Akshay Shetty

Curriculum Vitae

[Personal website]
akshay.shetty160992@gmail.com
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**

- Initiated and supervised research projects related to safe perception-based navigation and robust localization for autonomous robotic systems, leading to multiple journal and conference publications

Graduate Research Assistant — Champaign, Illinois
Grace Gao Research Group [website], UIUC — **2014–2021**

- Worked on research projects related to multi-sensor fusion (cameras, GPS, LiDAR, etc.) and trajectory planning. Being one of the initial lab members, initiated research agendas, made important purchasing recommendations and mentored incoming students. Key projects include:
  - adaptively estimating covariance of LiDAR-based positioning errors for GPS-LiDAR sensor fusion aided by 3d city models [pdf][video]
  - estimating relative pose between a UAV image and satellite imagery using ConvNets; integrating pose output with feature-based visual odometry for global localization [pdf][video]
  - ensuring safety of learning-based trajectory planners using reachability analysis [pdf][video]

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

- Setup the experimental testbed for NASA's SAFE50 project: developed software for visual SLAM-based autonomous UAV navigation and implemented onboard learning-based object detection for daily household items [video][code]

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

- Mentored and led a team of 3 student interns to develop visual-tag-based autonomous UAV navigation with obstacle avoidance using time-of-flight proximity sensors [video][slides][code]

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

- Improved Virtual Battle Space (VBS) training experience for defence personnel by developing and importing high-fidelity vehicle models from IPG Carmaker

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

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

Relevant Projects

Autonomous Multi-robot Exploration
DARPA Subterranean (SubT) Challenge - Virtual **Summer 2019**
- Developed autonomous navigation solutions for multiple robots exploring underground environments; adapted existing learning-based object detectors to detect a pre-specified list of artifacts; qualified as a preliminary finalist while participating as a one-member team [announcement]

Active Sensing for Robot Localization
Course project [presentation] **Fall 2018**
- Applied Reinforcement Learning to actively point limited field-of-view sensors at feature-rich areas

Deep Learning for LiDAR Odometry
Course project [report] **Fall 2017**
- Designed Convolutional Neural Networks to estimate LiDAR odometry; set up 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

Publications

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

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*, DOI: 10.33012/navi.548, December 2022. [pdf][video][code]
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][video]

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*, Accepted. [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]

Skills

Sensors	GPS, Cameras, LiDAR, IMU, proximity sensors
Programming	Python, C++, MATLAB, Git
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

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).

Teaching

Collaborator, AA173: *Flight Mechanics and Controls* **Spring 2021**
Stanford University

Lab and Teaching Assistant, AE483: *UAV Navigation and Control* **Fall 2015 & Fall 2016**
University of Illinois at Urbana-Champaign

Teaching Assistant, AE353: *Aerospace Control Systems* **Spring 2016 & Spring 2015**
University of Illinois at Urbana-Champaign

Teaching Assistant, *Dynamics and Control in State-Space* **Summer 2014**
Indian Institute of Technology Bombay

Teaching Assistant, MA214 *Numerical Analysis* **Summer 2014 & Fall 2013**
Indian Institute of Technology Bombay