Amirhossein TAMJIDI

PERSONAL DATA

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INTERESTS

Autonomous Vehicles, Safety Critical Software Development, Motion Planning Under Uncertainty (POMDP), Simultaneous Localization And Mapping, Estimation, Computer Vision

EXPERIENCE

FEB 2019 - PRESENT

SOFTWARE ENGINEER AT ZOOX , *Foster City, California*

- Member of the team that delivered first version of the Zoox's Collision Avoidance System (CAS). Delivered, trajectory validators and stop trajectory generation for our CAS system. Finished AB Dynamics training and Vehicle Software Operator training.
- Research, design, and deployment of initial version of the comfort metrics to our metrics pipeline.
- Owned our Planner Configuration node and made cross functional architectural changes in the whole software for productization purposes.
- Active member of the onboardning team that supported new hires in all levels across the organization. Worked with the managers to substantially improve our learning system.
- Currently working on areas reakted to our trajectory tracker.

JULY 2017 - FEB 2019

ROBOTICS ENGINEER AT SVAI INCORPORATED , *Henderson, Nevada*

- Working on a LIDAR based SLAM implementation for autonomous robotic systems, navigation in dynamic environments, coverage and exploration in multi-room settings.
- Developed GUI based on GTK++ and ncurses for different applications within our source code.
- Full stack responsibilities from prototyping, designing, implementing, verifying, and validating solutions and features.

JUNE, 2017

1ST SUMMER SCHOOL ON COGNITIVE ROBOTICS, *Cambridge, MIT*

- Experience with *Planning Domain Definition Language (PDDL), Reactive Model-based Programming Language (RMPL)* and, *Enterprise* all integrated in ROS (Robot Operating System
- An intensive and extensive review of the state of the art in the field of cognitive robotics including: *Robust Execution: Estimation, Monitoring and Scheduling, Motion Planning, Activity Planning, Perception and Manipulation and, Planning with Uncertainty and Risk.* (more details can be found in http://cognitive-robotics17.csail.mit.edu/)
- Actively participated in all the labs and talks and successfully implemented the path and trajectory planning part for the final challenge of the summer school.

FEB-MAY 2017

Student Technician in *Aerospace Engineering Department at Texas A&M University*

- Conducting research on applications of distributed state estimation in aerospace and robotics applications

Summer 2016 | **Interim Engineering Intern at Qualcomm Research**, *San Diego*

● Collaborative software development for Micro/Macro simulation of traffic and autonomous cars (ROS/Gazeboo/Python). The simulator consisted of a ROS/Gazebo component which was responsible for visualization and dynamic simulation (micro) and was used in conjunction with SUMO (Simulation of Urban MObility). The latter modelled car traffic, car following, and lane changing behaviour of cars. I extensively studied car following and lane changing models used for simulation and became an expert in using SUMO and its sub-packages. I wrote a script in Python code that modeled a traffic scenario with hundreds of cars and communicated back and forth between SUMO and ROS/Gazeboo component.

● Design and implementation of a continuous neural-network based reinforcement learning algorithm for autonomous car motion planning. The existing code for motion planning in qualcomm made simplistic assumptions about the behaviour of other cars. I improved the veracity of the underlying model and used it to train a neural network behavioral controller that would decide to change lanes and follow particular trajectories based on the relative position and velocity of self-car to other cars navigating near it. I showed that it was possible for my algorithm to learn from training data to make better decisions leading to noticeable decrease in the failure rate compared to the baseline predictive control based motion planning algorithm.

● Submitted an IDF for a patent titled *"MOTION PLANNING AND INTENTION PREDICTION FOR AUTONOMOUS DRIVING IN HIGHWAY SCENARIOS VIA GRAPHICAL MODEL-BASED FACTORIZATION"*. Submitted to The United States Patent and Trademark Office) .

