

# ANKIT V. MANERIKAR

Hillsboro, Oregon, USA  
Contact: +1 765 602 6962  
Email ID: [ankitmanerikar@gmail.com](mailto:ankitmanerikar@gmail.com)  
Website: [ankitvm.github.io](https://ankitvm.github.io)

## PROFESSIONAL SUMMARY

A PhD in Computer Vision with a wide research and industry experience in the field of Tomographic Image Processing, Robotics and Machine Learning spanning a period of fourteen 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>	GPA: 3.80	Aug 2023
Purdue University, USA	Master of Science <i>Electrical and Computer Engineering</i>	GPA: 3.84	Aug 2017
Mumbai University, India	Bachelor of Engineering <i>Electronics Engineering</i>	AP: 81.52%	July 2015
SBM Polytechnic, India	Pre-University Course (Engineering Diploma) <i>Industrial Electronics</i>	AP: 89.26%	July 2012

## RESEARCH EXPERIENCE

- Robot Vision Lab, Purdue University** Jan 2017 – May 2022  
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:

- GANecdotes - Self-Supervised One Shot Learning for Automatic Segmentation of StyleGAN Images:**  
A novel SwAV-based self-supervised learning framework for one-shot segmentation of GAN images – the proposed model outperforms baselines in terms of IoU (by 1.02 %) and speed (by a factor of 4.05).
- BagGAN – A StyleGAN-based Data Synthesis Tool for Baggage X-ray 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 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, and Avinash C. Kak. "Self-Supervised One-Shot Learning for Automatic Segmentation of StyleGAN Images." *arXiv preprint arXiv:2303.05639* (2023). [\[pdf\]](#) [\[code\]](#) (Under review by *IEEE T-PAMI*).
- 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 *28th 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 Lidar Mapping Systems on a 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, and Avinash C. Kak. "Self-Supervised One-Shot Learning for Automatic Segmentation of StyleGAN Images." *arXiv preprint arXiv:2303.05639* (2023). [\[pdf\]](#) [\[code\]](#) (Submitted to and under review by *IEEE Transactions on Pattern Analysis and Machine Intelligence*).

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

## PROFESSIONAL EXPERIENCE

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|---|--|
| <ul style="list-style-type: none"> <li>• <b>Intel Corporation</b><br/><i>Title: AI Algorithm Engineer - oneDNN</i></li> </ul>   | <p>Aug 2023 – Present<br/><b>Hillsboro. US</b></p>         |
| <ul style="list-style-type: none"> <li>- Responsible for development and maintenance of oneDNN, a cross-platform performance library providing highly vectorized and TBB blocks for deep learning applications. [<a href="#">link</a>]</li> <li>- Developed new features and algorithms for the library which are optimized for Intel processors, GPUs and other hardware.</li> </ul>   |  |
| <ul style="list-style-type: none"> <li>• <b>Intel Corporation</b><br/><i>Title: Deep Learning SWE Intern</i></li> </ul>   | <p>May 2022 – December 2022<br/><b>Santa Clara. US</b></p> |
| <ul style="list-style-type: none"> <li>- Conducted design and development to build and optimize AI software for the latest Intel x86 isa.</li> <li>- Profiled distributed deep learning models to identify performance bottlenecks for state-of-the-art ML workloads – worked specifically on the profiling of 3D-UNets and Vision Transformers.</li> <li>- Worked on ML-based autotuning of DGEMM kernels for DL workloads for varying hardware specifications.</li> </ul> |  |

- **Citizen Scales India (P) Ltd.**

Dec 2011 - May 2012

**SEEPZ, Mumbai**

**Title:** *Research Intern/Co-op*

- 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

**Mumbai**

**Title:** *Robotics Intern /Co-op*

- 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.** (Delhi, India): "*Shear Measurement System for Rotary Blade Cutter*" - A. Choudhury.
- **S M Technocrats Pvt. Ltd.** (Delhi, India): "*Efficiency Analysis for HF Induction Tube Welding*" - A. Choudhury.

## **LIST OF OTHER SELECT 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 IADC, 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>           | Python (Expert), C, C++ (Proficient), Bash, Shell, UNIX/Linux, Matlab/Octave.  |
| • <b>AI / Machine Learning</b>      | PyTorch (Expert), TensorFlow (Expert), OpenVINO, TensorRT, scikit-learn. GANs, Diffusion, GenAI, LLMs, VLMs, Transformers. |
| • <b>MLOps / Backend</b>            | oneDNN (Contributor), HuggingFace, Weights & Biases, SYCL, OpenCL.   |
| • <b>Computer Vision / Robotics</b> | ROS (Expert), OpenCV (Expert), SLAM, Image Segmentation, Path Planning.  |
| • <b>Cloud / Computer Security</b>  | Openstack (Expert), Eucalyptus, Docker, AWS SageMaker  |
| • <b>DevOps</b>                     | Git, SVN, Gitlab, Confluence, JIRA, CloudBees, Coverity, OSS-Fuzz  |

## **REFERENCES/CERTIFICATIONS:**

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*(Available upon request.)*