Akshay Shetty

Curriculum Vitae

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217-819-7733
Stanford, CA

Education

Ph.D. Aerospace Engineering [thesis] — Champaign, Illinois
University of Illinois at Urbana-Champaign — **2017–2021**

M.S. Aerospace Engineering [thesis] — Champaign, Illinois
University of Illinois at Urbana-Champaign — **2014–2017**

B.Tech. Aerospace Engineering — Mumbai, India
Indian Institute of Technology Bombay — **2010–2014**

Research and Work Experience

Postdoctoral Researcher — Stanford, California
NAV Lab [website], Stanford University — **2021–2022**
Advisor: Prof. Grace Gao

- Led and supervised multiple research projects related to safe navigation and robust state estimation for autonomous robotic systems

Research Intern — Mountain View, California
NASA Ames Research Center — **Summer 2017**

- Developed software for vision-based autonomous UAV navigation and object detection as part of NASA's SAFE50 project [video][code]

Research Intern — Mountain View, California
NASA Ames Research Center — **Summer 2016**

- Led a team of 3 student interns to develop visual-tag-based autonomous UAV navigation while avoiding obstacles detected by time-of-flight proximity sensors [video][slides][code]

Visiting Research Student — Shrivenham, UK
Cranfield University — **Summer 2013**

- Improved ground vehicle dynamics in Virtual Battle Space (VBS) by importing high-fidelity models from IPG Carmaker, resulting in an improved training experience for VBS users

Research Intern — Bangalore, India
Indian Space Research Organization (ISRO) — **Summer 2012**

- Evaluated various existing localization algorithms for the then upcoming Indian Regional Navigation Satellite System

Publications

Deep Learning | State Estimation, Sensor Fusion | Motion and Trajectory Planning | Perception

Journal Papers

1. Tara Mina, Ashwin V. Kanhere, **Akshay Shetty**, and Grace Gao, "GPS Spoofing-Resilient Filtering with Chimera and Self-Contained Odometry," *NAVIGATION: Journal of the Institute of Navigation*, Submitted. [pdf]
2. **Akshay Shetty**, Timmy Hussain and Grace Gao, "Decentralized Connectivity Maintenance for Multi-robot Systems Under Motion and Sensing Uncertainties," *NAVIGATION: Journal of the Institute of Navigation*, Accepted. [pdf] [video]

3. Ashwin V. Kanhere*, Shubh Gupta*, **Akshay Shetty**, and Grace Gao, "Improving GNSS Positioning using Iterative Deep Corrections," *NAVIGATION: Journal of the Institute of Navigation*, Accepted. [pdf] [video]
4. **Akshay Shetty** and Grace Gao, "Predicting State Uncertainty Bounds Using Non-linear Stochastic Reachability Analysis for Urban GNSS-based UAS Navigation," *IEEE Intelligent Transportation Systems*, DOI: 10.1109/TITS.2020.3040517, November 2020. [pdf]
5. **Akshay Shetty** and Grace Gao, "Adaptive Covariance Estimation of LiDAR-based Positioning Errors for UAVs," *NAVIGATION: Journal of the Institute of Navigation*, DOI: 10.1002/navi.307, May 2019. [pdf]

Magazine Articles

1. **Akshay Shetty** and Grace Gao, "GPS-LiDAR Fusion with 3D City Models," *GPS World Magazine*, Cover Story, September 2017. [pdf]

