Lejun Jiang

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EDUCATION

University of Pennsylvania (Penn) — Philadelphia, PA
Master of Science in Engineering, Robotics (GPA: 4.0/4.0) (projected) — May 2022
Coursework: Optimization Theory & Analysis; Machine Learning; Computer Vision; Learning in Robotics; Convex Optimization; Model Predictive Control

Shanghai Jiao Tong University (SJTU), (Dual Degree program with UMich) — Shanghai, China
Bachelor of Science in Engineering, Electrical and Computer Engineering (GPA: 3.8/4.0), Outstanding Graduates — Aug 2020
Coursework: Dynamics & Control of Connected Vehicles (Teaching Assistant); Solid Mechanics; Logic Design; Programming & Elementary Data Structures; Discrete Mathematics

University of Michigan (UMich), (Dual Degree program with SJTU) — Ann Arbor, MI
Bachelor of Science in Engineering, Mechanical Engineering (GPA: 4.0/4.0) w/ Minor in Electrical Engineering — May 2020
Coursework: Linear Systems Theory; Control System Analysis & Design; Dynamic System Modeling, Analysis & Control; Engineering Acoustics; Fluid Mechanics; Design & Manufacturing; Data Structures & Algorithms; Probability & Statistics

PUBLICATIONS

• **L. Jiang**, T. G. Molnar, G. Orosz. "On the Deployment of V2X Roadside Units for Traffic Prediction". Accepted by *Transportation Research Part C: Emerging Technologies*, 2021.
• S. Wong, **L. Jiang**, R. Walters, T. G. Molnar, G. Orosz, R. Yu. "Traffic Forecasting using Vehicle-to-Vehicle Communication". Proceedings of the *3rd Conference on Learning for Dynamics and Control*, PMLR 144:917-929, 2021.
• Y. Kim, **L. Jiang**, L. Munoz, J. Luntz, D. Brei, P. Alexander, W. Kim. "Fiber-Reinforced Inflatable Torsional Actuator Design with Performance-Enhancing Axial Tension". Presentation at *ASME 2019 Conference on Smart Materials, Adaptive Structures and Intelligent Systems*, in preparation for submission to *the ASME Journal of Mechanical Design*.

RESEARCH & WORK EXPERIENCE

Waymo, LLC. — Philadelphia, PA (Remote)
Intern, Behavior Planner, Prediction, & Controls - Roboticist/SWE — May 2021 – Present
• Developed software & algorithms for autonomous vehicles' onboard robust planning under uncertainty

Learning Robust Output Control Barrier Functions in CARLA Simulator — Philadelphia, PA
Group of Nikolai Matni — Apr 2021 - Present
• Modelled vehicle dynamics and created PID feedback controller for lane keeping that serves as safe expert demonstrations
• Interfaced with CARLA simulator for verification of learned Robust Output Control Barrier Functions

Multi-Vehicle Coordination for Overtaking Maneuvers of F1Tenth Autonomous Racing Cars — Philadelphia, PA
Real-Time and Embedded Systems Lab, implemented with Python (ZeroMQ, CVXPY, F1Tenth Gym) — Jan 2021 – May 2021
• Established scalable framework where central node generates coordinated overtaking maneuvers & communicates to each vehicle
• Combined RRT* path planning algorithm and minimum jerk trajectory smoothing for individual vehicles in shared occupancy grid
• Designed Mixed Integer Linear Program for time-optimal velocity tuning, observing vehicles' relative priority and hybrid dynamics

Traffic Prediction based on Vehicle-to-everything (V2X) Connectivity — Ann Arbor, MI
Group of Gabor Orosz — May 2019 – Aug 2020
• Developed Physics-Guided Deep Learning model for V2V traffic forecast with LSTM Recurrent Neural Network & Newell's model
• Established metrics to quantify amount of traffic prediction that roadside units (RSUs) can provide via V2I communication; developed optimal strategies for deploying RSUs along highways through evaluating proposed metrics numerically & analytically
• Modeled traffic flow with Markov Chain by establishing connection to continuum models; examined model through MATLAB simulations of single-lane traffic, attained robustness with 15% parameter variation tolerance

