Pranav Kumar Asthana

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EDUCATION

University of Maryland — **College Park, MD**
Doctor of Philosophy (Ph.D.) in Computer Science — *Aug 2024 - Present*

University of Illinois at Urbana Champaign — **Champaign, IL**
Master of Science in Computer Science (MSCS) ***GPA: 4.00/4*** — *May 2022*

- Relevant coursework: Computer Vision, Computational Photography, AI for Computer Graphics, Production Computer Graphics, ML for Signal Processing | Advised by Professor David A. Forsyth

Birla Institute of Technology and Science (BITS, Pilani) - Hyderabad — **Hyderabad, India**
Bachelor of Engineering (Hons.) in Computer Science (with Distinction) ***GPA: 9.09/10*** — *May 2019*

- Relevant coursework: Computer graphics, Machine learning, Artificial intelligence, Data mining, Information retrieval

RELEVANT WORK EXPERIENCE

ShortTok — **Remote**
Machine Learning Engineer | Mentor: Jayan Eledath — *Apr 2023 - Feb 2024*

- Leveraged Large language models (LLMs) and vision-language models (VLMs) for visual media (image and video) understanding and generating storytelling narratives
- Fine-tuned language models, re-ranking cross encoders and VLMs for media retrieval, object and activity recognition, captioning and video temporal grounding
- Developed a multi-aspect similarity engine using video, image and text features for enhanced discovery of content

Amazon — **Seattle, WA**
Applied Scientist | Mentor: Laurent Guigues — *Aug 2022 - Jan 2023*

- Part of Amazon's Just-Walk-Out (JWO) stores that operate cashier-less, using vision-based tracking and perception of shopping events from ceiling-mounted cameras
- Performed SLAM-based 3D reconstruction using stereo depth cameras and RGB-D fusion for mapping store geometry as point cloud and mesh models
- Used stationary LiDAR scanners to produce high density point clouds and meshes while dealing with reflective objects and multiple partially-overlapping point clouds
- Worked on a camera calibration pipeline to estimate ceiling camera pose in a 3D scan to an accuracy of ~ 2cm in a ~ 5000sqft store for over 900 cameras using scan images

Amazon Lab 126 — **Sunnyvale, CA**
Applied Scientist Intern | Mentor: Dylan Glas — *Jun 2021 - Aug 2021*

- Worked on Amazon's home robot, Astro - Used single image depth and 2D human pose detection for pointing gesture-based navigation
- Developed a system to enable the robot to detect human pointing and infer a target point on the floor, followed by navigating to that target
- Demonstrated that single image depth and 2D human pose data enables detection of target on floor with error less than 15cm at 4m

Arcesium — **Hyderabad, India**
Software Engineer — *Jun 2019 - Apr 2020*

- Worked in the performance analysis and reporting team as a backend developer
- Designed, developed, tested, deployed and maintained software for a financial reporting platform
- Technologies: Java EE, MS SQL Server, MyBatis, Mockito, Struts, ReactJS, HTML, CSS

RESEARCH & PROJECTS

Single Image Scene Relighting

Master thesis, advised by Professor David A. Forsyth

- A U-net based generator-discriminator system to relight single images realistically without paired or labeled data by exploiting images with similar geometry and intrinsic image decomposition
- Demonstrated the ability to control light distribution realistically in unseen images using priors to understand geometry and expected illumination distribution
- Developed an evaluation pipeline with FID (Fréchet Inception Distance), FID_∞ and a novel per-image metric, LocalFID to measure realism of relit images
- Performed experiments with various model parameters and showed rejection sampling methods to get best results given preferences on realism vs variation of generated images

Miscellaneous projects

- Image Morphing (implemented this paper)
  - Used structural similarity to find matches given a small set of correspondences
  - Learnt a dense flow field to morph between 2 image domains, using an intermediate "halfway domain"
  - Implemented a quadratic motion path that ensures smooth animation and that object deformations do not occur
- Computer graphics
  - Implemented the 3D rendering pipeline in OpenGL 3.3 to render a functional scene of a children's park with natural-looking trees generated using L-systems, a parallel rewriting system
  - Whitted ray-tracing of scenes with global illumination and accelerated structures like bounding-volume hierarchy (BVH) for transparent objects, mirrors and area lights
  - Implemented methods for gradient-domain image fusion (poisson/laplacian blending), texture synthesis using image quilting (this paper), rendering images and 3D models into images using image harmonization and image-based lighting, and image encoding and representation using MLPs with fourier-feature mapping (this paper)
- Evolutionary and genetic algorithms
  - Simulation of a quadruped learning to walk by reinforcement learning using neural networks trained with evolutionary strategies. Inspired by ludobots

TECHNICAL SKILLS

Topics: Deep learning, 3D reconstruction, SLAM, RGB-D fusion, 3D representations, camera calibration, image generation/synthesis, image editing, Generative Adversarial Networks (GANs), ray tracing, video analysis, language models (embedding, re-ranking, generative), Large Language Models (LLMs)

Programming Languages and frameworks: Proficient in Python (and deep learning libraries like PyTorch), Java, AWS and GCP cloud platforms, and have experience with C++, Javascript, HTML/CSS, SQL, React, OpenGL and GLSL

VOLUNTEER & EXTRACURRICULAR ACTIVITY

- Teaching: I enjoy teaching and have participated in volunteer teaching opportunities
  - Taught 2 short courses on Computer Graphics (L-systems) and Computer Vision during SAIL 2021 and 2022 at UIUC
  - Held a workshop on "Introduction to programming through Python" in 2016 and 2017 at a PSF Python conference in BITS Pilani, Hyderabad
  - Held weekly classes on python programming and machine learning as an undergraduate
- Member of the UIUC badminton club and BITS Pilani, Hyderabad badminton team. Captained the BITS Pilani, Hyderabad team in my junior year
- Other interests include hiking, mountaineering, playing chess and playing the guitar and keyboard