

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, and relevant mathematics.

Computer Vision

- Extensive experience in categorization, recognition, detection, and object proposal gained through coursework and research.
- Machine learning and deep learning frameworks for computer vision applications.

Education

Georgia Institute of Technology

Aerospace Engineering, Ph.D.

Atlanta, GA

Aug. 2015 – Dec. 2017 (Expected)

Thesis: “Adaptive Particle Filter for Closed-Loop Tracking from Occluded Airborne Images”

Georgia Institute of Technology

Aerospace Engineering, M.S.

Atlanta, GA

Aug. 2013 – Aug. 2015

Master’s Project: “Vision-Based Closed-Loop Detection and Tracking Using Micro Air Vehicles”

Tohoku University

Aerospace Engineering, B.S.

Sendai, Japan

April 2009 – March 2013

Thesis: “Development of an Omnidirectional Airspeed Indicator for Multi-rotor UAVs”

Experience

Mohamed Bin Zayed International Robotics Challenge

Computer Vision Engineer

Nov. 2015 – Current

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

NASA Small Unmanned Aircraft System Trajectory Modeling Approaches

Graduate Research Assistant

April 2016 – Current

- Develop a model for UAS traffic management (UTM) to predict a trajectory of a small UAS
- Improve the base of aircraft data (BADA) to accommodate models of small UASs
- Verify a new model through a high fidelity simulator and flight tests

2016 DJI Developer Challenge

Computer Vision Engineer

Jan. 2016 – July 2016

- Coded a ROS node that enables target tracking using DJI Matrice 100 through a Zenmuse X3 camera
- Developed a software that utilizes a detection of AprilTag in an extended Kalman filter framework
- Qualified for the 3rd round of the challenge, which includes top 15 of 100 teams

2015 AHS International 3rd Annual MAV Student Challenge

Computer Vision Engineer

Oct. 2014 – May 2015

- Trained and tested a Viola-Jones object detection framework using machine learning for target tracking
- Developed a C/C++ software to integrate vision measurements in an extended Kalman filter 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 lead 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 (Advanced), Python (Basic), html (Basic), php (Basic)

Library: OpenGL, OpenCV, pthread, GLUT, SDL, VLFat, MatConvNet

Technical: ROS, rvis, gazebo, git, vim, eclipse, CMake, Subversion, doxygen, graphviz, LaTeX, GIMP, Pro/Engineer, VICON, 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

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 Robotics and Automation (ICRA), May 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

Other Aerospace

7. 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
8. K. Nagatani, K. Akiyama, G. Yamauchi, H. Otsuka, **T. Nakamura**, S. Kiribayashi, "Volcanic Ash Observation in Active Volcano Areas using Teleoperated Mobile Robots -Introduction to Our Robotic-Volcano-Observation Project and Field Experiments-," Proceedings of the IEEE International Workshop on Safety, Security, and Rescue Robotics (SSRR), Oct 2013
9. **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
10. H. Otsuka, **T. Nakamura**, S. Kiribayashi, K. Nagatani, K. Yoshida, "Analysis of Thrust Change in Different Altitude Conditions for Small Rotary-Wing UAVs Propellers," Proceedings of the JSASS-H028, March 2013
11. T. Katsura, **T. Nakamura**, T. Shirahata, "Measures to Land and Sea Breeze on the Japan International Birdman Rally," Proceedings of the JSASS Sky Sports Symposium 17, 69-72, Nov 2011

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