Characterization & Design Methodology of Inflatable Torsional Actuators — Ann Arbor, MI
Smart Materials and Structures Design Laboratory — Jan 2019 – May 2019
• Enhanced actuator's operation performance by quantifying and exploiting effect of applied axial tension
• Modeled actuator's performance against its design and operating parameters; based on model developed unprecedented systematic design methodology for actuator, including design space visualization and step-by-step design process

PROJECT EXPERIENCE

Minimum-Snap Trajectory Generation and Control for Quadrotors Philadelphia, PA
ESE 650: Learning in Robotics Apr 2021 – May 2021
• Planned trajectory of quadrotors in densely cluttered environments with A^* / Dijkstra's algorithm
• Formulated minimum snap trajectory smoothing algorithm with Quadratic Programming, and designed Constrained Gradient Descent solver to optimize travelling time for each segment of the trajectory
• Constructed dynamic model & developed Non-linear Geometric Controller for accurate control of quadrotors in Crazyflie simulator

Machine Learning Algorithm Development with Python Philadelphia, PA
Implemented with Python (Numpy, PyTorch, Scikit-learn) Sep 2020 – Dec 2020
• Developed and learned deep Q-Network for MountainCar in OpenAI Gym, achieved success rate of 95%
• Implemented YOLO algorithm to realize fast real-time multi object detection and semantic label classification
• Developed a Convolutional Neural Network (CNN) for the Fashion MNIST dataset with PyTorch, achieved 91% overall accuracy
• Trained Random Forest, Kernel SVM, MLP & Adaboost classifiers on MNIST digits dataset with Scikit-learn, reached 99.3% accuracy

Lane Detection for Autonomous Vehicles Philadelphia, PA
Implemented with Python (Numpy, Cupy, OpenCV) Sep 2020 – Dec 2020
• Established Straight Lane Detection algorithm based on Canny Edge Detection and Hough Transform
• Improved accuracy by Curved Lane Detection algorithm based on Sobel Filtering, Perspective Warping & Sliding Window Search
• Adopted Vanishing Point Guided Network (VPGNet) to further enhance lane detection accuracy

Creating Digital Twin Models for Tobacco Drying Processes Shanghai, China
Capstone Design, Facilitator May 2020 – Aug 2020
• Developed 2D and 3D Finite Element Analysis (FEA) models for the tobacco drying process based on four physics modules in COMSOL Multiphysics; achieved 9.45% accuracy error with final model

2020 SAE Aero Design Competition Lakeland, FL
M-Fly SAE and AUVSI Aerospace Design Team, Aerodynamics Lead Sep 2019 – May 2020
• Led aerodynamics design of high-lift plane through trade studies, which are based on evaluations & analysis of lift/drag performance and static/dynamic stability with XFOIL & AVL
• Reduced 30% of wingspan and 50% of takeoff distance by adopting bi-wing configuration

Glovebox Pressure Control System for Redox Flow Battery Ann Arbor, MI
Capstone Design, Sponsor Contact, Team Leader Jan 2020 - May 2020
• Created Gas Inflow/Outflow On/Off Control Algorithm, which achieved accuracy error within $\pm\, 0.1$ mbar
• Analytically modelled the glovebox system and simulated its behavior by MATLAB to validate design

Drone Delivery Simulation Ann Arbor, MI
Implemented with C++ Apr 2020
• Minimized cost of setting up beacons for fast drone by building Minimum Spanning Tree (MST) with Prim's algorithm
• Minimized total energy cost for regular drone to visit all desired locations and return back to original location by implementing Branch and Bound algorithm based on Traveling Salesperson Problem (TSP) insertion heuristics

Query Language Database Implementation Ann Arbor, MI
Implemented with C++ Mar 2020
• Created relational database with object-oriented design to handle query language commands (insert, delete, generate index, join, etc) efficiently

