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)** *Electrical and Computer Engineering*	3.79/4.00	May 2023
Purdue University, *USA*	**Master of Science** *Electrical and Computer Engineering*	3.84/4.00	Aug 2017
Mumbai University, *India*	**Bachelor of Engineering** *Electronics Engineering (First Class with Distinction)*	81.52% *(1st Rank)*	July 2015
SBM Polytechnic, *India*	**Pre-University Course (Engineering Diploma)** *Industrial Electronics (First Class with Distinction)*	89.26% *(1st Rank)*	July 2012

RESEARCH EXPERIENCE

- **Robot Vision Lab, Purdue University** — Jan 2017 – May 2022, ***West Lafayette***
  Advisor: *Dr Avinash Kak*
  Title*:* *Graduate Research Assistant*

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:

- ***Self-Supervised One Shot Learning for Automatic Segmentation of Synthetic Images Using StyleGANs:***
  A SwAV-based self-supervised learner for one-shot segmentation of StyleGAN-generated images.
- ***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 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*

- **Course:** ECE 404 *Introduction to Computer Security* Jan 2021 – May 2021
- **Course:** ECE 382 *Feedback System Analysis and Design* Jan 2016 – May 2017

PUBLICATIONS:

- Manerikar, Ankit, Fangda Li, and Avinash C. Kak. **"DEBISim: A simulation pipeline for dual energy CT-based baggage inspection system**s." *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

• **J.R.D. Tata Trust Scholarship Award**	Scholarship for Undergraduate Engineering (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**	1st Rank in Industrial Electronics (Years: 2008-09, 2009-10, 2010-11, 2011-12)

PROFESSIONAL EXPERIENCE

- **Intel Corporation** May 2022 – December 2022
  Title: *Deep Learning SWE Intern* ***Santa Clara. US***

- Conducted design and development to build and optimize AI software for the latest Intel x86 isa.
- 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.
- Worked on ML-based autotuning of DGEMM kernels for DL workloads for varying hardware specifications.

- **Citizen Scales India (P) Ltd.** Dec 2011 - May 2012
  Title*: 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
  Title*: 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.** (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:

- **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:

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

REFERENCES:

(Available upon request.)