Sanjeev Narasimhan

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Education

Columbia University **New York, USA**
M.S. Computer Science, Machine Learning Research Specialization ***GPA: 3.97/4.00*** *May 2024*

Birla Institute of Technology and Science Pilani **Pilani, India**
B.E. Computer Science ***GPA: 9.85/10*** *(3.97/4.00)* *Jul 2020*
Academic Merit Scholarship, Distinction Graduate

Summary

MS Graduate in Computer Science with research and practical development expertise in applied machine learning, specializing in computer vision problems. Focus areas include high-accuracy object detection and tracking for smart streetscapes and ML applications in surgery. Over 2 years of experience as an ML Researcher, and over 2 years as a Software Engineer with strong backend engineering and design skills. Seeking opportunities in Applied Machine Learning within the industry.

Experience

Northwell Health **New York, USA**
Visiting Research Scientist *- Applications of AI in Robot-Assisted Surgery* *Jun 2024 – Present*

- Developed a multimodal LLM evaluation system using Gemini 1.5 Pro to identify phases in robotic surgical videos, achieving up to 80% accuracy. Collaborated with researchers from Google to leverage Gemini with Google Cloud Vertex AI.
- Designed and trained custom video models on hernia surgery videos to perform real-time action recognition with up to 90% accuracy.
- Developed a computer vision system to assess surgical skill from robotic suturing videos using Video Transformer models and machine learning techniques (Random Forests, XGBoost), achieving 75% accuracy.
- Automated data preprocessing tasks using Python/C++ to enhance efficiency and accuracy of deep learning model training. Managed large-scale datasets efficiently, including data collection, cleaning, and annotation, ensuring high data quality for training and evaluation.

AIDL Lab, Columbia University (https://www.aidl.ee.columbia.edu) **New York, USA**
Graduate Research Assistant *- Video Based AI Models for Streetscape Applications* *Jan 2023 – May 2024*

- Developed and trained CNN models using Python and deep learning frameworks (PyTorch, TensorFlow) to accurately transform street-level views into bird's eye views with less than 10% error for automatic camera calibration.
- Curated and released a new object detection dataset named 'Constellation' with 13K+ high-elevation urban streetscape images. Provided state-of-the-art object detection model benchmarks as an open-source contribution, enabling robust small object detection research and identifying a 10% performance gap between aerial pedestrian and vehicle detection.
- Contributed to the analysis of selected COSMOS Testbed data - https://cosmos-lab.org/experimentation/smart-city-intersections/

Summer Research Intern *- Video Based AI Models for Streetscape Applications* *Jun 2023 – Sep 2023*

- Trained state-of-the-art object detection models including the most recent YOLO variants (YOLOv7, v8) using PyTorch. Customized the model architecture to achieve 95%+ accuracy for real-time vehicle/pedestrian detection.
- Applied LSTM-based trajectory forecasting models on object tracks to estimate trajectories up to 4 seconds ahead and detect potential vehicle-pedestrian collisions. Deployed the model to perform inference on an RTSP stream at a busy NYC intersection.

Deloitte Digital **Bangalore, India**
Software Engineer / Analyst *Oct 2020 – Jun 2022*

- Built components on the Salesforce Cloud platform serving over a million end-users, supporting 100K+ average daily traffic with large volumes of data.
- 2+ years of experience with backend development with Java and database design with SQL, integrations (REST API), building front-end components (JavaScript/HTML/CSS).
- Led the project deployments using Git/Azure DevOps CI/CD pipelines for production releases.

PriceWaterhouse Coopers (PwC) **Dubai, UAE**
Intern Software Engineer *Jan 2020 – Jul 2020*

- Intern Software Developer, specializing in development on the Salesforce Platform. Gained experience with Java/Apex/SQL for backend development and handling bulk data.
- Implemented a Document Management System for a major government financial services entity and devised a centralized service system for 500+ qualifying companies.
- Engineered a backend solution for an educational institute serving over 50 thousand students, to assist in student enrollment and course administration.

