Utkarsh Sharma

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EDUCATION

Indian Institute of Science **2024 – 2026**
M.Tech in Computer Science and Automation - ***CGPA: 8.5*** *Bangalore, India*

Chandigarh University **2020 – 2024**
B.E. Computer Science - ***CGPA: 8.24*** *Mohali, India*

Shimla Presidency School **2018 – 2020**
Class XII (Central Board of Secondary Education) - ***87.2%*** *Ghanahatti, India*

TEACHING EXPERIENCE

Teaching Assistant - Algorithms and Programming | Prof. Viraj Kumar **Aug 2024 – Present**

- Teaching Assistant for undergraduate Algorithms and Programming course at Indian Institute of Science
- Conducting tutorial sessions, and supporting students in algorithmic problem-solving

PROJECTS

Vision Transformer for Classification | PyTorch **Oct – Nov 2025**

- Implemented the Transformer architecture (Vaswani et al., Attention Is All You Need) from scratch in PyTorch, covering encoder–decoder attention, positional encoding, and multi-head self-attention mechanisms
- Extended the implementation to Vision Transformer (ViT) (An Image Is Worth 16×16 Words) for image classification, adapting tokenization and patch embedding for 2D inputs
- Visualized attention maps and token interactions to interpret model behavior and analyze spatial attention patterns

CUDA Path Tracer | CUDA, C++ **Jul – Oct 2025**

- Developed a Monte Carlo Path Tracer integrating Radiosity to simulate physically based global illumination
- Implemented a parallel CUDA ray tracing kernel for high-performance rendering, achieving over 20× speedup compared to the CPU implementation
- Built a Bounding Volume Hierarchy (BVH) to accelerate ray–primitive intersection tests and reduce traversal overhead
- Designed a per-triangle directional grid to store form factor and sampling direction data

Volume Rendering and Visualization | C++, OpenGL **Aug – Nov 2025**

- Implemented volume rendering techniques including ray marching and transfer function mapping for 3D scalar field visualization as a part of Graphics and Visualization Coursework
- Developed Marching Cubes algorithm for isosurface extraction from volumetric data
- Built interactive volume slicing tools for multi-planar reconstruction and data exploration

Neural Path Guiding using Neural Parametric Mixture Model | Mitsuba, PyTorch **Jun – Jul 2025**

- Implemented the Neural Parametric Mixtures for Path Guiding paper to improve light transport efficiency in Monte Carlo rendering
- Developed a custom Mitsuba Integrator for data collection during rendering to enable neural-guided sampling
- Integrated tiny-cuda-nn Python bindings for training the neural network, employing a von Mises–Fisher Mixture Model and online learning for adaptive path guiding at ray intersections
- Built interactive visualizations in PyVista to analyze vMF mixture distributions and next-ray sampling behavior

Efficient Denoising based Path Tracing | PyTorch, PBRT **Mar – May 2025**

- Developed and analyzed neural denoising models to enhance image quality in low-sample Monte Carlo renderings
- Implemented and compared Diffusion-based and UNet-based denoisers for reducing variance and improving perceptual fidelity
- Collected and utilized G-Buffer data (albedo, normals, depth, and positions) as auxiliary network inputs to guide denoising and preserve scene details
- Evaluated denoiser performance on rendered datasets generated from PBRT, focusing on noise reduction and structural accuracy

SKILLS

Machine Learning & Deep Learning: Linear Regression, Logistic Regression, SVM, k-NN, Parametric Mixture Models (GMM, vMF Mixtures), Normalizing Flows, Neural Networks, CNNs, Transformers, Vision Transformers (ViT), Autoencoders, GANs, Diffusion Models
Computer Vision & 3D Graphics: Image Segmentation, 3D Generative Models (3DGS, NeRF), Volume Rendering, Ray Tracing, Mitsuba Renderer
Programming & Frameworks: Python (PyTorch), C++, CUDA
Mathematical & Statistical Tools: Linear Algebra, Probability & Statistics, Optimization Techniques

COURSEWORK

- Machine Learning for Signal Processing (PG)
- Deep Learning for Computer Vision (PG)
- Computational Methods of Optimization (PG)
- Database Management Systems (PG)
- Computational Topology (PG)
- Design and Analysis of Algorithms (PG)
- Probability and Statistics (PG)
- Systems for Machine Learning (PG)
- Graphics and Visualization (PG)
- Learning for 3D Vision and Inverse Graphics (PG)

ACADEMIC ACHIEVEMENTS

- **Rank 8 out of 123,967 candidates** - GATE Computer Science (CS) 2024
- **Rank 17 out of 39,210 candidates** - GATE Data Science & AI (DA) 2024
- **Winner** at CodeSmash2.0 Competitive Programming Contest
- **Finalist** at CodeRush 3.0 Competitive Programming Contest