Tzu-Yin Chao

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Research Interests My recent research directions are **zero-shot learning, meta-learning,** and **smart building related applications.** Previous projects make me desire to investigate deeper to machine learning algorithms for processing different types of input data (especially cross-domain data matching and applications with multiple types of data input), as well as few-shot/zero-shot learning algorithms.

Education

- **M.S.**, Dept. of *Electrical Engineering*, National Chung Cheng University *Feb. 2018 – Jan. 2020*
- **B.S.**, Dept. of *Electrical Engineering*, National Chung Cheng University *Sep. 2013 – June. 2017*

Publications

- ***Make an Omelette with Breaking Eggs: Zero-Shot Learning for Novel Attribute Synthesis***
  - In Submission 2021.
  - **Tzu-Yin Chao***, Yu Hsuan Li*, Ching-Chun Huang, Pin-Yu Chen, Wei-Chen Chiu
  (* The authors contributed equally to this work)
    - To reduce the manual cost during producing an attribute dataset, we propose to synthesis novel attribute detectors for automatically annotating instance-level attribute labels for datasets, by learning to apply human perception in a zero-shot learning manner.

- ***Vacant Parking Space Detection based on Task Consistency and Reinforcement Learning***
  - Published in 2020 ICPR (IEEE International Conference on Pattern Recognition).
  - Manh-Hung Nguyen, **Tzu-Yin Chao**, Ching-Chun Huang
    - Given relations of the source and the target task, our proposed framework allows guiding the target task model (e.g., a trained vacant-space detector) by the existing source task model (e.g., a car motion classifier) via reinforcement learning.
    - We also provide a trick to deal with the noisy guiding signal generated by the imperfect source task model during training.

- ***Online self-learning for smart HVAC control***
  - Oral paper in 2019 SMC (IEEE International Conference on Systems, Man and Cybernetics).
  - **Tzu-Yin Chao**, Manh-Hung Nguyen, Ching-Chun Huang, Chien-Cheng Liang, Chen-Wu Chung
    - We propose a model predictive control system with a dynamic learning environment model to adjust the set point of the HVAC system for stabilizing the temperature of a large office in **real-world** buildings.
    - Our proposed 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*** *(Mar. 2020 – now)*
  **This work is now in progress.*
  - Partnership: Taiwan Semiconductor Manufacturing Company, Ltd. (TSMC)
  - Goal: The target is to improve the transferability and convergence speed of our previous work done in 2018 for controlling the HVAC system to allow fast deployment in different buildings. Our team is devoted to solving these issues in this project.

- ***Low-cost Setup for Learning-based Vacant Parking Space Detection*** **(***Nov. 2019 – Sep. 2020)*
  **The related paper was accepted by the 2020 IEEE International Conference on Pattern Recognition (ICPR).*
  **This work has been applied in a parking lot of NYCU*
  - Goal: Conventional transfer learning requires to access the source data as well as the pre-collected data from the target domain; besides, it fails to apply new data collected data for training after the deployment.

Thus, the target of this project is to develop a vacant space detection system which can start with low labeling costs, avoid to store the heavy source dataset, and progress through time.

- ***Human occupancy estimation for smart building management (****Mar. 2019 – Jul. 2020)*
  **This work has been applied in building 15B, Taiwan Semiconductor Manufacturing Company, Ltd.*
  ** This work won the Golden Award in 2020 Intelligent Living Space Design Competition, Taiwan.*
  - Partnership: Taiwan Semiconductor Manufacturing Company, Ltd. (TSMC)
  - Goal: The target is to estimate occupancy by real-time sensor values as an indicator for switching smart buildings to different control modes. In this project, on image-based sensors are available; besides, the only limited labeled peak samples are provided (i.e., only a few samples are annotated to be either "fully occupied" or "no people").

- ***Intelligent Control for HVAC*** *(Mar. 2018 – Jul. 2018)*
  **This work has been applied in building 15A and 12P7, Taiwan Semiconductor Manufacturing Company, Ltd.*
  ** The naïve version of this work was accepted by the 2019 IEEE SMC as an oral paper.*
  ** The design obtains a patent in Taiwan.*
  ** This work won the Silver Award in 2018 Intelligent Living Space Design Competition, Taiwan.*
  - **Partnership:** Taiwan Semiconductor Manufacturing Company, Ltd. (TSMC)
  - **Goal:** The target of this project is to design a data-driven control system to keep the temperature of a large office stabilized at the user's expectation value by adjusting the settings of HVAC. The system is required to **start with limited and biased data** but **perform stable control quality in the early stage**.

Teaching Experience

- ***Teaching Assistant***, Introduction to Computer Science *2019 Spring.*
  Dept. of Electrical Engineering, National Chung Cheng University (CCU)
- ***Teaching Assistant***, Machine Learning *2018 Fall.*
  Dept. of Electrical Engineering, National Chung Cheng University (CCU)

Working Experience

- ***Research Assistant****, dept. of Computer Science, National Yang Ming Chiao Tung University (NYCU)*
  Mar. 2020 – Now.
  Advisor: Ching-Chun Huang (NYCU)
  Co-advisors: Wei-Chen Chiu (NYCU), Pin-Yu Chen (IBM research)
  - Academicals research on deep learning field, related to zero-shot learning and meta-learning.
  - Leader of a 7 people group for developing machine learning applications for smart building.
- ***Student intern****, Awoo inc.* *Apr. 2017 – Jul. 2017.*
  - Working on the backend design for the website.

Awards

- ***Gold Award in 2020 Intelligent Living Space Design Competition****, hold by Architecture and Building Research Institute, Ministry of the Interior, Taiwan.* *Nov. 2020.*
- ***Silver Award in 2018 Intelligent Living Space Design Competition.****, hold by Architecture and Building Research Institute, Ministry of the Interior, Taiwan.* *Nov. 2018.*

Skills

- ***Python*** *(Pytorch, Tensorflow)* **, C, Matlab, PHP.**