Cadence (formerly Invecas Inc.) **Hyderabad, India**
Intern Software Engineer *Jun 2018 – Aug 2018*

- Developed a full-stack web application with analytics dashboards to track project and employee performance, resulting in a 30% improvement in project management efficiency.

Teaching

CS3 Streetscapes NSF Engineering Research Center (https://cs3-erc.org/) **New York, USA**

Engineering Mentor *Jul 2024 – Aug 2024*

- Mentored high-school students for the CS3 My Streetscape Summer Research Institute, an interdisciplinary education program on urban technology with the Center for Smart Streetscapes (CS3) at Columbia Engineering.
- Taught Machine Learning/Deep Learning concepts and familiarized students with end-to-end machine learning development, training and deployment.

Dept. of Electrical Engineering, Columbia University **New York, USA**

Teaching Assistant *- EECS E6691 Advanced Deep Learning* *Jan 2024 – Jun 2024*

- Head TA for seminar-style course, which covers advanced topics in deep learning including recent literature on state-of-the-art models. Responsibilities include teaching state-of-the art architectural and modeling concepts, preparation and grading of assignments/exams/projects and preparation and setup of in-class Kaggle competitions.

Teaching Assistant *- ECBM E4040 Neural Networks & Deep Learning* *Sep 2023 – Dec 2023*

- Head TA for the delivery of graduate-level course which covers theoretical underpinnings, architectures and performance, and applications of neural networks. Responsibilities include grading of assignments/exams, setup of Google Cloud Linux Environments for the class to enable model training/development, and provide academic instruction to students in the classroom.

Athletics Department, Columbia University **New York, USA**

NCAA Student Tutor *Jan 2023 – Jun 2023*

- Instructed NCAA Student-Athletes at Columbia University in Data Structures and Algorithms using Java, adapting teaching methods to fit their unique schedules and learning needs.

Projects

Stable Diffusion Inference Optimization **Dec 2023**

- Benchmarked several state-of-the-art inference optimization techniques for Stable Diffusion v1.5 including quantization, token merging, distilled UNet/VAE and JIT compilation.
- Achieved up to 7x speedup in per-image generation time while maintaining high image quality by combining multiple optimization techniques.

Pass Receiver Prediction in Broadcast Soccer Clips **Apr 2023**

- Developed a multi-stage system combining object detection, perspective transformation, clustering, and graph neural networks (GNNs) to predict optimal soccer player passes in broadcast clips.
- Attained 70% end-to-end accuracy on a custom dataset, highlighting the potential of the system to aid soccer professionals and broadcasters in gaining crucial information about the sport.

Neural Fashion Captioning using Transformers **Dec 2022**

- Created an image captioning model for fashion data (DeepFashion Multimodal) using transformer networks to generate high-quality captions for finer attributes such as clothing fabric, jewelry, patterns, etc.
- Gained a 20% increase in caption quality (BLEU score) by pre-training the backbone to perform attribute classification.

Publications

- Turkcan, M.K.; **Narasimhan, S.** et al. **"Constellation Dataset: Benchmarking High-Altitude Object Detection for an Urban Intersection."** Preprint, (ArXiv 2024) /abs/2404.16944.
- Zang, C.; Turkcan, M.K.; **Narasimhan, S.** et al. **Surgical Phase Recognition in Inguinal Hernia Repair—AI-Based Confirmatory Baseline and Exploration of Competitive Models.** MDPI Bioengineering 2023, 10, 654.

Skills

Areas: Machine Learning, Deep Learning, Computer Vision, Data Science, Software Engineering
Languages: Python, Java, C, SQL, HTML5/CSS, JavaScript
Frameworks: PyTorch, Tensorflow, Keras, NumPy, Pandas, Scikit-Learn, CUDA, Android Studio, Bootstrap
Misc: Linux, HPC/Slurm, Google Cloud Platform (GCE), Git, GitHub, Docker, Azure DevOps, Agile Methodology, Salesforce