Tianchen Ji

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Research interest: Robot Perception; Sensor Fusion; Machine Learning; Motion Tracking; Safe Autonomy

EDUCATION

Ph.D., University of Illinois at Urbana-Champaign   2019–2024
Electrical and Computer Engineering, Advisor: Katherine Driggs-Campbell

B.S., Xi'an Jiaotong University   2015–2019
Electrical Engineering, GPA: 92.7/100

Visiting Student, University of California, Berkeley   2017–2018
Electrical Engineering and Computer Sciences, GPA: 3.95/4.00

SELECTED PUBLICATIONS

1. **An Attentional Recurrent Neural Network for Occlusion-Aware Proactive Anomaly Detection in Field Robot Navigation**
   Andre Schreiber, **Tianchen Ji**, D. Livingston McPherson, Katherine Driggs-Campbell
   IEEE/RSJ International Conference on Intelligent Robots and Systems (**IROS**), 2023.

2. **Structural Attention-based Recurrent Variational Autoencoder for Highway Vehicle Anomaly Detection**
   Neeloy Chakraborty, Aamir Hasan*, Shuijing Liu*, **Tianchen Ji***, Weihang Liang, D. Livingston McPherson, Katherine Driggs-Campbell
   International Conference on Autonomous Agents and Multiagent Systems (**AAMAS**), 2023.

3. **Proactive Anomaly Detection for Robot Navigation with Multi-Sensor Fusion**
   Tianchen Ji, Arun Narenthiran Sivakumar, Girish Chowdhary, Katherine Driggs-Campbell
   IEEE Robotics and Automation Letters (**RA-L**), 2022.

4. **Traversing Supervisor Problem: An Approximately Optimal Approach to Multi-Robot Assistance**
   Tianchen Ji, Roy Dong, Katherine Driggs-Campbell
   Robotics: Science and Systems (**RSS**), 2022.

5. **Robust Output Feedback MPC with Reduced Conservatism under Ellipsoidal Uncertainty**
   Tianchen Ji, Junyi Geng, Katherine Driggs-Campbell
   IEEE Conference on Decision and Control (**CDC**), 2022.

6. **Multi-Modal Anomaly Detection for Unstructured and Uncertain Environments**
   Tianchen Ji, Sri Theja Vuppala, Girish Chowdhary, Katherine Driggs-Campbell
   Conference on Robot Learning (**CoRL**), 2020.

7. **Online Monitoring for Safe Pedestrian-Vehicle Interactions**
   Peter Du, Zhe Huang*, Tianqi Liu*, **Tianchen Ji***, Ke Xu*, Qichao Gao*, Hussein Sibai, Katherine Driggs-Campbell, Sayan Mitra
   IEEE International Conference on Intelligent Transportation Systems (**ITSC**), 2020.

SELECTED RESEARCH PROJECTS

Deep Anomaly Detection for Robot Navigation   2020–Now

- Proposed a deep camera-lidar fusion approach for real time failure detection of mobile robots.
- Proposed a novel discriminative model for pattern recognition, termed Supervised Variational Autoencoder.
- Validated the effectiveness of the network in both offline dataset and online operation of field robots.
- The proposed network is able to predict future robot failures with higher accuracy than existing approaches in highly uncertain environments.

Multi-Robot Assistance in Uncertain Environments   2021–2022

  – Formulated the human supervision of a multi-robot system as a graph traversal problem.
  – Provided an approximately optimal solution to the assistance problem based on the traveling salesman problem.
  – The task completion time of the human-robot team decreased by $\sim 5\%$ compared to the baselines.

Online Monitoring for Safe Pedestrian-Vehicle Interactions   2019–2020

  – Designed a real time monitoring system to provide safety guarantees for autonomous vehicles among pedestrians.
  – Implemented the system in both simulation and real world on a Polaris Gem electric vehicle.

WORK EXPERIENCE

Meta   Redmond, WA
Research Scientist Intern   05/2023–12/2023

  – Designed and built a recurrent neural network for hand motion tracking on Meta Quest 3, which achieved more than 2X improvement over the heuristic-based Plan of Record in terms of the tracking accuracy.
  – Created and landed the machine learning pipeline, including dataset generation, model training, and evaluation.
  – Optimized and deployed the trained TorchScript model on VR headsets for real-time execution at 100 Hz.

SenseTime   San Jose, CA
Research Intern   05/2022–08/2022

  – Designed and built deep learning models for image enhancement in raw image pipelines.
  – Designed and built lightweight machine learning models based on RAISR with comparable image enhancement performance to deep neural networks on mobile devices.

Autowise.ai   Shanghai, China
Software Engineer Intern   06/2019–08/2019

  – Optimized and benchmarked the control module of autonomous vehicles, focusing on model predictive control.
  – The run time efficiency of the improved control module increased by 400% compared to the previous version.

TEACHING

- **Head Teaching Assistant** at University of Illinois at Urbana-Champaign   Spring 2022
  Principles of Safe Autonomy (ECE 484)
- **Teaching Assistant** at University of Illinois at Urbana-Champaign   Fall 2021
  Control System Theory and Design (ECE 515)

SKILLS

- **Languages:** Python, C++, Matlab, HTML, LaTeX
- **Packages & Tools:** PyTorch, OpenCV, NumPy, SciPy, Pandas, ROS, Gazebo, Git, WordPress

SERVICES

- **Journal and Conference Reviewer:** TNNLS, RA-L, ICRA, IROS, ITSC, IV, CDC
- **Web and Media Chair:** Coordinated Science Laboratory Student Conference (CSLSC), 2021

SELECTED AWARDS AND SCHOLARSHIPS

- Conference Presentation Award, University of Illinois at Urbana-Champaign   2020
- National Scholarship, Xi'an Jiaotong University   2016, 2017

SELECTED COURSES

Machine Perception, Learning-based Robotics, Meta-learning, Pattern Recognition, Computer Vision, IoT Algorithms, MDPs and Reinforcement Learning, Random Processes, Optimization, Control System Theory and Design