2013-2016 | Research Assistant in *Aerospace Engineering Department at Texas A&M University*

- Development of a hybrid Distributed State Estimation method that is robust to link failure. The vast majority of contemporary DSE methods on sensor networks and multiagent applications presuppose that the communication network remains connected all the time. Those that don't, make compromises resulting in substantial performance decrease in case of intermittent network disconnection. I proposed a novel Hybrid DSE method that could recover attractive estimation performance under much weaker network assumptions. In my thesis, I developed variants of this method specially suited for DSE applications with non-linear motion and observation models and non-gaussian noise. Recently my paper on the proposed method won the best student paper award in *INTERNATIONAL SYMPOSIUM ON MULTI-ROBOT AND MULTI-AGENT SYSTEMS*.
- Development of a novel method for motion planning under uncertainty in dynamic environments. In this collaborative work I and my colleague proposed a convex program to design a feedback policy in non-Gaussian belief space for a class of systems with differentiable non-linear observation model. Contrary to competing approaches to the problem that rely on the maximum likelihood heuristic, in our method the size of the optimization vector only grows linearly with time horizon and dimension of the state. We also proposed a new approach to deal with obstacles as a part of optimization problem. Again, in the presence of the obstacle, there is no increase in the number of variables. Therefore, our proposed solution can be use in on-line applications.
- In this collaborative work we proposed a method for motion planning under uncertainty to deal with situations where ambiguous data associations result in a multimodal hypothesis on the robot state. In the global localization problem, sometimes referred to as the "lost or kidnapped robot problem", given little to no a priori pose information, the localization algorithm should recover the correct pose of a mobile robot with respect to a global reference frame. We proposed a Receding Horizon approach, to plan actions that sequentially disambiguates a multimodal belief to achieve tight localization on the correct pose in finite time, i.e., converge to a unimodal belief.
- Planning and Control for Cooperative Manipulation and Transportation with Aerial Robots
- Contributions to FIRM MATLAB Toolbox: This application is an implementation of Feedback-based Information Road Maps (FIRM) in MATLAB which is a method for motion planning under uncertainty

2010-2013 | Research Assistant in INTELLIGENT AUTONOMOUS SYSTEMS LABORATORY, *University of Arkansas at Little Rock*

- Design and implementation of pose estimation algorithms for autonomous cars in GPS denied environments that can work in the presence of moving cars. The algorithm was tested on *Ford Campus Vision and Lidar Data Set.*
- Implementation and test of Visual-SLAM (Simultaneous Localization and Mapping) methods based on fusion from camera and 3D Velodyne Lidar. I proposed a pose estimation method based on 1-Point RANSAC EKF (Extended Kalman Filter) framework. The method fuses the depth data from a LIDAR and the visual data from a monocular camera to estimate the pose of an Unmanned Ground Vehicle (UGV) in a GPS denied environment. Its estimation framework continually updates the vehicle's 6D pose state and temporary estimates of the extracted visual features' 3D positions. In contrast to the conventional EKF-SLAM (Simultaneous Localization And Mapping) frameworks, the proposed method discards feature estimates from the extended state vector once they are no longer observed for several steps. As a result, the extended state vector always maintains a reasonable size that is suitable for online calculation. The fusion of laser and visual data is performed both in the feature initialization part of the EKFSLAM process and in the motion prediction stage. A RANSAC pose calculation procedure is devised to produce pose estimate for the motion model. The proposed method has been successfully tested on the Ford campus's LIDAR-Vision dataset. The results are compared with the ground truth and the estimation error is   1.9
- Development, implementation and test of a new pose estimation method that was used in the *Smart Cane* project. The algorithm was tested on the data from SR400 SwissRanger Flash LIDAR.
- Development and implementation of Realtime data acquisition from dynamixel servo motor in RTAI realtime operating system.
- Experience with Systems Programming, Socket Programming and writing sensor drivers in Linux.
- Processing and refinement of 3D point cloud data. Working with mesh-grid algorithms, smoothing and clearing mesh-grid data.

JAN-MAY 2010 | Software Developer and Robotics Engineer in *Mechatronics Research Laboratory (MRL)*, Qazvin, Iran

- Implementation of trajectory tracking algorithms in mobile robots
- Design and implementation of a new exploration algorithm for mobile robots based on occupancy grid maps

EDUCATION

MAY 2017	**Texas A&M University**, Master of Science in AEROSPACE ENGINEERING, Thesis: "Decentralized Estimation and Planning Under Uncertainty" Advisor: Dr. Suman Chakravorty
SEPTEMBER 2009	**K.N. Toosi University of Technology**, Master of Science in ELECTRICAL ENGINEERING (CONTROL MAJOR), Thesis: "Developing Methods for Performance Improvement of EKF in SLAM Problem" Advisor: Prof. Hamid D. Taghirad
JUNE 2006	**Tabriz University**, Bachelor of Science in ELECTRICAL ENGINEERING (CONTROL MAJOR), Thesis: "Hybrid PSO-GA Method for Designing Fuzzy Controller" Advisor: Dr. Mohammad Taghi Vakili

RELEVANT GRADUATE COURSES

Computer Science	**Mechanical Engineering**	**Electrical Engineering**
Analysis of Algorithms	Spacecraft Dynamics	Estimation and Detection Theory
Artificial Intelligence	Continuum Mechanics	Stochastic Systems
Machine Learning	Theory of Fluid Mechanics	Image Processing
Linux Systems Programming	Robotics	Neural Networks
Embedded Systems		Neural Networks
		Pattern Recognition
		Optimal Control
		Fuzzy Control
		Multivariate Control

COMPUTER SKILLS

Programming Languages	C++, Python
Operating System	Linux, Windows
Developer Tools	Bazel, git, vim
Software Packages	ROS, v-rep, MeshLab, Inkscape
Productivity	Mkdocs, Latex, Lyx

ACTIVITIES

2015-present	IEEE Student member
2015-present	IEEE Robotics and Automation Society member
2015-present	IEEE Systems, Man, and Cybernetics Society member
2013-present	Member of Estimation, Decision and Planning Laboratory (http://edplab.org/)
2010-2012	Member of Intelligent Autonomous Systems Laboratory (http://ualr.edu/cxye/laboratory.htm)
2010	Member of Mechatronics Research Laboratory (MRL) (http://www.mrl.ir/)
2008-2010	Member of Pars Robotics Team (http://www.pars-robotic.ir/)
2006-2009	Member of Advanced Robotics & Automated Systems (ARAS)
2007-2008	Organizer of Control group's Bi-weekly seminars at K.N. Toosi University of Technology
2005-2006	Head of the Robosoccer team, Tabriz University
2004-2006	Member of the Robosoccer team, Tabriz University

Honors and Awards

2017	Best Student Paper Award in International Symposiumon Multi-Robot and Multi-Agent Systems, 2017
2013	Best Student Paper Award in IEEE International Symposium on Robotic and Sensors Environments (ROSE)
2010	Chosen among the 10 Pre-final teams in Rescue Robot league of ROBOCUP World Championships in Singapore, 2010, with MRL robotic group
2010	Third Place Award in ROBOCUP IRAN-Open 2010 with Pars Robotic Group

Publications

Journal Papers

[1] A. Tamjidi, R. Oftadeh, S. Chakravorty, and D. Shell, "Efficient recursive distributed state estimation of hidden markov models over unreliable networks," *Autonomous Robots*, pp. 1–18

[2] A. Tamjidi and C. Ye, "**6-DOF pose estimation of an autonomous car by visual feature correspondence and tracking**," *International Journal of Intelligent Control and Systems*, vol. 17, no. 3, pp. 94–101, 2012

[3] C. Ye, S. Hong, and A. Tamjidi, "**6-DOF Pose Estimation of a Robotic Navigation Aid by Tracking Visual and Geometric Features**," *IEEE Transactions on Automation Science and Engineering*, vol. 12, no. 4, pp. 1169–1180, 2015

Refereed Conference Papers

[3] A. Tamjidi, R. Oftadeh, S. Chakravorty, and D. Shell, "**Efficient Distributed State Estimation of Hidden Markov Models over Unreliable Networks**," in *International Symposium on Multi-Robot and Multi-Agent Systems*, 2017 (received Best Student Paper Award)

[4] A. Tamjidi, S. Chakravorty, and D. Shell, "**Decentralized State Estimation via a Hybrid of Consensus and Covariance intersection**," in *International Conference on Intelligent Robots and Systems (IROS)*, 2016

[5] S. Agarwal, A. Tamjidi, and S. Chakravorty, "**Motion Planning for Active Data Association and Localization in Non-Gaussian Belief Spaces**," in *International Workshop on Algorithmic Foundations of Robotics (WAFR)*, 2016

[6] M. Rafieisakhaei, A. Tamjidi, S. Chakravorty, and P. R. Kumar, "**Feedback motion planning under non-Gaussian uncertainty and non-convex state constraints**," in *IEEE International Conference on Robotics and Automation (ICRA)*, pp. 4238–4244, 2016

[7] A. Tamjidi and C. Ye, "**A pose estimation method for unmanned ground vehicles in GPS denied environments**," in *SPIE Defense, Security, and Sensing*, pp. 83871K–83871K, 2012

