

Jiachen Li

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EDUCATION

University of California, Berkeley

Ph.D. in Robotics (Mechanical Engineering)

Mechanical Systems Control (MSC) Laboratory & Berkeley DeepDrive (BDD)

Academic advisor: Masayoshi Tomizuka

Berkeley, CA, USA

08/2016 - Present

Harbin Institute of Technology

B. Eng. in Automation (Honors School)

Research Institute of Intelligent Control and System

Harbin, China

08/2012 - 07/2016

WORK EXPERIENCE

Toyota Research Institute

Research Intern

Los Altos, CA, USA

06/2019 - Present

University of California, Berkeley

Graduate Student Researcher

Berkeley, CA, USA

08/2016 - Present

RESEARCH INTERESTS

Machine learning, artificial intelligence, optimization approaches and their applications to probabilistic behavior prediction, decision making and motion planning for intelligent systems such as autonomous vehicles and robotics.

RESEARCH AND PROJECTS

Interaction-Aware Probabilistic Behavior Prediction for On-Road Vehicles

08/2017 - Present

The research aims at recognizing driver behaviors and traffic situations as well as predicting future trajectories for multiple highly interactive agents jointly. The methodologies mainly cover probabilistic graphical models, deep learning, computer vision techniques and Bayesian theories.

- Proposed and implemented a generic hierarchical framework for interactive scene evolution prediction
- Proposed and implemented an adversarial learning framework for time-series prediction
- Proposed and implemented a generative neural system for multi-modal trajectory distribution learning
- Proposed and implemented a Deep Hidden Markov Model (DHMM) to recognize driver behaviors

Occluded Multi-Object Tracking and Motion Prediction

08/2017 - Present

The research aims at realizing accurate and robust tracking of surrounding traffic participants simultaneously in a uniform framework as well as handling partial or complete occlusions by incorporating learning-based behavioral models to make long-term motion prediction. The methodologies mainly covers sequential Monte Carlo, deep learning and probabilistic graphical models.

- Proposed and implemented a constrained mixture sequential Monte Carlo (CMSMC) approach
- Proposed and implemented a generic tracking and trajectory prediction framework based on CMSMC
- Enhanced tracking and prediction performance under occlusions by incorporating learning-based deep generative models

Solving Constrained Optimization Problems with Neural Networks

09/2016 - 07/2017

The research aimed at incorporating soft constraints into neural networks to solve nonlinear optimization problems. The proposed approach was used to obtain future trajectories of the ego vehicle.

- Developed Constrained Policy Net (CPN) to solve nonlinear constrained optimization
- Utilized CPN to generate safe and feasible ego vehicle motions

Decision Making via Deep Q-Net Based Inverse Reinforcement Learning

08/2017 - 12/2017

The project aimed at enabling the autonomous vehicles to learn to make optimal lane keeping and lane change behaviors in highway scenarios from expert demonstrations, which can generate collision-free, feasible and smooth trajectories. The methodologies mainly cover deep (inverse) reinforcement learning.

- Solved optimization problems to obtain optimal expert demonstrations
- Incorporated the deep Q-Network as the reinforcement learning step in IRL framework

A Novel Variable Selection Approach for Eliminating Redundant Information

07/2014 - 06/2016

The research aimed at proposing a novel variable selection approach based on modified partial least squares (PLS) regression, which is applied in process control to eliminate redundant information.

- Modified the canonical PLS regression and reduced the computational cost of the algorithm.
- Proposed a novel variable selection approach based on modified PLS regression.
- Applied the variable selection approach to a numerical and practical industrial process and tested the validation and efficiency of the method.
- Participated in the design of a variable selection aided residual generator.