Stocks Market Implementation Ann Arbor, MI
Implemented with C++ Feb 2020
• Created implementation of stock market with object-oriented design and optimized its performance with priority queue
• Implemented priority queue with sorted array, binary heap and pairing heap; compared their performance against each other

Automatic Ball Collection Robot Ann Arbor, MI
Course Project, Team Leader Jan 2019 – May 2019
• Designed, modeled, simulated, and manufactured linkage system by SolidWorks and ADAMS
• Executed combined feedforward and PID feedback control algorithm using Arduino, achieved 97% accuracy for given task

Robotic Arm with Soft Robotics Shanghai, China
Course Project Feb 2018 – May 2018
• Designed and manufactured pneumatic silicone rubber gripper along with robotic arm based on Siemens NX that achieved high flexibility and efficiency for grabbing and transporting objects of different shapes and sizes
• Implemented remote control using PS2 wireless controller and Arduino microcontroller

9th SJTU Mechanical Innovation Competition for Freshmen Shanghai, China
Runner-up Apr 2017

- Designed and built robot with high efficiency of holding and transporting objects of different shapes to desired areas
- Implemented remote control using PS2 wireless controller and Arduino microcontroller
- Controlled robot on behalf of team to contest with 47 opponent teams and won the 2nd prize

TEACHING EXPERIENCE

"Dynamics & Control of Connected Vehicles"   Shanghai, China
Teaching Assistant   May 2020 – Aug 2020
- Managed MATLAB simulation codes for project and homework, including simulations of Adaptive or Connected Cruise Control, energy consumption, etc.
- Held office hours; Assisted instructor in class; Created rubrics for homework problems and graded 10 students' submissions

"Heat Transfer"   Ann Arbor, MI
Grader   Jan 2020 – May 2020

"Introduction to Solid Mechanics"   Ann Arbor, MI
Grader   Sep 2019 – Dec 2019

"Academic Writing II"   Shanghai, China
Teaching Assistant   Feb 2018 – May 2018
- Polished students' essays during office hours, collected and answered common questions to enhance communication

UM-SJTU JI Volunteer Teaching Group   Eryuan, Yunnan, China
Group leader   Dec 2017 – Jan 2018
- Planned, organized, and held various courses (Math, Science, English, Art, etc) and activities with local government and teachers to help local students, involving 4 primary schools and 1 vocational high school
- Led group to win title of "Outstanding Team of Aid Education" out of 4 volunteer teaching groups

AWARDS, SCHOLARSHIP & HONORS

Shanghai Jiao Tong University Outstanding Graduates   Shanghai Jiao Tong University
Overall outstanding performance in the undergraduate career   2020

Robert. M. Caddell Memorial Scholarship   University of Michigan
Study in the area of materials and/or manufacturing and made significant contributions to relevant student activities   2020

James B. Angell Scholar   University of Michigan
Achieve an "A" record for two or more consecutive terms   2020

University Honors   University of Michigan
Earned a 3.5 GPA or higher during the term   FA18, WI19, FA19, WI20

Dean's List   University of Michigan
Achieved high scholastic standing for the term   FA18, WI19, FA19

Volunteer Spirit Scholarship   Shanghai Jiao Tong University
Contribution to public welfare as a volunteer   2018

Undergraduate Excellent Scholarship   Shanghai Jiao Tong University
Overall outstanding performance during the year   2017, 2018

Dean's List   Shanghai Jiao Tong University
Achieved high scholastic standing for the term   FA16, SU17, FA17, SU18

Honorable Mention   Mathematical Contest in Modeling / Interdisciplinary Contest in Modeling
Honorable performance in the contest   2017

SKILLS

Programming Languages: C++, C, Python, MATLAB, Arduino, Verilog, LaTeX.
Development Tools & Software: PyTorch, Scikit-learn, OpenCV, CVXPY, MPT3, Protobuf, ROS, Github, Simulink, COMSOL, SolidWorks.