Akash Nagaraj

· Researcher · Software Developer ·

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Education

PES University (PES Institute of Technology)

Bangalore, India

Bachelor of Technology | Major: Computer Science | Minor: Data Science — *2015 - 2019*

- Overall GPA: 9.02/10 | Minor GPA: 10/10 | Major GPA: 9.51/10
- Dean's list for 6/7 semesters (Merit scholarship for being in the top 20 students of the batch)
- Best undergraduate thesis in Computer Science

Relevant Courses

- **AI/ML:** Computational Methods for Mind, Brain and Behavior*, Deep Learning*, Advanced Machine Learning
- **Computer Science:** Data Structures, Design & Analysis of Algorithms, Cloud Computing, Big Data, Operating Systems
- **Mathematics:** Computational Probability & Statistics*, Information Theory*, Statistical Inference*, Discrete Mathematics and Logic, Linear Algebra & Applications.

* = Audited as a Research Scholar at Brown University

Experience

Serre Lab, Brown University

Providence, RI, USA

Research Scholar, *Advisor: Thomas Serre* — *October 2021 - Present*

- **Learning human-like 3D Visual Representations:** Novel, scalable data diet and training regime to align machine vision with humans, utilizing 3D vision with generated NeRF trajectories resulting in rotational equivariance. ***(Under Review at NeurIPS 2023 UniReps)***.
- **Behavioural Markers of External Cues:** Building an objective framework to characterize the influence of external cues, genes and neural activity on behavioral modules from videos, using Generative Modelling, Transformers & Representation Learning (*with NIH*).
- **Clinical Scar Characterization:** Developed an AI-based system to process raw medical image data, to locate and characterize non-suicidal self-injury scars using recurrent feedback mechanisms and MaskRCNN (*with Massachusetts General Hospital, Harvard Univ.*).
- **Models of Human Depth Perception:** Constructing unsupervised models of depth perception of humans in response to 2-dimensional stimuli, using Energy-based Models.
- **Horizontal Gated Recurrent Unit:** Optimizing feedback-based neural circuits with a new learning algorithm-cRBP (Contractor Recurrent Back-Propagation). Authored tutorials on using recurrent feedback loops to work with neural, sequential, and image data.
- **Visual Constancy:** Investigating visual constancy across environmental stimulus changes, and modeling visual competitive (inhibitory and excitatory) neural hypercolumns to solve intricate computer vision problems.
- **Multiple Object Tracking:** Extending InT to a neural-circuit-based MOT algorithm, currently achieving SOTA results on TrackingNet.
- **Harmonization:** Training routine that aligns DNN and human visual strategies while improving categorization for images and videos.

Goldman Sachs

Bangalore, India

Senior Analyst (Promoted in December 2020) — *January 2020 - September 2021*

- **Derivative Trading Flows** Worked on algorithmic trading, high-touch and low-touch flows for derived equity instruments (bonds, ETF, stocks) for the Global Equities Trading Desk, in New York.
- **Securities Trading Platform:** Built the trading platform for Global Equities Trading Desk with 5x more capacity (100k+ orders) and extremely low latency (<1ms) to handle a daily cash flow of $5 billion. Led the development of the Trade Enrichment Module.
- **Design and Scaling:** Brainstormed and engineered various system design architectures to improve and scale trading workflows.

Cisco Systems

Bangalore, India

Software Development Engineer (offered a full-time position from Internship) — *January 2019 - January 2020*

- **Failure Analysis Senti-meter:** Streamlined timeline of sentiment analysis and prediction of corrective action of Cisco product failures globally from over 24 hours to 2 minutes using Feature Engineering, Machine Learning and Natural Language Processing.
- **Gnosis Signature Effectiveness:** Reduction of vulnerabilities using a signature-based approach to identify and rectify bugs.
- **LIFR:** Invented an AI-based solution to improve inventory Line-In Fill Rate, placed first in the Cisco Intern Global Case Competition.

Centre for Cloud Computing and Big Data

PES University, Bangalore, India

Research Intern, *Advisors: Dinkar Sitaram, K V Subramanium, Sanchika Gupta* — *August 2017 - May 2018*

Teaching Assistant: Cloud Computing — *December 2018 - May 2019*

- Worked on **Machine Learning-based Analysis of *Filarial lymphoedema*** using association rules and frequency pattern mining, and **Learning Algorithms in Static Analysis of Web Applications** using encoding, static fuzzing, and machine learning.
- **Teaching Assistantship:** Mentored and evaluated 40+ students building a microservice platform with container orchestration.

Crucible of Research and Innovation

PES University, Bangalore, India

Summer Intern: Embedded Systems, *Advisor: Vinod K Agrawal* — *April 2016 - July 2016*

- Developed a low-cost blood pump to advance dialysis in rural India, and built modules used on the in-house satellite - **PiSat**.

Research Publications

Diffusion Models as Artists: Are we Closing the Gap between Humans & Machines?

2023

Published at ICML 2023, Available on arXiv

*Victor Boutin, Thomas Fel, **Akash Nagaraj**, Lakshya Singhal, Rithik Mukherjee, Julien Colin, Thomas Serre*

Real-time Automated Answer Scoring

2018

Published at IEEE ICALT 2018, available on IEEExplore, arXiv and YouTube

***Akash Nagaraj**, Mukund Sood, Gowri Srinivasa*

Cross-domain Variational Capsules for Information Extraction *2020*

Published at Springer ICICSE 2020, available on SpringerLink and arXiv

***Akash Nagaraj**, Akhil K, Akshay Venkatesh, Srikanth H R*

A Concise Introduction to Reinforcement Learning in Robotics *2020*

Accepted for presentation at Springer ICMISC 2020, available on arXiv

***Akash Nagaraj**, Mukund Sood, Bhagya M Patil*

Learning Algorithms in Static Analysis of Web Applications *2018*

Accepted for presentation at Springer ICMISC 2020, available on arXiv

***Akash Nagaraj**, Mukund Sood, Vivek Kapoor, Yash Mathur, Bishesh Sinha, