Abraham P. Vinod

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Academic Research Positions

Postdoctoral Research Fellow 2019–current
The University of Texas at Austin, USA
Advisor: Dr. Ufuk Topcu
Research focus: Data driven constrained autonomy with safety guarantees

Education

Doctoral student in Electrical Engineering 2014 – 2018
The University of New Mexico (UNM), USA **GPA: 4.26/4.0**
Advisor: Dr. Meeko M. K. Oishi
PhD Thesis: Scalable Stochastic Reachability: Theory, Computation, & Control
Research areas: Optimization (convex, discrete, and stochastic), control theory

Bachelor & Master of Technology 2009 – 2014
Indian Institute of Technology Madras (IITM), India **GPA: 8.59/10**
Major: Electrical Engineering Minor: Biomedical Engineering
Master Thesis: Deterministic Attitude Estimation

Languages

Proficient — Python, MATLAB | Familiar — C, C++, HTML, CSS, Javascript

Research Projects

Safe control of systems under sparse data . . . . . January, 2019 – Present
◦ Data-driven constrained control leveraging side information

Control of constrained stochastic systems . . . April 2016 – December, 2018
◦ Proposed optimization-based (convex and stochastic) for probabilistic safety guarantees in systems controlled by a human and/or autonomous agents
◦ Developed SReachTools, a repeatability-evaluated, unit-tested, open-source MATLAB toolbox (8,940 lines of code with 8,240 lines of comments)
◦ Used for obstacle avoidance, autonomous surveillance, and space applications

Validation of cognitive models . . . . . January 2015 – March 2016
◦ Analyzed a cognitive model for the actions of an average human participant

Deterministic attitude estimation for robotics . . . . May 2013 – June 2014
◦ Designed an algorithm for orientation estimation (hardware validation)

Internships

Student Intern — R&D (Connected cars) . . . . . Summer 2017
Nissan Research Center — Silicon Valley, Sunnyvale, California, US
◦ Developed location estimation techniques using CAN and GPS data for cars
◦ Created a Python-based workflow for secure over-the-air updates

Interim Engineering Intern . . . . . Summer 2012
Qualcomm Incorporated, Hyderabad, India
◦ Analyzed performance of the DRAM with the existing mobile platform builds
◦ Created a framework that sped up the debugging process by 30%

Scholastic Achievements

◦ Finalist for best paper award in the 21st ACM International Conference on Hybrid Systems: Computation and Control (HSCC), 2018
◦ Best student paper award in the 20th ACM International Conference on Hybrid Systems: Computation and Control (HSCC), 2017
◦ Prof. Achim Bopp prize for best student hardware project at IITM, 2014

Scholastic Achievements (Contd.)

- Central Board of Secondary Education scholarship for undergraduate studies
- Indian Institute of Technology Joint Entrance Examination All-India Rank of 709, where a total of 384,977 students gave the exam (in top 0.002%)
- All India Engineering Entrance Examination All-India Rank 609 and Tamil Nadu State Rank 18, where over 1 million students gave the exam (in top 0.001%)

Publications (Scholar)

Published: 2 peer-reviewed journal and 20 peer-reviewed conference papers
In review: 2 journal papers

- **A. Vinod**, A. Israel, and U. Topcu, "Convexified contextual optimization for on-the-fly control of smooth systems," American Control Conference, 2020
- **A. Vinod**, J. Gleason, and M. Oishi, "SReachTools: A MATLAB Stochastic Reachability Toolbox," Hybrid Systems: Control and Computation, 2019
- **A. Vinod***, V. Sivaramakrishnan*, and M. Oishi, "Piecewise-Affine Approximation-Based Stochastic Optimal Control with Gaussian Joint Chance Constraints," American Control Conference, 2019 (* equal contrib.)
- **A. Vinod***, S. Rice*, Y. Mao, M. Oishi, and B. Acikmese, "Stochastic Motion Planning Using Successive Convexification and Probabilistic Occupancy Functions," Conference on Decision and Control, 2018 (* equal contrib.)
- **A. Vinod** and M. Oishi, "Scalable Underapproximative Verification of Stochastic LTI Systems Using Convexity and Compactness," Hybrid Systems: Control and Computation, 2018 (**Finalist for best paper award**)
- **A. Vinod**, B. HomChaudhuri, and M. Oishi, "Forward stochastic reachability analysis for uncontrolled linear systems using Fourier Transforms," Hybrid Systems: Control and Computation, 2017 (**Best paper award**)
- **A. Vinod**, A. D. Mahindrakar, S. Bandyopadhyay, and V. Muralidharan, "A Deterministic Attitude Estimation Using a Single Vector Information and Rate Gyros," IEEE/ASME Transactions on Mechatronics, 2015

Relevant Courses

Online: Machine learning, Optimization (convex and discrete), Game theory

UNM: Probability and stochastic processes, Advanced calculus — I & II, Detection and estimation theory, Advanced probability theory, Complex systems theory, Multivariable control theory, Linear systems

IITM: Computer Methods in Electrical Engineering, Nonlinear systems, Mechanics of Robotic Manipulators, Fundamentals of Medical Instrumentation

Extra-curricular activities

PhoneGap application ..... May 2015
- Created a Phonegap application to visualize personal mobility data
- Used MQTT and Amazon AWS to complete this project in two weeks

TATA EngiNX Innovation Challenge ..... June 2013 – September 2013
- Collaborated on an Android application to recognize American Sign Language

Android Application Development ..... Summer 2013
- Developed a test-taking application for the placement team of the institute

Core member of Institute Electronics Club ..... August 2012 – May 2013
- Conducted three hands-on training sessions on development boards

FIRA Robosoccer World Cup ..... October 2011 – August 2013
- Led the Indian team in Robosoccer World Cup, 2013, held in Bristol, UK
- Implemented efficient control and communication protocols for the robots