COMPUTER SKILLS

- **Programming:** Python, C & C++, MATLAB/Simulink
- **Deep Learning Framework:** TensorFlow, PyTorch, Caffe
- **Design and Simulation:** ROS, Multisim, AutoCAD, OrCAD

PUBLICATION

- J. Li, W. Zhan, Y. Hu and M. Tomizuka, "Generic Tracking and Prediction Framework and Its Application in Autonomous Driving", *under review*.
- J. Li, H. Ma, and M. Tomizuka, "Conditional Generative Neural System for Probabilistic Trajectory Prediction", in *2019 IEEE Conference on Robotics and Systems (IROS)*, 2019.
- J. Li*, H. Ma* and M. Tomizuka, "Interaction-aware Multi-agent Tracking and Probabilistic Behavior Prediction via Adversarial Learning", in *2019 IEEE Conference on Robotics and Automation (ICRA)*, 2019.
- J. Li, H. Ma, W. Zhan and M. Tomizuka, "Coordination and Trajectory Prediction for Vehicle Interactions via Bayesian Generative Modeling", in *2019 IEEE Intelligent Vehicles Symposium (IV)*, 2019.
- H. Ma, J. Li, W. Zhan and M. Tomizuka, "Wasserstein Generative Learning with Kinematic Constraints for Probabilistic Interactive Driving Behavior Prediction", in *2019 IEEE Intelligent Vehicles Symposium (IV)*, 2019.
- J. Li, H. Ma, W. Zhan and M. Tomizuka, "Generic Probabilistic Interactive Situation Recognition and Prediction: From Virtual to Real", in *2018 IEEE International Conference on Intelligent Transportation Systems (ITSC)*, 2018.
- J. Li, W. Zhan and M. Tomizuka, "Generic Vehicle Tracking Framework Capable of Handling Occlusions Based on Modified Mixture Particle Filter", in *2018 IEEE Intelligent Vehicles Symposium (IV)*, 936-942, 2018.
- W. Zhan, L. Sun, Y. Hu, J. Li and M. Tomizuka, "Towards a Fatality-Aware Benchmark of Probabilistic

Reaction Prediction in Highly Interactive Driving Scenarios”, in *2018 IEEE International Conference on Intelligent Transportation Systems (ITSC)*, 2018.

- W. Zhan, J. Li, Y. Hu and M. Tomizuka, “Safe and Feasible Motion Generation for Autonomous Driving via Constrained Policy Net”, in *Industrial Electronics Society, IECON 2017-43rd Annual Conference of the IEEE*, 4588-4593, 2017.
- J. Li, C. Duan and Z. Fei, “A Novel Variable Selection Approach for Redundant Information Elimination Purpose of Process Control”, *IEEE Transactions on Industrial Electronics*, 63(3), 1737-1744, 2016.
- C. Duan, Z. Fei and J. Li, “A Variable Selection Aided Residual Generator Design Approach for Process Control and Monitoring”, *Neurocomputing*, 171, 1013-1020, 2016.
- S. Shi, Z. Fei and J. Li, “Finite-time Hinf Control of Switched Systems with Mode-dependent Average Dwell Time”, *Journal of the Franklin Institute*, 353(1), 221-234, 2016.

PROFESSIONAL EXPERIENCE

- Co-organizer of Workshop in *2019 IEEE Intelligent Vehicles Symposium (IV)* 2019
- Reviewer of *IEEE Transactions on Industrial Electronics* 2017 – Present
- Reviewer of *IEEE Transactions on Intelligent Transportation Systems* 2017 – Present
- Reviewer of *IEEE International Conference on Robotics and Automation (ICRA)* 2018 - Present
- Reviewer of *IEEE Intelligent Vehicles Symposium (IV)* 2018 - Present
- Reviewer of *IEEE Conference on Intelligent Transportation Systems (ITSC)* 2018 - Present
- Member of *IEEE Intelligent Transportation Systems Society (ITSS)* 2016 - Present
- Member of *IEEE Robotics and Automation Society (RAS)* 2016 - Present

AWARDS AND ACHIEVEMENTS

- Top Ten Outstanding Graduate, Harbin Institute of Technology 2016
- Meritorious Winner, Mathematical/Interdisciplinary Contest in Modeling 2015