

# ANKIT V. MANERIKAR

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## PROFESSIONAL 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 ten years, with authorship in multiple publications and encompassing contribution to over ten labs and companies.

## EDUCATION

Purdue University, USA	Doctor of Philosophy (PhD) <i>Electrical and Computer Engineering</i>	3.79/4.00	May 2022
Purdue University, USA	Master of Science <i>Electrical and Computer Engineering</i>	3.84/4.00	Aug 2017
Mumbai University, India	Bachelor of Engineering <i>Electronics Engineering (First Class with Distinction)</i>	81.52% (1 <sup>st</sup> Rank)	July 2015
SBM Polytechnic, India	Pre-University Course (Engineering Diploma) <i>Industrial Electronics (First Class with Distinction)</i>	89.26% (1 <sup>st</sup> Rank)	July 2012

## RESEARCH EXPERIENCE

- Robot Vision Lab, Purdue University Jan 2017 – Present  
Advisor: Dr Avinash Kak  
Title: 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-HQ – A StyleGAN-based Data Synthesis Tool for Baggage CT Scans:**  
This research focuses on a mitigating the data availability problem for threat detector design by using adversarial networks for annotated data synthesis of baggage CT scans for explosives detection.
  - DEBISim – A Simulation Pipeline for Dual Energy CT-Based baggage Inspection Systems:**  
The initiative aims at designing a physics-based CT simulation framework for X-ray 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.
- 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 was a part of the ALERT TO-7 AATR Initiative and 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 threat object detection.

- **Hierarchical Visual SLAM for Hospital Robotics:**

A robot navigation project in collaboration with Botzee Inc., a robotic think-tank aiming at building dense visual maps for modular robot navigation in hospital environments.

#### Major Publications:

- Manerikar, Ankit, Fangda Li, and Avinash C. Kak. "DEBISim: A simulation pipeline for dual energy CT-based baggage inspection systems." *Journal of X-Ray Science and Technology* 29.2 (2021): 259-285. [[pdf](#)][[code](#)]
- 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**

Jun 2016 – May 2017

**Advisors:** Dr Ayman Habib, Dr Melba Crawford

**West Lafayette**

**Title:** Graduate Researcher (Master's Degree)

#### 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

**Terms**

**Title:** Graduate Teaching Assistant

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|---|------------------------|--|---------------------|
| - | <b>Course:</b> ECE 404 | <i>Introduction to Computer Security</i>   | Jan 2021 – May 2021 |
| - | <b>Course:</b> ECE 382 | <i>Feedback System Analysis and Design</i> | Jan 2016 – May 2017 |

#### PUBLICATIONS:

- Manerikar, Ankit, Fangda Li, and Avinash C. Kak. "**DEBISim: A simulation pipeline for dual energy CT-based baggage inspection systems.**" *Journal of X-Ray Science and Technology* 29.2 (2021): 259-285. [[pdf](#)] [[code](#)]

- 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. [\[pdf\]](#)[\[GitHub\]](#)

## HONORS AND AWARDS

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| • <b>J.R.D. Tata Trust Scholarship Award</b> | Scholarship for Undergraduate Engineering<br>(Years: 2012-13, 2013-14)                               |
| • <b>Best Student Paper Award</b>            | "Particle Swarm Optimization in Control Systems Design",<br><i>IEEE Technomania 2013</i> ,           |
| • <b>Student Award for Academic Merit</b>    | 1 <sup>st</sup> Rank in B.E. (Electronics, DJSCoE),<br>6 <sup>th</sup> Rank in University of Mumbai. |
| • <b>Juhu Lions Club Scholarship Award</b>   | 1 <sup>st</sup> Rank in Industrial Electronics<br>(Years: 2008-09, 2009-10, 2010-11, 2011-12)        |

## PROFESSIONAL EXPERIENCE

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

## LIST OF OTHER SELECTED PROJECTS:

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- **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:** [\[video\]](#)  
(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 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.

## SKILLS:

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|---------------------------------------|--|
| • <b>Core Programming</b>             | <b>Python</b> (Expert), C++ (Proficient), C (Proficient), Matlab (Proficient). |
| • <b>Computer Vision</b>              | <b>OpenCV</b> , PCL, PyTorch3D.  |
| • <b>Machine Learning</b>             | <b>PyTorch</b> (Expert), TensorFlow, <b>scikit-learn</b> .                     |
| • <b>Computer Graphics/Simulation</b> | <b>Qt</b> , MayaVi, ASTRA, Simulink.   |
| • <b>Robotics</b>                     | <b>ROS</b> (Expert), Gazebo, ARIA  |
| • <b>Developer Tools/IDEs</b>         | <b>VSCode</b> , <b>PyCharm</b> , Eclipse IDE, AVR-gcc.                         |
| • <b>Cloud Computing</b>              | <b>Openstack</b> (Expert), Eucalyptus, AWS.                                    |

## REFERENCES:

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(Available upon request.)