

ANKIT V. MANERIKAR

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❖ SUMMARY:

A PhD candidate with a wide research and industry experience in the field of Tomographic Image Processing, Computer Vision, Robotics and Machine Learning spanning a period of seven years, with authorship in multiple publications and encompassing contribution to over eight labs and companies.

❖ EDUCATION:

Purdue University, USA.	Doctor of Philosophy (PhD) Major: Electrical and Computer Engineering	May 2021 (Expected)
Purdue University, USA.	Master of Science Major: Electrical and Computer Engineering	Aug 2017
University of Mumbai, India	Bachelor of Engineering Major: Electronics Engineering Division: First Class with Distinction (1 st Rank)	July 2015
SBM Polytechnic, India	Pre-University Course (Engineering Diploma) Major: Industrial Electronics Engineering Division: First Class with Distinction (1 st Rank)	July 2012

❖ RESEARCH EXPERIENCE:

• Robot Vision Lab, Purdue University

Advisor: Dr. Avinash Kak

Jan 2017 – Present

Designation: Graduate Research Assistant

West Lafayette

Major Projects:

▣ **BAA-1703 Contract on Dual Energy ATR for Airport Security:**

A DoHS (Department of Homeland Security) project to research deep learning and adaptive boosting methods for threat detection in airport checkpoint security using Dual Energy CT security screeners.

Contributions:

▣ ***BagGAN – A GAN-based Data Augmentation Tool for Baggage CT Scans:***

This research focuses on a mitigating the data availability problem for threat detector design for baggage security screening. Our proposed approach uses adversarial networks to produces new samples for threat detection using artificial target image projection onto threat-free baggage scans.

▣ ***DEBISim - An X-ray Dataset Simulator for Material Detection using Multi-energy X-ray Scanners:***

The initiative aims at a designing a deep-learning based CT simulation/data augmentation framework for X-ray image data generation to aid the testing/training of machine learning algorithms for threat detection with Single-/Dual-energy CT screening.

▣ ***Classifier Design for 3D Segmentation using Dual Energy X-ray Tomography:***

This project involves the design of improved classifier frameworks for X-ray based object detection using density and atomic number data from Dual Energy CT – it encompasses decomposition algorithms for Dual Energy CT as well as 3D object segmentation/classification.

▣ **ALERT TO-7 Adaptive ATR Initiative:**

An ALERT-sponsored project on Adaptive Automatic Target Recognition (AATR) for CT-based Threat Object Detection Systems for airport baggage screening.

Contributions:

▣ ***Adaptive Automatic Target Recognition (AATR) for CT-Based Object Detection Systems:***

This project which was a part of the ALERT ATR Initiative involved the design of an Automatic Target Recognition System for adaptively segmenting and identifying target objects of varying specifications – the design involves a hierarchical supervoxel segmenter coalesced with an AdaBoost classifier for object detection.

▫ **Hierarchical Map Building for Multi-Sensor SLAM:**

The research topic deals with the design of a Hierarchical Sensor Fusion Architecture for SLAM - the system is designed for autonomous navigation on a Pioneer PowerBot equipped with Stereo Cameras and LiDARs.

Major Publications:

- Manerikar, Ankit, Fangda Li and Avinash C. Kak. "DEBISim: A Simulation Pipeline for Dual Energy X-ray Baggage Inspection Systems." *Journal of X-ray Science and Technology*, Vol. 29.1, 2020 (Pre-print).
- Manerikar, Ankit, Tanmay Prakash, and Avinash C. Kak. "Adaptive target recognition: A case study involving airport baggage screening." *Anomaly Detection and Imaging with X-Rays (ADIX) V*. Vol. 11404. International Society for Optics and Photonics, 2020. [\[pdf\]](#)
- Manerikar, Ankit, Fangda Li, and Avinash Kak. "A Spectrum-Adaptive Decomposition Method for Effective Atomic Number Estimation using Dual Energy CT." IS&T Electronic Imaging: *Computational Imaging VIII, IS&T International Symposium on Electronic Imaging*, 2020. [\[pdf\]](#)
- Li, Fangda, Ankit Manerikar, Tanmay Prakash, and Avinash Kak. "A Splitting-Based Iterative Algorithm for GPU-Accelerated Statistical Dual-Energy X-Ray CT Reconstruction." IS&T Electronic Imaging: *Computational Imaging VIII, IS&T International Symposium on Electronic Imaging*, 2020. [\[pdf\]](#)
- Li, Fangda, Ankit Manerikar, and Avinash C. Kak. "RMPD—A Recursive Mid-Point Displacement Algorithm for Path Planning." In *Twenty-Eighth Intl. Conference on Automated Planning and Scheduling*. 2018. [\[pdf\]](#)

