Evan Gravelle, Ph.D. Candidate

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SUMMARY

Mechanical engineer with interdisciplinary research experience in control and estimation theory, robotics, and machine learning. Strong foundation in mathematical modeling, probability, and analysis. Extensive programming experience (Python, C++, MATLAB, ROS) with a passion for artificial intelligence.

EDUCATION

University of California, San Diego, California, USA

Ph.D., Mechanical and Aerospace Engineering, cum. GPA: 3.78 — expected March 2017

- Advisor: Sonia Martínez
- Thesis title: Distributed Load Balancing Algorithms under Discrete Constraints

M.S., Mechanical and Aerospace Engineering, cum. GPA: 3.75 — September 2013

University of California, Santa Barbara, California, USA

B.S., Mechanical Engineering, cum. GPA: 3.87, *summa cum laude*, first in class — June 2012

PROFESSIONAL EXPERIENCE

Machine Learning Project — March 2016 - present

- Extensive graduate/online coursework and paper reading on Markov decision processes, support vector machines, policy/value iteration, TD(λ), SARSA(λ), efficient exploration, Q-learning, neural networks, tree search, and deep Q-networks.
- Implemented deep Q-learning (DQN) with experience replay from scratch in Python using Tensorflow, based on "Human-level control through deep reinforcement learning."
- Implemented value iteration, policy iteration, expectation-maximization, and SARSA(λ) for various OpenAI Gym environments.
- Currently working on solving each DOOM level in OpenAI Gym, starting with DQN and progressing toward asynchronous advantage actor-critic with extensions.

Lab Lead for Multi-Agent Robotics Lab (http://muro.ucsd.edu) — June 2015 - present

- Led undergraduate and graduate researchers in individual projects towards developing autonomous capabilities of lab's ground and air robot testbed, helped determine and direct the long-term focus of the testbed.
- Helped successfully implement various algorithms on ground robots (Turtlebot) and quadrotors (Parrot AR.Drone) using Robot Operating System (ROS) including centralized and decentralized multi-agent deployment using Voronoi iteration, centralized and decentralized localization using an overhead camera with ArUco markers, tuned PID motion controllers, cyclic pursuit, simultaneous localization and mapping, and human-swarm interaction via an Android app.
- Achieved first place with team in graduate ROS course competition by solving an autonomous retrieval task using computer vision techniques for identification and tracking, ceiling template matching for localization, waypoint heuristic method for motion planning, PID control for base/arm motion and obstacle avoidance, and a state-based outer loop controller to monitor and change behavior modes.

Graduate Student Researcher at UC San Diego — August 2012 - present

- Designed, proved convergence properties, and analyzed performance of a quantized load balancing algorithm under discrete constraints, a dynamic lane reversal algorithm on a road network, and a dynamic rerouting algorithm on a road network.
- Designed, proved convergence properties, and analyzed performance of and rerouting algorithm for a vehicular road network.

- Simulated and tested each algorithm in MATLAB, including both macroscopic and microscopic traffic models.
- Currently working on two projects, an efficient intelligent intersection control policy and guaranteeing differential privacy for drivers while accurately estimating state of a road network.

Research Intern at SPAWAR Systems Center Pacific June 2016 - present

- Researched underwater localization techniques for autonomous underwater vehicles using sparse single range measurements.
- Implemented an unscented Kalman filter and an extended Kalman filter in C++ using MOOS-IvP publish/subscribe architecture for accurate and efficient estimation, tested in simulation, presented a poster.
- Currently working on optimal trajectory planning for minimizing estimation error.

Research Assistant at Trinity College Dublin June 2011 - August 2011

- Researched the packing structure of mono-disperse microbubbles in cylinders as a function of the bubble diameter to cylinder diameter ratio. Wrote MATLAB code for visualization of these bubbles as images of 3D structures and helped characterize the packing structure, presented a poster.

Teaching Assistant Spring 2014, Spring 2015, present

- 2 quarters Probability and Statistical Methods, 1 quarter Motion Planning
- Tasks included weekly supplemental lectures, office hours, revising homeworks/tests, grading midterms, and holding review sessions.

Campus Learning Assistance Services Tutor September 2010 - June 2012

- Group and individual tutor for calculus and differential equations at University of California, Santa Barbara. Held classes which involved clarifying lecture material and demonstrating proper mathematical techniques for solving problems.

ADDITIONAL INFORMATION

- Proficient with C++, Python, Tensorflow, MATLAB, ROS, git, Subversion, LaTeX. Comfortable with Linux, OS-X, Windows.
- Led lab outreach tours for high school and university groups to inspire students to join STEM fields and consider careers in robotics/research.

PUBLICATIONS

E. Gravelle and S. Martínez. *Distributed Dynamic Lane Reversal and Rerouting for Traffic Delay Reduction*. Submitted May 2016 to Automatica.

E. Gravelle and S. Martínez. *Traffic Delay Reduction via Distributed Dynamic Lane Reversal and Rerouting*. 22nd International Symposium on Mathematical Theory of Networks and Systems, July 2016.

E. Gravelle and S. Martínez. *An Anytime Distributed Load Balancing Algorithm Satisfying Capacity and Quantization Constraints*. IEEE Transactions on Control of Networked Systems, November 2015.

E. Gravelle and S. Martínez. *Quantized Distributed Load Balancing with Capacity Constraints*. IEEE Conference on Decision and Control, December 2014.