

Aman Tiwary

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EDUCATION

Aug 2024	MS in Mechanical Engineering Advised by Prof. Behçet Açıkmese, Aeronautics & Astronautics <u>Relevant Courses:</u> Convex Optimization, Intelligent Controls, Multivariable Controls, Probabilistic Robotics, Computer Vision <u>GPA:</u> 3.80/4.0	UNIVERSITY OF WASHINGTON
May 2017	BE in Mechanical Engineering Advised by Prof. Sudip Das, Space Engineering and Rocketry <u>Relevant Courses:</u> Data Structures & Algorithms, Finite Element Method, Design of Machine Element <u>GPA:</u> 7.91/10.0	BIRLA INSTITUTE OF TECHNOLOGY, MESRA

RESEARCH INTERESTS

I am deeply intrigued by leveraging active vision to enhance robust autonomous robot navigation. My research explores the synthesis of active vision techniques and the guarantees of convex optimization-based guidance methods to generate safe and efficient trajectories in real-time for robots navigating uncertain environments while achieving a specified goal (e.g., search and rescue operations, environmental monitoring, object reconstruction, scene exploration, and inspection). I am interested in exploring:

- **Viewpoint space optimization for Model-based navigation:** Formulating an optimal control problem given an imaging environment and target object to incorporate the visual sensor's constraints (e.g., Resolution, Focus, Field of View) as well as positioning system constraints (e.g., Degree of Freedom)
- **Non-Model-based navigation (Active Vision):** Autonomously navigating through an unknown environment by formulating information gain through visual sensors and rewarding uncovering new information
- **Localization and Mapping:** Identifying a sequence of sensor pose and associated controllable parameters for building a complete high-quality map of an unknown environment
- **Real-time Trajectory Optimization with perception in loop**

PUBLICATIONS

CONFERENCES

- [C1] Skye Mceowen, **Aman Tiwary**, Daniel Calderone, Taewan Kim, Behcet Acikmese, "Hypersonic Reentry Guidance with Continuous Time Constraint Satisfaction," AIAA SciTech 2025 (Submitted)
- [C2] Skye Mceowen, Daniel Calderone, **Aman Tiwary**, Jason Zhou, Taewan Kim, Purnanand Elango, Behcet Acikmese "Auto-Tuned Primal-Dual Successive Convexification for Hypersonic Reentry Guidance," AIAA SciTech 2025 (Submitted)

RESEARCH WORK

Mar. 2022 - Current	UW Autonomous Controls Laboratory (ACL) Trajectory Optimization for 3D scene reconstruction: (Master's Thesis) Advised by: Dr. Behçet Açıkmese Developed 6DOF quad-rotor trajectory planning package (C++, Python), integrating active vision techniques with convex optimization-based guidance methods (Successive Convexification with state-triggered line of sight constraints)	WA, USA
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Built a guidance framework to generate feasible trajectories for continuous acquisition of high-resolution images of the target object in complex environments resulting in high-quality **point cloud reconstruction**

Active View Planning with Guaranteed Keypoint Coverage :

Developed and implemented a novel framework for **view plan optimization** by formulating the problem in the sensor frame and imposing hard constraints on the sensor's field of view. This transformed the problem into a **convex optimization** problem and provided mathematical guarantees for keypoint coverage.

Student Assistant:

Maintaining **Trajectory Optimization** software library for live flight demonstrations with quad-rotor (**C++**) that directly contributed to successful execution of **20+** live flight demonstrations involving complex aerial maneuvers with quad-rotors

Developing next generation of drone hardware to support perception and onboard trajectory computing tasks

Sep. 2022 - Dec. 2022

Reinforcement Learning for Flying Insect Robots (CSE571)