● **Digital Photogrammetry Research Group, Purdue University**

Advisors: Dr. Ayman Habib, Dr. Melba Crawford

Jun 2016 – May 2017

Designation: Graduate Researcher (Master's Degree)

West Lafayette

Major Projects:

- ***SLAM-Assisted Coverage Path Planning for Lidar Mapping Systems:***
The research for this project was centred on the development of an efficient Coverage Path Planner for Mapping Vehicles. The developed planner uses a variant of the Exact Cellular Decomposition Method using MSA optimality criterion to implement a routing algorithm to be used with online SLAM.
- ***Pseudo-GNSS/INS Systems for Terrestrial/Aerial Photogrammetry Using Online SLAM:***
This implementation encompasses a SLAM-based Pseudo-GNSS/INS system for a Mapping Vehicle equipped with LiDARs and Cameras to operate in GPS-devoid environments. The system has been successfully implemented for indoor terrestrial Lidar Mapping Systems on a prototype Roomba ICreate2 and using Velodyne 3D LiDARs.

Major Publications:

- Shamseldin, Tamer, Ankit Manerikar, Magdy Elbahnasawy, and Ayman Habib. "SLAM-based Pseudo-GNSS/INS localization system for indoor LiDAR mobile mapping systems." In *2018 IEEE/ION Position, Location and Navigation Symposium (PLANS)*, pp. 197-208. IEEE, 2018. [\[pdf\]](#)
- Manerikar, Ankit, Tamer Shamseldin, and Ayman Habib. "SLAM-Assisted Coverage Path Planning for Indoor LiDAR Mapping Systems." *arXiv preprint arXiv:1811.04825* (2018). [\[pdf\]](#)

❖ **TEACHING EXPERIENCE:**

● **Purdue University – West Lafayette**

Jan 2016 – May 2017

Designation: Graduate Teaching Assistant

West Lafayette

- Assisted undergraduate students for the course ECE 38200: *Feedback System Analysis and Design*.
- Carried out sessions to teach students practical controller and compensator design using MATLAB tools.

❖ **PUBLICATIONS:**

- Manerikar, Ankit, Fangda Li and Avinash C. Kak. "DEBISim: A Simulation Pipeline for Dual Energy X-ray Baggage Inspection Systems." *Journal of X-ray Science and Technology*, Vol. 29.1, 2020 (*Under Review*).
- Manerikar, Ankit, Tanmay Prakash, and Avinash C. Kak. "Adaptive target recognition: A case study involving airport baggage screening." *Anomaly Detection and Imaging with X-Rays (ADIX) V*. Vol. 11404. International Society for Optics and Photonics, 2020. [\[pdf\]](#)
- Manerikar, Ankit, Fangda Li, and Avinash Kak. "A Spectrum-Adaptive Decomposition Method for Effective Atomic Number Estimation using Dual Energy CT." IS&T Electronic Imaging: *Computational Imaging VIII, IS&T International Symposium on Electronic Imaging*, 2020. [\[pdf\]](#)

- Li, Fangda, Ankit Manerikar, Tanmay Prakash, and Avinash Kak. "A Splitting-Based Iterative Algorithm for GPU-Accelerated Statistical Dual-Energy X-Ray CT Reconstruction." *IS&T Electronic Imaging: Computational Imaging VIII, IS&T International Symposium on Electronic Imaging*, 2020. [pdf]
- Li, Fangda, Ankit V. Manerikar, and Avinash C. Kak. "RMPD—A Recursive Mid-Point Displacement Algorithm for Path Planning." In *Twenty-Eighth International Conference on Automated Planning and Scheduling*. 2018. [pdf].
- Shamseldin, Tamer, Ankit Manerikar, Magdy Elbahnasawy, and Ayman Habib. "SLAM-based Pseudo-GNSS/INS localization system for indoor LiDAR mobile mapping systems." In *2018 IEEE/ION Position, Location and Navigation Symposium (PLANS)*, pp. 197-208. IEEE, 2018. [pdf]
- Manerikar, Ankit, Tamer Shamseldin, and Ayman Habib. "SLAM-Assisted Coverage Path Planning for Indoor LiDAR Mapping Systems." *arXiv preprint arXiv:1811.04825* (2018). [pdf]
- Manerikar, Ankit, and Anandpara, Tanvi. "Design of a Practical Cat-righting Reflex (CRR) Model." *Procedia Computer Science* 45 (2015): 514-523. [pdf][GitHub]
- Manerikar, Ankit, and Anandpara, Tanvi. "Position Control Using Ultrasonic Levitation Assembly." *Proceedings of DJ Spark 2015* (2015): 119-123.
- Manerikar, Ankit, and Khan, Shahid. "Particle Swarm Optimization in Control System Design." *IEEE Technomania* (2013), *FRCRE*, Mumbai.

