

Takuma Nakamura

Website: takumanakamura.net/English

Expertise

Sensor Fusion

- Linear/nonlinear filters such as Kalman filter, unscented Kalman filter, and particle filter with an emphasis on sensor fusion of vision and other onboard sensors on autonomous systems
- Principles of probability, random variables, linear algebra, and relevant mathematics

Computer Vision

- Extensive experience in categorization, recognition, detection, and object proposal
- Machine learning and deep learning frameworks for computer vision applications

Education

Georgia Institute of Technology, Atlanta, GA

Aerospace Engineering, Ph.D.

Aug. 2015 - Aug. 2018 (Expected)

Aerospace Engineering, M.S.

Aug. 2013 - Aug. 2015

Tohoku University, Sendai, Japan

Aerospace Engineering, B.S.

April 2009 - March 2013

Professional Experience

Georgia Institute of Technology

Graduate Research Assistant

May 2014 - May 2017, Aug. 2017 - Current

- Developing a model for UAS traffic management (UTM) to predict a trajectory of a small UAS
- Improving the base of aircraft data (BADA) to accommodate models of small UASs
- Participating in NASA Small Unmanned Aircraft System Trajectory Modeling Approaches

Amazon Prime Air

Research Scientist Intern

May 2017 - Aug. 2017

- Developed hardware and software to collect visual and inertial data to validate navigation algorithm
- Responsible for statistical and numerical tests of visual inertial navigation algorithms

Selected Research Experience

Mohamed Bin Zayed International Robotics Challenge

Computer Vision Engineer

Nov. 2015 - March 2016

- Devised a particle filter architecture for a UAV to autonomously land on a moving truck
- Updated an existing software written in C++ to detect a visual target placed on a landing location
- Developed a vision algorithm to detect a colored package for a UAV to autonomously pick up

2016 DJI Developer Challenge

Computer Vision Engineer

Jan. 2016 - July 2016

- Developed a ROS code that enables marker-based 9-DOF target tracking using onboard camera
- Qualified for the 3rd round of the challenge, which includes top 15 of 100 teams

2015 American Helicopter Society International 3rd Annual MAV Student Challenge

Computer Vision Engineer

Oct. 2014 - May 2015

- Developed a C/C++ software to integrate machine-learning-based vision measurements in an EKF framework
- Won 1st prize (\$5,000) by autonomously detecting a target and landing on the target with a 500 g UAV

2011 Japan International Human Powered Aircraft Rally (a.k.a Birdman Rally)

Chief Cockpit Designer & Pilot

Aug. 2009 - July 2011

- Designed a cockpit of a human-powered airplane that was made of CFRP and led the assembly team
- Piloted the human-powered airplane in the competition in 2011 and recorded 18 km in 90 minutes
- Won 1st prize (\$10,000) and the best pilot award

Skills and Certifications

Programming: C (fluent), C++ (fluent), Matlab (fluent), Latex (advanced), Python (basic), html (basic), php (basic)

Library: ROS, OpenGL, OpenCV, Eigen, dlib, GLUT, SDL, VLFeat, MatConvNet, rviz, gazebo

Software Development: git, vim, CMake, doxygen, graphviz, eclipse, Subversion, docker

Technical: Pro/Engineer, GIMP, CATIA, Confluence, JIRA

Instrumentation: VICON, OptiTrack, Arduino, Raspberry Pi, ARM (Cortex M3), AVR(ATmega 328, Atmega168)

Language: English (fluent), Japanese (native), German (basic)

Certifications: FAA private pilot, FAA small UAS pilot, PADI advanced SCUBA diver

Selected Publications

Vision-Based Landing

1. **T. Nakamura**, D. Magree, E. N. Johnson, "Estimation Techniques in Robust Vision-Based Landing of Aerial Vehicles," Proceedings of the 20th IFAC World Congress, July 2017
2. **T. Nakamura**, S. Haviland, D. Bershadsky, E. N. Johnson, "Vision Sensor Fusion for Autonomous Landing," Proceedings of the AIAA SciTech Forum, January 2017
3. **T. Nakamura**, S. Haviland, D. Bershadsky, E. N. Johnson, "Vision- Based Optimal Landing on a Moving Platform," Proceedings of the 72nd AHS Annual Forum and Technology Display, May 2016

Detection & Tracking from Airborne Images

4. **T. Nakamura**, S. Haviland, D. Bershadsky, D. Magree, E. N. Johnson, "Particle Filter for Closed-Loop Recognition and Tracking from Occluded Airborne Images," Proceedings of the IEEE International Conference on Unmanned Aircraft Systems (ICUAS), June 2017
5. **T. Nakamura**, E. N. Johnson, "Vision-Based Multiple Model Adaptive Estimation of Ground Targets from Airborne Images," Proceedings of the IEEE International Conference on Unmanned Aircraft Systems (ICUAS), June 2016
6. **T. Nakamura**, S. Haviland, D. Bershadsky, D. Magree, E. N. Johnson, "Vision-Based Closed-Loop Tracking Using Micro Air Vehicles," Proceedings of the IEEE Aerospace Conference, March 2016

Small UAS Traffic Management

7. L. Ren, M. C. Effen, H. Yu, E. Johnson, Y. Yoon, **T. Nakamura**, C. A. Ippolito, "Small Unmanned Aircraft System (sUAS) Categorization Framework for Low Altitude Traffic Services," Proceedings of the IEEE/AIAA Digital Avionics Systems Conference (DASC), September 2017
8. L. Ren, M. C. Effen, H. Yu, E. Johnson, **T. Nakamura**, Y. Yoon, C. A. Ippolito, "Small Unmanned Aircraft System (sUAS) Trajectory Modeling in Support of UAS Traffic Management (UTM)," Proceedings of the AIAA Aviation, June 2017

Other Aerospace

9. H. Mehmood, **T. Nakamura**, E. N. Johnson, "A Maneuverability Analysis of a Novel Hexarotor UAV Concept," Proceedings of the IEEE International Conference on Unmanned Aircraft Systems (ICUAS), June 2016
10. K. Nagatani, K. Akiyama, G. Yamauchi, H. Otsuka, **T. Nakamura**, S. Kiribayashi, "Volcanic Ash Observation in Active Volcano Areas using Teleoperated Mobile Robots," Proceedings of the IEEE International Workshop on Safety, Security, and Rescue Robotics (SSRR), October 2013
11. **T. Nakamura**, S. Kiribayashi, K. Nagatani, K. Yoshida, "Development of an Omnidirectional Airspeed Indicator for Multi-rotor UAVs," Proceedings of the JSASS-H031, March 2013

Selected Awards

- AHS Micro Air Vehicle Student Challenge Autonomous Category First Prize, \$5,000 May 2015
- AHS Micro Air Vehicle Student Challenge Manual Category First Prize, \$3,000 May 2015
- Funai Overseas Scholarship, Tuition and Living Expenses for Two Years Aug. 2013 - July 2015
- Japan International Human-Powered Aircraft Rally First Prize, \$10,000 July 2011

Review Activities

- AIAA SciTech Forum 2016 and 2017
- IEEE International Conference on Robotics and Automation (ICRA) 2016 and 2017