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 Random Forest for unbalanced datasets by integrating class importance and leaf weights. [pdf]
  - Proposed method achieved 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." International Conference on Medical Image Computing and Computer Assisted Intervention (**MICCAI**), 2023. **Accepted**.
- **Fangda Li**, Zhiqiang Hu, Wen Chen, and Avinash Kak. "A Laplacian Pyramid Based Generative H&E Stain Augmentation Network." ArXiv Preprint, 2023. Submitted to IEEE Transactions on Medical Imaging (TMI).
- **Fangda Li**, Ankit Manerikar, 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 (ICAPS), 2018.

Teaching Experience

- **Head TA, Deep Learning, ECE60146** — **Purdue University**
  Graduate level class on CNN, RNN, Transformer, GAN, etc. — *Spring 2023*
- **Head TA, 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

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:

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.