including ACER Inc.), in the 13th 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 (The 2nd real-world application project, against the competitors from industry, including ACER Inc.), in the 11th 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 (CCU) **Chiayi, Taiwan**
Introduction to Computer Science *2019 Spring*

Teaching Assistant, National Chung Cheng University (CCU) **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.
○ Investing in research for zero-shot learning and meta-learning.
○ Leading a 7-people-group to research and develop machine learning applications for smart building.

Awoo Inc. **Chiayi, Taiwan**
Student intern *Apr. 2017 - Jul. 2017*
○ Backend development for websites.

Patents

○ **HVAC control method (co-inventor) - TW Patent I746087** *Nov. 2021*
○ **Vacant parking space detection method and system (co-inventor) - TW Patent Pending 110129963** *Aug. 2021*

Awards

○ **Gold Award (The 1st real-world application project, against the competitors from industry, including ACER Inc.)**, in the 13th Intelligent Living Space Design Competition, Taiwan. *Nov. 2020*
○ **Silver Award (The 2nd real-world application project, against the competitors from industry, including ACER Inc.)**, in the 11th Intelligent Living Space Design Competition, Taiwan. *Nov. 2018*

Skills

○ **Python: Familiar** (PyTorch, TensorFlow, Keras)
○ **C: Familiar**
○ **Matlab: Fair**
○ **JAVA: Basic**
○ **PHP: Basic**