

# Ethan(Shurui) Zhang

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## EDUCATION

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### UNIVERSITY OF MICHIGAN

M.S., Computer Science and Engineering

Ann Arbor, MI

Sept. 2017 – Dec. 2020

Ph.D. Candidate, Next Generation Transportation Systems

Sept. 2017 – June 2022

- **Research Interests:** Machine learning, Deep learning, Autonomous vehicles, Data mining, Parallel computing

### SOUTHEAST UNIVERSITY

B.E., School of Transportation

Nanjing, China

Sept. 2013 – July 2017

## WORK EXPERIENCE

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### TUSIMPLE

San Diego, CA

Prediction Research Engineer Intern, Prediction Team

May 2021 – July 2021

- Proposed, designed and developed deep learning-based trajectory prediction algorithm at intersections for vehicles using Python, C++ and MXNet; The algorithm outperformed existing predictor at TuSimple and state-of-the-art; Evaluated the algorithm on large dataset collected by autonomous vehicle, especially edge-cases encountered by autonomous vehicles;
- Developed data pipelines using C++ and Python for data retrieval and processing on autonomous vehicles for prediction pipelines
- Collaborated with coworkers, improved and enriched prediction pipelines at TuSimple

## SELECTED PROJECTS

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*Learning-based predictive models and decision-making for autonomous vehicles, 2019-2021 (collaborate with DENSO Inc.)*

- Proposed a trajectory prediction algorithm based on RNN, CNN, and augmented attention mechanism; Developed with Python and Tensorflow, the proposed algorithm outperformed state-of-the-arts and had excellent real-world performance
- Proposed an algorithm for driving aggressiveness prediction; the proposed algorithm was based on unsupervised learning and capable of predict driving risk probability; the algorithm was first-of-its-kind to provide 10-sec probabilistic prediction on driving aggressiveness
- Designed a system for real-time risk driving prediction in connected vehicle environment; Developed integration and visualization pipelines for its deployment in real-world;
- Developed pipeline to process large real-time connected vehicle trajectory dataset with Python; Clustered trajectories into driving patterns
- Developed periodic model update pipeline between AWS and vehicles; the pipeline trains newest model on AWS and sends it to users
- Collaborated with industry companies; Deployed prediction algorithms in real-world systems in Michigan and Ohio

*GPS localization accuracy improvement using reinforcement learning, 2018*

- Proposed reinforcement learning-based algorithm to improve GPS accuracy; Developed with Python and Tensorflow; the work was based on A3C algorithm and reduced error by 50% compared to EKF
- Proposed a correction-based action space and confidence-based reward function to improve model performance

*Mobile robot inference and SLAM, 2018*

- Developed Bayesian models, EKF, PF and UKF algorithms for robot state inference with MATLAB; Tested in simulated environment
- Developed EKF-SLAM; Tested algorithm on Victoria park benchmark dataset

*Parallel computing on high performance computing clusters, 2018*

- Developed GPU-based parallel algorithms with CUDA; Developed OpenMP-based and MPT-based parallel computing algorithms with C++; Run and evaluate algorithms on GPU and CPU clusters at University of Michigan and at Pittsburgh super-computing center
- Proposed and developed a GPU-based parallel algorithm for mapping between large networks with CUDA; Achieved significant speedup

## PUBLICATIONS AND PATENT

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**Ethan Zhang**, Lei Wang et al., "SAPI: Surroundings-Aware Vehicle Trajectory Prediction at Intersections" (Preprint)

**Ethan Zhang**, Neda Masoud et al., "Step Attention: Sequential Pedestrian Trajectory Prediction" (Preprint)

**Ethan Zhang**, Neda Masoud et al., "Predicting Risky Driving in a Connected Vehicle Environment" (Preprint)

**Ethan Zhang**, Neda Masoud et al., "A Learning-Based Method for Predicting Heterogeneous Traffic Agent Trajectories: Implications for Transfer Learning" (Manuscript)

**Ethan Zhang**, Neda Masoud., "Increasing GPS Localization Accuracy with Reinforcement Learning"(Manuscript)

**Ethan Zhang**, Neda Masoud, "V2XSim: A V2X Simulator for Connected and Automated Vehicle Environment Simulation" (Manuscript)

**Ethan Zhang**, Neda Masoud et al., "Parallel Computing Algorithm for Real-time Mapping between Large-scale Networks" (Manuscript)

**Ethan Zhang**, Neda Masoud et al., System for Predicting Aggressive Driving. (Pending U.S. Patent)

## SKILLS

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**Programming:** Python, C/C++, CUDA, Matlab, SQL

**Tools:** Tensorflow, PyTorch, MXNet, scikit-learn, OpenCV, MPI, OpenMP, Git, LLVM, AWS, Gazebo, Linux