❖ AWARDS AND HONORS:

- **J.R.D. Tata Trust Scholarship Award** Merit-based Scholarship for Undergraduate Students for the academic years: 2012-13, 2013-14.
- **Best Student Paper Award** "Particle Swarm Optimization in Control Systems Design", *IEEE Technomania 2013*
- **Student Award for Academic Merit** 1st Rank in B.E. (Electronics, DJSCoE), 6th Rank in University of Mumbai.
- **Juhu Lions Club Scholarship Award** Scholarship for 1st Rank in Industrial Electronics for the academic years: 2008-09, 2009-10, 2010-11, 2011-12.

❖ PROFESSIONAL EXPERIENCE:

- **Gade Autonomous Systems** June 2016 - July 2016
Designation: Intern: Machine Learning, Firmware & Robotics **Mumbai/Frankfurt**
 - Headed the team for Cortex M4F-based Firmware development of smart devices for fitness/automotive applications.
 - Designed HMM Machine Learning Algorithms for smart networks with inertial and IR sensing systems.
- **Citizen Scales India (P) Ltd.** Dec 2011 - May 2012
Designation: Research Intern/Co-op **SEEPZ, Mumbai**
 - Collaborated with a team of Firmware Engineers for design of a Moisture Analysis Device on an ARM7 platform.
 - Implemented Regression-based algorithms for Temperature Compensation in Micro-Precision Weighing Scales.
- **Technophilia Systems** June 2010 – Nov 2010
Designation: Robotics Intern /Co-op **Mumbai**
 - Designed a Partial Gait Model for the Autonomous Navigation of a Biped.
 - Designed navigation algorithms on an Atmega-XX platform and with a centroid-based object-tracking algorithm.
- **Consultancy Projects:**
 - **Rollform Equip. Pvt. Ltd.** (New Delhi, India): "*Shear Measurement System for Rotary Blade Cutter*" - A. Choudhury.
 - **S M Technocrats Pvt. Ltd.** (New Delhi, India): "*Efficiency Analysis for HF Induction Tube Welding*" - A. Choudhury.

❖ LIST OF OTHER SELECT PROJECTS:

- **HMM based Smart Gesture Recognition using Wearable Inertial Sensors:**
(Gade Autonomous Systems, Mumbai)
 - Developed a Machine-Learning algorithm using Hidden Markov Models to perform Gesture Recognition using wearable inertial sensors for adaptively learning a set of repetitive gestures made by an individual.

- ▣ **Indoor Place Categorization for Visual SLAM:** [\[video\]](#) [\[GitHub\]](#)
(Course Project: BME595 (Deep Learning), Fall 2017 – Purdue University)
 - Developed a Place Recognition Classifier using ResNet CNNs and inductive transfer learning to learn indoor visual landmarks during mobile robot navigation.
- ▣ **Optimal Constrained Coverage Path Planning for a Mobile Robot:** [\[pdf\]](#) [\[GitHub\]](#)
(Course Project: AAE568 (Applied Optimal Control & Estimation), Spring 2016 – Purdue University)
 - Developed a Pseudospectral Optimal Control based method for a Coverage Path Planning by a Mobile Robot.
 - Simulated a MATLAB model to generate Optimal CPP Trajectory for obstacle avoidance and complex boundaries.
- ▣ **Position Control Using Ultrasonic Levitation Assembly:**
(Undergraduate Senior Project, University of Mumbai.)
 - Designed a Contactless Precision Position Control system harnessing sound waves to suspend particles in mid-air.
 - Developed digital controller code for the levitation system using a Tiva C-series (TM4C123GH6PM) ARM processor.
- ▣ **A Portable Soil Health Monitoring System for Dynamic Soil Mapping:** [\[video\]](#)
(Presented at Texas Instruments IIADC, 2014)
 - Implemented a portable UV-VIS spectrophotometer system allowing on-field spectral analysis of soil.
 - Developed a sensing mechanism for measurement of soil OC (Organic Carbon) content using NIR Spectral Peaks.
 - Designed an optoelectronic system as well as signal conditioning circuits for system operation.

❖ REFERENCES:

(Available upon request.)