Conference Papers

1. **Akshay Shetty**, Adam Dai, Alexandros Tzikas and Grace Gao, "Safeguarding Learning-Based Planners Under Motion and Sensing Uncertainties Using Reachability Analysis," *International Conference on Robotics and Automation (ICRA) 2023*, Submitted. [pdf] [video]
2. Shubh Gupta*, Ashwin V. Kanhere*, **Akshay Shetty**, and Grace Gao, "Designing Deep Neural Networks for Sequential GNSS Positioning," *Proceedings of the Institute of Navigation GNSS+ conference (ION GNSS+ 2022)*, Denver, CO, Sep. 2022. **Best Presentation of the Session Award**. [pdf][slides][video]
3. Tara Mina, Ashwin V. Kanhere, **Akshay Shetty**, and Grace Gao, "GPS Spoofing-Resilient Filtering with Chimera and Self-Contained Odometry," *Proceedings of the Institute of Navigation GNSS+ conference (ION GNSS+ 2022)*, Denver, CO, Sep. 2022. [pdf][slides][video]
4. Ashwin V. Kanhere, Tara Mina, **Akshay Shetty**, and Grace Gao, "Factor Graph-based Spoofing Mitigation using the Chimera Signal Enhancement," *Proceedings of the Institute of Navigation GNSS+ conference (ION GNSS+ 2022)*, Denver, CO, Sep. 2022. [pdf][slides][video]
5. **Akshay Shetty**, Timmy Hussain and Grace Gao, "Decentralized Connectivity Maintenance for Multi-robot Systems Under Motion and Sensing Uncertainties," *Proceedings of the Institute of Navigation GNSS+ conference (ION GNSS+ 2021)*, St. Louis MO, Sep. 2021. **Best Presentation of the Session Award**. [pdf][slides][video]
6. Ashwin V. Kanhere*, Shubh Gupta*, **Akshay Shetty**, and Grace Gao, "Improving GNSS Positioning using Iterative Deep Corrections," *Proceedings of the Institute of Navigation GNSS+ conference (ION GNSS+ 2021)*, St. Louis MO, Sep. 2021. [pdf][slides][video][code]
7. **Akshay Shetty** and Grace Gao, "Trajectory Planning Under Stochastic and Bounded Sensing Uncertainties Using Stochastic Reachability," *Proceedings of the Institute of Navigation GNSS+ conference (ION GNSS+ 2020)*, St. Louis MO, Sep. 2020. [pdf][slides][video]
8. **Akshay Shetty** and Grace Gao, "Predicting State Uncertainty for GNSS-based UAV Path Planning Using Stochastic Reachability," *Proceedings of the Institute of Navigation GNSS+ conference (ION GNSS+ 2019)*, Miami FL, Sep. 2019. [pdf][slides]
9. **Akshay Shetty** and Grace Gao, "UAV Pose Estimation using Cross-view Geolocalization with Satellite Imagery," *International Conference on Robotics and Automation (ICRA)*, Montreal, Canada, May 2019. [pdf][video][data]
10. **Akshay Shetty** and Grace Gao, "Covariance Estimation for GPS-LiDAR Sensor Fusion for UAVs," *Proceedings of the Institute of Navigation GNSS+ conference (ION GNSS+ 2017)*, Portland OR, Sep. 2017. [pdf]
11. **Akshay Shetty** and Grace Gao, "Vision-Aided Measurement Level Integration of Multiple GPS Receivers for UAVs," *Proceedings of the Institute of Navigation GNSS+ conference (ION GNSS+ 2015)*, Tampa FL, Sep. 2015. [pdf]

12. **Akshay Shetty** and Grace Gao, "Measurement Level Integration of Multiple Low-Cost GPS Receivers for UAVs," *Proceedings of the International Technical Meeting of the Institute of Navigation (ION ITM 2015)*, Dana Point, CA, Jan. 2015. [pdf]

Additional Projects

Active Sensing for Robot Localization
Course project [presentation] **Fall 2018**
- Implemented reinforcement learning to actively point sensors towards feature-rich areas

Deep Learning for LiDAR Odometry
Course project [report] **Fall 2017**
- Designed convolutional networks to estimate LiDAR odometry; setup simulator in Unity game engine to generate training, validation and test data [video]

Parallel Point Cloud Feature Extraction
Course project [report] **Spring 2017**
- Developed parallel CUDA-accelerated algorithms for feature extraction from 3D point clouds; evaluated algorithms on a NVIDIA Jetson TX2 connected to a Velodyne LiDAR

UAV Simulation Environment
Course project **Spring 2016**
- Built a simulator in MATLAB to visualize path planning algorithms with obstacle avoidance; simulator was later used in *UAV Navigation and Control* (AE483) lab course taught at UIUC

Skills

Sensors	GPS, Camera, LiDAR, IMU, proximity sensors
Programming	Python, C++, MATLAB, C#
Learning and Robotics	PyTorch, ROS, AirSim, Unity, Gazebo, Pixhawk

Honors and Awards

2022 Best Presentation of the Session Award [video], *ION GNSS+ 2022*
2021 Best Presentation of the Session Award [video], *ION GNSS+ 2021*
2019 Video of the Month [video], *Coordinated Science Lab, University of Illinois*
2016 Google Special Mention, *HackIllinois*
2015 Most Creative Team, *Smart Bar Hackathon*
2014 Institute Silver Medal, *Indian Institute of Technology Bombay*

Academic Community Service

Session Chair, *ION ITM Conference* [website] **Jan 2022**
Session: Navigation of Unmanned Aerial Vehicles and other Autonomous Systems

Student Moderator, *3rd NorCal Controls Workshop* [website] **Jan 2021**
Virtual

Paper Reviewer
IEEE Transactions on Robotics (T-RO); International Conference on Robotics and Automation (ICRA); NAVIGATION: Journal of The Institute of Navigation; IEEE Transactions on Aerospace and Electronic Systems (T-AES); AIAA Journal of Guidance, Control, and Dynamics (JGCD).