# Fangda Li

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At Purdue University, I am a Ph.D. Candidate in the Robot Vision Lab (RVL) under the supervision of Prof. Avinash Kak. My research interest is in deep learning and computer vision, especially for medical imaging.

## Education

- **Doctor of Philosophy** — **Purdue University**
  *Electrical and Computer Engineering, GPA: 4.00/4.0* — *2017 – Fall 2023*
- **Master of Science** — **Purdue University**
  *Electrical and Computer Engineering, GPA: 3.53/4.0* — *2015 – 2017*
- **Bachelor of Science** — **Purdue University**
  *Electrical and Computer Engineering, GPA: 3.81/4.0* — *2012 – 2015*

## Technical Expertise

**Languages**: `Python` (7+ years), `C/C++`, `CUDA`
**Python Tools**: `NumPy`, `SciPy`, `Matplotlib`, `OpenMP`
**Machine Learning**: `PyTorch`, `TensorFlow`, `sklearn`
**Computer Vision**: `OpenCV`, `skimage`, `OpenGL`

## Research Experience

- **Robot Vision Lab, Purdue University** — **West Lafayette, IN**
  *PhD Candidate* — *August 2015 – Current*
  - Designed a generative **image-to-image translation** framework that translates H&E-stained images into various IHC stains while accurately predicting the diagnosis-critical molecular representations. [pdf]
  - By using a novel adaptive contrastive learning based objective, the training of the virtual IHC-restaining network is robust to the inevitable and often severe inconsistencies in groundtruth H&E-IHC image pairs.
  - Designed a **generative stain augmentation network** for augmenting H&E-stained cell images with synthesized yet realistic stains that can help desensitize downstream application-specific models to stain variations. [pdf]
  - By disentangling representations for cell morphology and stain while using a Laplacian Pyramid based architecture, the model can achieve transformation to arbitrary stains with high efficiency.
  - Designed an end-to-end automated, real-time, machine learning-based **semantic segmentation** framework for **automatic explosive recognition** in 3D dual-energy X-ray CT images of airport passenger checked baggage.
  - By using an ensemble of **deep learning and boosting** algorithms, the framework achieved state-of-the-art detection rates while maintaining low false alarm over a large-scale dataset (5k+ real-world baggage scans).
  - Developed a GPU-accelerated **model-based CT image reconstruction** algorithm for dual-energy X-ray CT that outperformed state-of-the-art approaches in both signal-to-noise ratio and convergence speed. [pdf]
  - Contributed to installing and maintaining an OpenStack **cloud computing** framework for all research at RVL.
  - Developed a novel **motion planning** algorithm that leverages recursion and gradient descent to find efficient yet smooth trajectories for robot navigation in congested and narrow spaces. [pdf]
  - Developed **computer graphics** software in OpenGL for 3D interactive apple tree pruning simulation. [pdf]

- **10x Genomics, Inc.** — **Pleasanton, CA**
  *Image Analyst Intern* — *May 2021 – August 2021*
  - Developed a framework for performant **nuclear instance segmentation** in H&E-stained histological images.
  - Designed and implemented **generative adversarial networks** for normalizing the wide range of variations among the H&E stain appearances.

- **Vipshop US, Inc.** — **San Jose, CA**
  *Augmented Reality Intern* — *May 2017 – August 2017*
  - Developed a **true scale estimation** module for monocular ORB-SLAM by integrating IMU inputs using Extended Kalman Filter on mobile devices.
  - Conducted literature review on and implemented various algorithms for the Multi-Armed Bandit problem.

- **TNT, Leibniz University** — **Hanover, Germany**
  *Research Intern* — *June 2014 – August 2014*
  - Improved the Random Forest algorithm for unbalanced datasets by integrating class importance and leaf weights. [pdf]
  - Proposed algorithm outperformed the state-of-the-art on real-world face detection and traffic sign recognition datasets.

## Selected Publications

- **Fangda Li**, Zhiqiang Hu, Wen Chen, and Avinash Kak. "Adaptive Supervised PatchNCE Loss for Learning H&E-to-IHC Stain Translation with Inconsistent Groundtruth Image Pairs." MICCAI (2023). **Accepted.**
- **Fangda Li**, Zhiqiang Hu, Wen Chen, and Avinash Kak. "A Laplacian Pyramid Based Generative H&E Stain Augmentation Network." Preprint (2023). **Submitted to TMI.**
- **Fangda Li**, Ankit Manerikarm, and Avinash Kak. "A Two-Pathway Framework for Automatic Explosive Detection in Dual-Energy X-Ray CT Baggage Security Imagery." Internal Technical Report (2021).
- Ankit Manerikar, **Fangda Li**, and Avinash C. Kak. "DEBISim: DEBISim: A Simulation Pipeline For Dual Energy CT-based Baggage Inspection Systems." Journal of X-Ray Science and Technology (2021).
- **Fangda Li**, 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 (2020).
- **Fangda Li**, Ankit Manerikar, and Avinash Kak. "RMPD – A Recursive Mid-Point Displacement Algorithm for Path Planning." In Proceedings of the International Conference on Automated Planning and Scheduling (2018).

## Teaching Experience

- **Deep Learning, ECE60146** — **Purdue University**
  *Graduate level class on CNN, RNN, Transformer, GAN, etc.* — *Spring 2023*
- **Computer Vision, ECE664** — **Purdue University**
  *Graduate level class on Geometric Computer Vision, e.g. Stereo Reconstruction.* — *Fall 2022*
- **Digital Systems Senior Design, ECE477** — **Purdue University**
  *Senior undergrad level class on Embedded System design and programming.* — *2019 – 2021*

## Relevant Coursework

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|---|---|---|
| Computer Vision | Deep Learning | Data Mining |
| Computational Models | Convex Optimization | Sparse Modeling |
| Digital Image Processing | Operating Systems | Multiple-View Geometry |

## Selected Course Projects

- Python implementation of various CV algorithms from scratch:

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|---|---|
| Homography estimation for image mosaicking | Iterative Closest Point for point cloud alignment |
| Levenberg–Marquardt algorithm | Zhang's algorithm for camera calibration |
| Stereo-based scene reconstruction | PCA, LDA and cascaded AdaBoost for face detection |

- Python implementation of various ML algorithms from scratch:

| | | |
|---|---|---|
| Support Vector Machine | Boosted Decision Trees | Random Forest |
| K-Means | Hierarchical Clustering | Expectation Maximization |

- Implemented a ResNet-based framework using torch to automatically detect metastasized breast cancer on gigabyte-sized whole-slide microscopic images.