# 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

## Experience

**Northwell Health** — **New York, USA**
*Visiting Research Scientist* — *Jun 2024 – Present*
- Trained state-of-the-art video models on hernia surgery videos to perform real-time action recognition with up to 90% accuracy.
- Developed a computer vision system using Video Transformer models and machine learning techniques (Random Forests, XGBoost) to assess surgical skill from robotic suturing videos with 75% accuracy.
- Utilized Python/C++ to automate data preprocessing tasks, enhancing efficiency and accuracy in model training. Managed large-scale datasets efficiently, including data collection, cleaning, and annotation, ensuring high data quality for training and evaluation.

**COSMOS Lab, Columbia University** — **New York, USA**
*Graduate Research Assistant* — *Jan 2023 – May 2024*
- Conducted cutting-edge research under the guidance of Prof. Zoran Kostic at Columbia University. Currently a member of the cosmos computer vision team (https://cosmos-lab.org/). Research funded by Center for Smart Streetscapes (CS3) NSF grant.
- 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.

*Summer Researcher* — *Jun 2023 – Sept 2023*
- Trained state-of-the-art object detection models including the most recent YOLO variants (YOLOv7, v8) using PyTorch. Customized the model architecture using feature map merging 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*
- Launched several Salesforce Cloud solutions as a Software Engineer for a long-term client in the sports industry. Created a membership scheme and digital product suite, serving over a million end-users.
- 2+ years of experience with backend development (Java and SQL), integrations (REST API), building front-end components (JavaScript/HTML/CSS).
- Led the project deployments using Git/Azure DevOps CI/CD for production releases.

## 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