Shantanu Thakar

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RESEARCH INTERESTS

- Physics aware motion planning of high degree of freedom systems • Artificial intelligence for robot task and motion planning • Machine learning and non-linear optimization for robotic applications

EDUCATION

PhD in Mechanical Engineering, University of Southern California, USA *Aug 2016 - Present*
Coursework: *AI, Deep Learning, Optimization, Planning for Autonomous Robots, Analytical Dynamics*
Master of Technology in Mechanical Engineering, IIT Bombay, India *Jul 2014 - May 2015*
Coursework: *Mobile Robotics, Non-linear Control, System Identification, Embedded Control*
Bachelor of Technology in Mechanical Engineering, IIT Bombay, India *Jul 2010 - May 2014*
Coursework: *Linear Algebra, Feedback Control, Kinematics and Dynamics of Robotic systems*

RESEARCH PROJECTS

Motion Planning for High-DOF Robotic Systems *Advisor:* Dr. S.K. Gupta, USC
- Developed motion planning algorithms for point-to-point motions in cluttered environments and efficient pick-up and transport operations for redundant manipulators and non-holonomic mobile manipulators.
- Devised sequential optimization based algorithms for constrained motion planning of high-DOF systems

Learning for High-Speed Grasping *Advisor:* Dr. S.K. Gupta, USC
- Developed an SVM based active machine learning approach to construct a meta-model for estimating the probability of successfully grasping objects under pose uncertainty with a fast moving gripper

Planning for Bi-manual Mobile Manipulation *Advisor:* Dr. S.K. Gupta, USC
- Designed search based spatial constraint checking and caching algorithms for task assignment and motion planning for bi-manual mobile manipulators resulting in 86% decrease in computation time as compared to traditional techniques.

INTERNSHIPS

Advanced Robotics Intern *Aug 2019 - Dec 2019*
Siemens Corporate Technology, Berkeley, CA, USA *Advisor*: Dr. Chengtao Wen
- Designed and implemented impedance and force control on Yaskawa Motoman GP50 robot in Gazebo using *ros_control* for robotic surface finishing applications
- Developed suction grasping heuristics for robotic pick-up of mobile phones to generate data in simulation. Trained deep neural network to learn the robot grasping pose from a bin of randomly placed phones.

Research Associate *Aug 2015 - Apr 2016*
Autonomous Vehicles Lab, IISc Bangalore, India *Advisor*: Dr. Ashwini Ratnoo
- Designed a virtual target guidance logic for path following of UAVs, such that with respect to the line-of-sight, the UAV maintains an equal and opposite lead angle of the virtual target. Resulted in a significantly faster ($> 100\%$) convergence to the desired path as compared to state-of-the-art

COMPUTER AND INDUSTRIAL ROBOT SKILL

- **Programming & Frameworks:** Python, C++, MATLAB, JAVA, TensorFlow, ROS, PyBullet, Gazebo, OMPL, MoveIt!, VREP, Solidworks, Simulink, Eigen, IPOPT, OpenCV
- **Robots:** Kuka LWR iiwa 7 and iiwa 14, EPSON C3, S5, Rethink Robotics Baxter, Clearpath Robotics Husky, Universal Robots UR5, InspectorBots Super Mega Bot, ABB IRB

SELECTED PUBLICATIONS (full list on website)

- **S. Thakar**, V. Annem, A. Kabir, P. Rajendran and S. K Gupta; "Accounting for Part Pose Estimation Uncertainties during Trajectory Generation for Part Pick-Up Using Mobile Manipulators "; IEEE ICRA 2019, Montreal, Canada
- **S. Thakar**, L. Fang, B. Shah and S. K Gupta; "Towards Time-Optimal Trajectory Planning for Pick-and-Transport Operation with a Mobile Manipulator"; In 14th IEEE CASE 2018, Munich, Germany
- **S. Thakar** and A. Ratnoo; "A Tangential Guidance Logic for Virtual Target Based Path Following"; AIAA Guidance, Navigation and Control Conference (GNC) 2017, Grapevine, Texas