LI WANG

Senior Autopilot Controls Engineer at Tesla

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EDUCATION

Georgia Institute of Technology, Atlanta, GA	August 2014 - May 2018
Doctor of Philosophy in Department of Electrical & Computer Engineering	GPA: 4.00/4.00
Clemson University, Clemson, SC	July 2012 — May 2014
Master of Science in Department of Electrical & Computer Engineering	GPA: 4.00/4.00
Huazhong University of Sci. & Tech., Wuhan, China	July 2008 — June 2012
Bachelor of Science (with honor) in Department of Mechanical Engineering	GPA: 91.60/100 Ranking: 1/54

WORK EXPERIENCE

Senior Autopilot Controls Engineer, Tesla — May 2018 - Present
Project: Controller Design for Tesla Autopilot — *Manager: Frank Havlak*
· Developing Tesla autopilot controller currently used by 300K+ Tesla model X/S/3 owners worldwide.
· Working on design and implementation of autosteer, drive-on-nav, smart summon, and other enhanced autopilot features.

Summer Research Intern, Siemens Corporate Technology — May 2017 - August 2017
Project: Planning and Scheduling of Flexible Manufacturing Systems — *Advisor: Ulrich Muenz*
· Developed graph-based Model Predictive Control planning and scheduling algorithm for flexible manufacturing systems.
· Implemented the MPC graph-based planner in C++ and interfaced with Siemens Tecnomatix plant simulator.

Summer Research Intern, OFS Fitel LLC — June 2014 - August 2014
Project: Software Development for Plasma-based Optical Fiber Manufacturing Process — *Advisor: David Braganza*
· Worked on hardware&software integration for Siemens PLC, HMI, RF power circuit, and other periphery devices.
· Developed software for manufacturing recipe optimization and automation in multi-programming language environment

Summer Research Intern, DEPUSH Robotic Education Technology — June 2011 - August 2011
Project: Educational reconfigurable mechantronical platform (Video Link) — *Advisor: Kevin Rong*
· Developed a modular mechantronic platform with mechantronic transmission, micro-controller and Labview interface

RESEARCH EXPERIENCE

Graduate Research Assistant, Georgia Institute of Technology — August 2014 - May 2018
Topic: Safe Learning and Control of Multi-robot Systems (Video Link 1, 2, 3) — *Advisor: Magnus Egerstedt*
· Developed safety control certificates to ensure safe aggressive maneuvers of multi-quadrotor and mobile robot swarms.
· Designed online safe learning algorithm for quadrotor dynamics using recursive Gaussian Process with safety guarantees.
· Implemented safety certificates on teams of quadrotors and robots with Robot Operating System (ROS) (C++, Python).
· Integrated a multi-robot test-bed with multiple quadrotors, mobile robots, joystick/Iphone, and motion capture system
· Programmed stable hovering and trajectory tracking of quadrotors with Extended Kalman Filter and sensor fusion.

Graduate Research Assistant, Clemson University — May 2013 - May 2014
Topic: Online Control, Estimation and Sensor Fusion of Bioreactor — *Advisor: Richard Groff*
· Developed and implemented nonlinear adaptive state estimator for online tracking of oxygen uptake rate in bioreactor.
· Designed and implemented a Kalman filter and particle filter for bioreactor sensing data filtering and fusion
· Implemented bioreactor real-time control and data acquisition with xPC-target, OPC, UDP and serial communication

Undergraduate Research Group Leader, HUST — March 2011 - June 2012
Topic: Geometric error modelling and compensation for multi-axis machine tools — *Advisor: Fangyu Peng*
· Used CAD/CAM software for machine tools and parts modeling and tool cutting path generation and optimization
· Modeled kinematics of multi-axis machine tools with geometric error and developed tool path post-processing algorithms

SOFTWARE AND HARDWARE SKILLS

Programming Tools:	Python, C and C++, Matlab&Simulink, ROS (in Ubuntu Linux), PLC, Labview
System&Controls:	Linear/nonlinear/optimal/networked control, regular/cascaded PID control, LQR control
Machine Learning:	Gaussian Process, Hidden Markov Model, PCA, Expectation-Maximization, KNN/Q learner
Signal Processing:	Complementary/Kalman/Extended-Kalman/Particle Filtering, SVD, Convex optimizations
Robotic Hardware:	Crazyflie Quadrotor, AR Drone, Segway/Khepera III/Magellan Pro Robots, GRIST bots
Robotic Software	ROS, MQTT, Player/Stage, Vrep simulator, Rviz, Optitrack/Vicon Motion Capture System
Robotics	Quadrotor dynamics, manipulator forward/inverse kinematics, path planning (PRM, A*)
CAD/CAM	Solidworks(3 yrs), AutoCAD(3 yrs), UG(3 yrs), Inventor(2 yrs), Mastercam(1 yr)
Engineering Skills	Siemens PLC, CNC, Micro-Controller, Oscilloscope, Signal generator, 3D printing, Laser cutter

SELECTED HONORS

Best Multi-Robot Paper Award: Best Multi-Robot Systems Paper Award at top Robotics conference ICRA 2017
Jenny H. Krauss Fellowship: Awarded to top Georgia Tech graduate students with excellent academic record
Top winner of BlueCompetition: A worldwide competition sponsored by BlueSens Gas Sensor GmbH(Germany)
Chinese National Scholarship: Awarded to top 2% college students by the Chinese Ministry of Education
China National Innovation Grants: Awarded to teams of undergraduates with innovative research projects

MEDIA COVERAGE

D1. *IEEE spectrum*, "Swarms of Robots Manage to Not Run Into Each Other", Web link

D2. *Engadget*, "Virtual 'top hats' ensure swarming drones won't crash", Web link

D3. *Robohub*, "The Robotarium: A remotely accessible swarm robotics research testbed", Web link

D4. *Digital trends*, "This swarm of drones uses virtual force fields to avoid crashing into each other", Web link

SERVICE

Session Co-Chair, IFAC Conference on Analysis and Design of Hybrid Systems, Atlanta, 2015.