[8] A. Tamjidi, C. Ye, and S. Hong, "**6-DOF pose estimation of a portable navigation aid for the visually impaired**," in *IEEE International Symposium on Robotic and Sensors Environments (ROSE)*, pp. 178–183, 2013 (received Best Student Paper Award)

[9] A. Mobarhani, S. Nazari, A. Tamjidi, and H. D. Taghirad, "**Histogram based frontier exploration**," in *International Conference on Intelligent Robots and Systems (IROS)*, pp. 1128–1133, 2011

[10] A. Tamjidi, H. D. Taghirad, and A.-A. Aghamohammadi, "**On the consistency of EKF-SLAM: Focusing on the observation models.**," in *International Conference on Intelligent Robots and Systems (IROS)*, pp. 2083–2088, 2009

[11] A. Norouzzadeh Ravari, H. D. Taghirad, and A. Tamjidi, "**Vision-based fuzzy navigation of mobile robots in grassland environments**," in *IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM)*, pp. 1441–1446, 2009

[12] A.-A. Aghamohammadi, H. D. Taghirad, A. Tamjidi, and E. Mihankhah, "**Feature-Based Laser Scan Matching For Accurate and High Speed Mobile Robot Localization**," in *European Conference on Mobile Robots (ECMR)*, 2007

[13] A.-A. Aghamohammadi, A. Tamjidi, and H. D. Taghirad, "**SLAM using single laser range finder**," *IFAC Proceedings Volumes*, vol. 41, no. 2, pp. 14657–14662, 2008

[14] A.-A. Aghamohammadi, A. Tamjidi, and H. D. Taghirad, "**A solution for SLAM through augmenting vision and range information**," in *International Conference on Intelligent Robots and Systems (IROS)*, pp. 1037–1042, 2008

Refereed non-English Papers

[14] A. Tamjidi and H. D. Taghirad, "**Consistency Analysis in EKF-SLAM and proposing a novel approach to reach a better consistency while reducing computational cost**," in *Iranian Conference on Electrical Engineering (ICEE)*, 2009

[15] S. Nazari, A. Tamjidi, S. Kiaei, and H. D. Taghirad, "**Design and implementation of a concurrent mapping and navigation method based on Laser Range finder's data**," in *Iranian Conference on Electrical Engineering (ICEE)*, 2009

[16] A. Mohammadzade Jasour, A. Tamjidi, and M.-T. Vakili Baghmisheh, "**Fuzzy controller design using PSO and GA**," in *2nd joint congress on fuzzy and intelligent systems, Tehran, Iran*, 2008

[17] A. Tamjidi and M.-T. Vakili Baghmisheh, "**Augmenting Vision and LRF Information: Towards Encoder-free SLAM in Unstructured Environments**," in *5th Machine Vision and Image Processing Conference, Tabriz, Iran*, 2008

[18] A.-A. Aghamohammadi and A. Tamjidi, "**An Introduction to Modified Methods in Ant Colony Systems Optimization and Proposing A New Local Optimizer**," in *10th Intelligent Systems Conference, Tehran, Iran*, 2005

Technical Reports

[19] A. Tamjidi, S. Chakravorty, and D. Shell, "**Decentralized State Estimation via a Hybrid of Consensus and Covariance intersection**," *arXiv preprint arXiv:1603.00955*, 2016

[20] S. Agarwal, A. Tamjidi, and S. Chakravorty, "**Motion Planning in Non-Gaussian Belief Spaces (M3P): The Case of a Kidnapped Robot**," *arXiv preprint arXiv:1506.01780*, 2015

Dissertations

[21] A. Tamjidi, "**Decentralized Estimation and Planning Under Uncertainty**," Master's thesis, Department of Aerospace Engineering, Texas AM University, August 2009

[22] A. Tamjidi, "**Developing Methods for Performance Improvement of EKF in SLAM Problem**," Master's thesis, Department of Electrical and Computer Engineering, Khaje Nasir Toosi University of Technology, August 2009

[23] A. Tamjidi, "**Hybrid PSO-GA Method for Designing Fuzzy Controller**," Master's thesis, Department of Electrical and Computer Engineering, Tabriz University, June 2006

LANGUAGES

ENGLISH:Fluent   FARSI:Fluent   AZERI:Mother Tongue

INTERESTS AND ACTIVITIES

Technology, Open-Source, Programming
Paradoxes in Decision Making, Psychoanalysis, Behavioural Finance
Football, Travelling