Low-power Reinforcement learning on Visual Confined-Space Navigation for Insect-scale Robots : Implemented the Proximal Policy optimization method in AirSim (Microsoft Simulator) to train a quadrotor equipped with cameras on the left and right sides to autonomously navigate the corridor without colliding. The optical flow map from the left and right camera was the observation, which was processed and fed to the PPO network; the quadrotor's position and collision information was the state

Jan. 2022 - May. 2022

UW Formula Motorsports(UWFM) - Driverless

WA, USA

Developed dynamic vehicle's bicycle model in Python and used it to develop a Model Predictive Controller to find an optimal set of control inputs for the vehicle to go around the track quickly and efficiently

Jan. 2022 - Mar. 2022

Denoising Image for Classification using Autoencoders (CSE455)

Developed and trained a Convolutional Autoencoder to denoise an image for classification(MNIST Dataset) using Pytorch(project) with a minimum classification accuracy of **76.5%** at a noise factor of 0.9(Gaussian noise)

Aug. 2016 - May. 2017

Design Optimisation of a Car Underbody Diffuser for Obtaining Maximum Downforce (Undergraduate Thesis) Advised by: Dr. Sudip Das, Professor,

JH, IND

Conceptualized and Simulated the undertray design with the car in optimum lap, demonstrating an improvement of 2.5% in a lap time of the car without undertray

May. 2014 - May. 2016

Design of a formula student chassis according to lateral load transfer distribution Team Srijan(Formula Student)

JH, IND

Developed a mathematical model of a flexible chassis and an infinitely stiff chassis based on roll stiffness distribution and lateral load transfer distribution and plotted the variation of chassis stiffness with respect to weight distribution

Determined the chassis members based on FEM simulations on ANSYS APDL that have the major contribution in torsional stiffness and Optimized the weight of the chassis by varying the cross-section and relocating the tubes while maintaining the stiffness.

INDUSTRY EXPERIENCE

Jun. 2022 - Sep. 2022

Monarch Tractor - Controls Engineering Intern(HW)

CA, USA

Performed system identification of an Electro-Hydraulic Steering Actuator and used it to design a feedforward steering controller, which improved the steering response by 100 ms

2017 - 2021

Tata Motors Ltd

MH, IND

Jul. 2018 - Jul. 2021

Senior Manager | Cost Engineering

Led Cross-Functional Team for Gearbox and Engine Cooling System of Bharat Stage 6 vehicles and identified cost reduction opportunities through DFMA, cost-driver analysis, Linear Performance Pricing, and VAVE with key contributions worth \$ 2 million in potential savings for commercial and passenger vehicle

Aug. 2017 - Jul. 2018

Graduate Engineer Trainee | Sales & Marketing

Oversaw sales team of 3 dealerships and facilitated sales of Buses and small commercial passenger vehicles in Gujarat, contributing to an increase in market visibility from 80% to 92% and an increase in market share by 4%

MENTORSHIP

UNDERGRADUATES

Edgerton M Cook (Mechanical Engineering at the University of Washington)
Phuong Le (Aeronautics and Astronautics at the University of Washington)

SKILLS

PROGRAMMING

Competent with **C/C++**, **Python**, **MATLAB**, **Simulink**

LIBRARIES

Competent with **Eigen**, **PCL**, **CVXPY**, **OpenCV**, **Open3D**

DESIGN/SIMULATION

Competent with **AirSim**, **Rerun**, **Solidworks**, **AutoCAD**, **ANSYS**

MATHEMATICAL SKILLS

Competent with **Linear Algebra**, **Convex Optimization**

REFERENCES

BEHÇET AÇIKMEŞE

- **Position:** Professor, Aeronautics and Astronautics Department, University of Washington
- **Relationship:** Master's Advisor, Autonomous Controls Lab PI
- **Email:** behcet@uw.edu

SUDIP DAS

- **Position:** Professor, Space Engineering and Rocketry, Birla Institute of Technology, Mesra
- **Relationship:** Undergraduate Advisor
- **Email:** sudipdas@bitmesra.ac.in