Junnan Song

Ph.D. Candidate in Electrical Engineering
Cell: (860)771-8230 E-mail: junnan.song@uconn.edu

HIGHLIGHTS

- Expertise in *Path Planning, Robot Navigation* and *Multi-robot Control*.
- Advanced in C/C++, MATLAB and Simulink.
- Strong hands-on ability gained during real-world experiments using autonomous vehicles equipped with various on-board sensing systems, e.g., Hokuyo lasers, sonars and localization systems.
- Experienced with Linux-based operating systems.
- Fluent written and verbal communication skills.

EDUCATION

- **Ph.D. Candidate,** Electrical Engineering **09/2012-Present**
  Department of Electrical and Computer Engineering, University of Connecticut, USA GPA: 4.045/4.0
- **Master of Science,** Electrical Engineering **09/2012-05/2016**
  Department of Electrical and Computer Engineering, University of Connecticut, USA GPA: 4.045/4.0
- **Master of Engineering,** Control Theory and Control Engineering **09/2010-07/2012**
  School of Information Science and Engineering, Northeastern University (China) GPA: 87.3/100
- **Bachelor of Engineering,** Automation **09/2006-07/2010**
  School of Information Science and Engineering, Northeastern University (China) GPA: 88.4/100

RESEARCH EXPERIENCE

Research Assistant *at Laboratory of Intelligent Networks and Knowledge-perception Systems* **09/2012-Present**
University of Connecticut, Storrs, CT, USA

- ***Coverage Path Planning in Unknown Environments using Autonomous Vehicles (AVs)***
  - ✧ Established a novel online coverage path planning algorithm that guarantees complete coverage and produces superior coverage performances as compared to many existing algorithms;
  - ✧ Implemented in C++ and validated via real-world experiments using an autonomous ground vehicle equipped with various on-board sensing systems;
  - ✧ Incorporated ICP-based *SLAM* algorithms into the system for coverage in GPS-denied environments.
- ***Multi-Robot Resilient Control in Unknown Environments***
  - ✧ Developed a distributed resilient control algorithm for multi-robot coverage in unknown environments;
  - ✧ The algorithm is resilient to catastrophic robot failures via dynamic task reallocations, and also is efficient by preventing idling of early completed robots;
  - ✧ Implemented in C++ and validated in various complex scenarios on the high-fidelity Player/Stage simulator.
- ***Curvature Constrained Path Planning for Autonomous Underwater Vehicles (AUVs)***
  - ✧ Developed a pose-based $A^\star$ algorithm to find time-optimal paths for AUVs that can move at variable speeds but restricted by bounded curvature;
  - ✧ Validated in various complex obstacle-rich environments using MATLAB;
  - ✧ Supported by Office of Naval Research.
- ***3-D Coverage Path Planning for Underwater Terrain Reconstruction***
  - ✧ Developed a *3-D* coverage algorithm based on multi-level coverage trees for underwater terrain reconstruction;
  - ✧ Surface reconstruction using alpha-shapes using sampled point cloud;
  - ✧ Implemented in C++ and validated on the Robot Operating System (ROS).

Research Assistant at *State Key Laboratory of Synthetical Automation for Process Industries* **09/2010-07/2012**

Automation Research Center, Northeastern University, China

- ***Adaptive Control for a Dual-tank Liquid System***
  - ✧ Developed a weighted step-ahead self-tuning decoupling controller for controlling the water level of a dual-tank water system. The unmodeled dynamics is estimated using BP neural networks.
  - ✧ Validated the algorithm using Simulink on a R&D process control experiment platform.

PUBLICATIONS

- **J. Song** and S. Gupta, "$\epsilon^{\star}$: An Online Coverage Path Planning Algorithm", *IEEE Transactions on Robotics* (Conditionally Accepted), 2017.
- **J. Song** and S. Gupta, "SLAM based Shape Adaptive Coverage Control using Autonomous Vehicles", The *10th International Conference on System of Systems Engineering*, 2015, San Antonio, TX, USA.
- **J. Song**, K. Qiu, S. Gupta and J. Hare, "SLAM based Adaptive Navigation of AUVs for Oil Spill Cleaning", *MTS/IEEE OCEANS* 2014, St. John`s, Canada.
- **J. Song**, S. Gupta and J. Hare, "Game-theoretic Cooperative Coverage using Autonomous Vehicles", *MTS/IEEE OCEANS* 2014, St. John`s, Canada.
- **J. Song**, S. Gupta, J. Hare and S. Zhou, "Adaptive Cleaning of Oil Spills by Autonomous Vehicles under Partial Information", *MTS/IEEE OCEANS* 2013, San Diego, CA, USA.
- **J. Song**, S. Gupta and T. Wettergren, "Time-optimal Path Planning for Underwater Vehicles in Obstacle Constrained Environments", *MTS/IEEE OCEANS* 2017, Anchorage, AL, USA.
- Z. Shen, **J. Song**, K. Mittal and S. Gupta, "Autonomous 3-D Mapping and Safe-Path Planning for Underwater Terrain Reconstruction Using Multi-Level Coverage Trees", *MTS/IEEE OCEANS* 2017, Anchorage, AL, USA.
- Z. Shen, **J. Song**, K. Mittal and S. Gupta, "An Autonomous Integrated System for 3-D Underwater Terrain Map Reconstruction", *MTS/IEEE OCEANS* 2016, Monterey, CA, USA.
- J. Hare, S. Gupta, **J. Song** and T. Wettergren, "Classification Induced Distributed Sensor Scheduling for Energy Efficiency in Underwater Target Tracking Sensor Networks", *MTS/IEEE OCEANS* 2017, Anchorage, AL, USA.
- J. Hare, S. Gupta and **J. Song**, "Distributed Smart Sensor Scheduling for Underwater Target Tracking", *MTS/IEEE OCEANS* 2014, St. John`s, Canada.
- **J. Song** and S. Gupta, "Cooperative Autonomy for Resilience and Efficiency of Multi-Robot Coverage Tasks in Unknown Environments", *IEEE Transactions on Systems, Man and Cybernetics: Systems*. (Under Review).

PATENT

- L. Wang, **J. Song**, J. Hou, H. Wang and Y. Chi, A Multifunctional process control experiment platform, China Patent, CN 201110286749, 2011.

HONORS & AWARDS

- *Pre-doctoral Fellowship*, Dept. of Electrical & Computer Engineering, University of Connecticut, 2015-2017, USA.
- *Doctoral Student Travel Award*, University of Connecticut, 2017, USA.
- *Outstanding Graduates of Liaoning Province*, 2012, China.
- *First Prize*, The 7th National Post-Graduate Mathematical Modeling Contest, 2010, China.
- *Second Prize*, The 12th "Challenge Cup" National Extra-curricular Academic Works Competition of Science and Technology, 2011, China.
- *Distinguished Prize*, The 10th "Challenge Cup" Extra-curricular Academic Works Competition of Science and Technology, Liaoning Province, 2011, China.
- *Neusoft Excellence Scholarship*, Neusoft Corporation, 2009, China.
- *Suzhou Industrial Park Scholarship*, Suzhou Industrial Economic Development Zone, 2011, China.
- *Outstanding Student Award*, Northeastern University (China), 2007-2010.