Peer Reviewer for Controls and Robotics Society: IEEE Transactions on Robotics (T-RO), IEEE Transactions on Automatic Control (TAC), IEEE Transaction on Control of Networked Systems (TCNS), IEEE Robotics and Automation Letters (RAL), ICRA, IROS, CASE, CDC, ACC, ECC.

PUBLICATIONS

A. Thesis
A1. "Multi-Robot Coordination and Safe Learning Using Barrier Certificates", Georgia Institute of Technology, 2018
A2. "Design and Implementation of a Real-time Adaptive Oxygen Transfer Rate Estimator", Clemson University, 2014

B. Peer-reviewed Journal Papers
B1. **L. Wang**, A. Ames, and M. Egerstedt, "Safety Barrier Certificates for Collisions-Free Multi-robot Systems", *IEEE Transactions on Robotics (T-RO)*, vol. 33, no. 3, pp. 661-674, 2017.
B2. F. Celi, **L. Wang**, L. Pallottino, and M. Egerstedt, "Deconfliction of Motion Paths with Traffic Inspired Rules in Robot-Robot and Human-Robot Interactions", *IEEE Robotics and Automation Letters (RA-L)*, accepted, 2019
B3. M. Ohnishi, **L. Wang**, G. Notomista, and M. Egerstedt, "Safety-aware Adaptive Reinforcement Learning with Applications to Brushbot Navigation", *IEEE Transactions on Robotics (T-RO)*, conditionally accepted, 2018
B4. F. Peng, J. Ma, **L. Wang**, R. Yan and B. Li, "Post-processing Algorithm Based on Total Differential Method for Multi-axis Machine Tools with Arbitrary Configuration", *Chinese Journal of Mechanical Engineering*, vol. 48, no. 13, pp. 121-127, 2012.

C. Peer-reviewed Conference Papers
C1. **L. Wang**, E. A. Theodorou, and M. Egerstedt, "Safe Learning of Quadrotor Dynamics Using Barrier Certificates", *IEEE International Conference on Robotics and Automation (ICRA)*, pp. 2460-2465, 2018.
C2. **L. Wang**, A. Ames, and M. Egerstedt, "Safe Certificate-Based Maneuvers for Teams of Quadrotors Using Differential Flatness", *IEEE International Conference on Robotics and Automation (ICRA)*, pp. 3293-3298, 2017.
C3. D. Pickem, P. Glotfelter, **L. Wang**, M. Mote, A. Ames, E. Feron, and M. Egerstedt, "The Robotarium: A Remotely Accessible Swarm Robotics Research Testbed", *IEEE International Conference on Robotics and Automation (ICRA)*, **Best Multi-Robot Systems Paper Award, Best Conference Paper Finalist**, pp. 1699-1706, 2017.
C4. **L. Wang**, D. Han, and M. Egerstedt, "Permissive Barrier Certificates for Safe Stabilization Using Sum-of-squares", *American Control Conference (ACC)*, pp. 585-590, 2018
C5. A. Li, **L. Wang**, P. Pierpaoli, and M. Egerstedt, "Formally Correct Composition of Coordinated Behaviors Using Control Barrier Certificates", *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pp. 3723-3729, 2018.
C6. M. Jantsch, N. Nandola, **L. Wang**, M. Hakenberg, U. Munz, "Enhanced branch and bound approach for receding horizon based planning", *IEEE 14th International Conference on Automation Science and Engineering (CASE)*, pp. 160-163, 2018.
C7. **L. Wang**, A. Ames, and M. Egerstedt, "Multi-objective Compositions for Collision-free Connectivity Maintenance in Teams of Mobile Robots", *2016 Decisions and Control Conference (CDC)*, pp. 2659-2664, Dec. 2016.
C8. **L. Wang**, A. Ames, and M. Egerstedt, "Safety Barrier Certificates for Heterogeneous Multi-robot System", *2016 American Control Conference (ACC)*, pp. 5213-5218, July 2016.
C9. U Borrmann, **L. Wang**, A. Ames, and M. Egerstedt, "Control Barrier Certificates for Safe Swarm Behavior", *2015 IFAC Conference on Analysis and Design of Hybrid Systems (ADHS)*, Oct. 2015.
C10. **L. Wang**, M. E. Pepper, A. Padmakumar, T. C. Burg, S. W. Harcum, and R. E. Groff, "A Real-time Adaptive Oxygen Transfer Rate Estimator for Metabolism Tracking in Escherichia coli Cultures", *IEEE Engineering in Medicine and Biology Conference*, pp. 6191-6194, 2014
C11. M. E. Pepper, **L. Wang**, A. Padmakumar, T. C. Burg, S. W. Harcum, and R. E. Groff, "A CMI-based Controller for Achieving High Growth Rate E.coli Cultures", *IEEE Engineering in Medicine and Biology Conference*, pp. 2911-2915, 2014