

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	Dec 2020 (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

Designation: Graduate Research Assistant

Jan 2017 – Present
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:

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

The thesis research focuses on the design of a deep-learning based CT simulator 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, 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, 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.)