Jiayi "Jerry" Su

1637 W Wisconsin Ave, Milwaukee, WI 53233
Current visa status: F-1

Email: jerry.su@marquette.edu
Website: jiayisu.com
Github: github.com/jerichosu

Education

- **Marquette University** — Milwauke, USA
  Doctor of Philosophy - Electrical and Computer Engineering — *May 2018 - Present*
- **Marquette University** — Milwauke, USA
  Master of Science - Electrical and Computer Engineering — *August 2016 - May 2018*

  Thesis: *Sensor Intrusion Detection in Control Systems Using Estimation Theory*

SUMMARY

- A fourth-year Ph.D. student working in the area of state/parameter estimation theory, deep learning based computer vision and its applications.
- **Computer vision & Deep Learning**:
  • 3 years of academic experience in image classification, object detection, multi-object tracking and human activities recognition using state-of-the-art deep learning and state estimation techniques.
  • Basic knowledge in medical image reconstruction using filtered back projection and iterative method.
- **State & Parameter Estimation**:
  • Over 5 years of research experience in state estimation and parameter identification using Kalman filter (and its variants like EKF, SPKF) based techniques.
  • Deep understanding in estimating State-of-Charge (SOC) and State-of-Health (SOH) of Lithium-ion cells using Kalman filter based methods.

Academic Project & Experience

- **Multi-Target Tracking (Computer Vision & State Estimation)** — Milwaukee
  NSF Project — *Dec 2021 - Present*
  - Developed a robust online multi-object tracking (MOT) algorithm. Tracking accuracy outperformed state-of-the-art on several benchmarks. Demo
  - Implemented an online multi-object tracking (MOT) algorithm to track pedestrians detected by CNN based object detectors. Could track pedestrians' position with intermittent sensor measurements. Demo
- **Human Actions Detection (Deep Learning & Computer Vision)** — Milwaukee
  NSF Project — *May 2020 - Present*
  - Implemented a 3D Convolutional Neural Network (3D-CNN) to detect pedestrian abnormal behaviors from surveillance videos. Results outperformed state of the art on several surveillance video datasets. Demo
  - Developed a two-stream (RGB+flow) based 3D-CNN to detect abnormal behaviors from videos using Pytorch, achieved state of the art performance on several violence video datasets. Demo
  - Used Raj, a High Performance Cluster (HPC) at Marquette University, and Horovod, a distributed training framework, to speed up the training process. Used Ray Tune for hyperparameter tuning.
- **Lithium-ion Cells SOC and SOH Estimation (State & Parameter Estimation)** — Milwaukee
  Research Project — *May 2019 - Present*
  - Developed an online SOC estimation algorithm for LiFePO4 cells using Multiple Model Adaptive Estimation (MMAE) technique. Brought faster ($\sim 30\%$) speed convergence and smaller ($\sim 25\%$) estimation error compared to EKF under the same initial state estimates and error covariance. Could still converge fast even if initial conditions are poor. ACC 2021
  - Reduced the computation cost and the quantization error of MMAE approach by combining MMAE and EKF together, while still achieved higher ($\sim 2\%$) estimation accuracy compared to MMAE alone. ECC 2021
  - Came up with a simultaneous SOC and cell capacity estimation technique using MMAE approach. Achieved faster speed convergence and smaller estimation error compared to Joint and Dual estimation technique under the same initial set up. CCTA 2022 (Accepted)

- **Sensor and Actuator Intrusions Detection (State Estimation)** Milwaukee
  Research Project *August 2017 - Dec 2018*
  - Developed a bank of Kalman filters based Multi-Model technique to detect either sensor or actuator intrusions on Cyber-Physical Systems when it is under attack by unknown type of signals. DSCC 2020
  - Implemented a fading memory (exponential data weighting) technique that can speed up the convergence of the Kalman filter, applied on Multi-Model detection technique to reduce the intrusion detection time delay. CDSR 2020

Publications

- **J. Su**, S. Schneider and E. Yaz, "Robust Online Multi-Object Tracking with improved motion model and selective data weighting," (Under review).
- E. Clemens, **J. Su**, P. Her, H. Medeiros, E. Yaz, S. Schneider, "Empirical Assessment of Transfer Learning for Violence Detection in Videos," (Under review).
- **J. Su**, S. Schneider, E. Yaz and F. Josse, "Simultaneous State of Charge and Total Capacity Estimation of Lithium-ion Cells Using Multiple Model Adaptive Estimation," Conference on Control Technology and Applications (CCTA), 2022 (Accepted).
- **J. Su**, S. Schneider, E. Yaz and F. Josse, "Online State of Charge Estimation of Lithium-ion Battery Cells: A Multiple Model Adaptive Estimation Approach," American Control Conference (ACC), 2021, pp. 4447-4452.
- **J. Su**, A. Strandt, S. Schneider, E. Yaz and F. Josse, "Improved State of Charge Estimation of Lithium-ion Battery cells," European Control Conference (ECC), 2021, pp. 1645-1650.
- **J. Su**, Y. Weng, S. Schneider and E. Yaz. "Sensor and Actuator Intrusion Detection for Cyber-Physical Systems via Adaptive Estimation Algorithm." Dynamic Systems and Control Conference (DSCC), vol. 84287, p. V002T33A002. American Society of Mechanical Engineers, 2020.
- **J. Su**, Y. Weng, S. Schneider and E. Yaz. "Accelerated Detection Method for Sensor and Actuator Intrusions in Cyber-Physical Systems Using Multiple Model Estimation Algorithm," Proc. of 7th Int. Conf. on Control, Dynamic Systems and Robotics (CDSR), 2020

Service & Activities

- **Reviewer**:
  IEEE conference on Decision and Control (2020, 2021, 2022)
  IFAC World Congress (2020)
- **Teaching Assistant**:
  EECE 1610: Introduction to Computer Programming (Fall 2018, Spring 2019)
  EECE 2010 Electric Circuits 1 (Fall 2018)
  EECE 2015 Circuits Laboratory 1 & 2 (Fall 2018, 2019, 2020, Spring 2019)
  ELEN 2040 Engineering Systems (Fall 2019, 2020)
  ELEN 3020 Linear Systems Analysis (Spring 2019, 2020)
  EECE 5310 Control Systems (Graduate level class, Fall 2020)
  EECE 5320 Digital Control Systems (Graduate level class, Spring 2019, 2020)
  EECE 5510 Digital Signal Processing (Graduate level class, Fall 2019, 2020)
  EECE 6020 Probability and Random Processes in Engineering (Graduate level class, Spring 2020)

Skills Summary

- **Programming Languages**: Python, C++, MATLAB/Simulink, Octave, R, HTML/CSS
- **Frameworks**: Pytorch, Keras, OpenCV, Scikit-learn, Ray Tune, Horovod
- **Tools**: Git, LaTeX, Markdown, Bash
- **Platforms**: Linux, HPC
- **High Performance Computing**: Slurm
- **Languages**: English (Full professional proficiency), Chinese (Native)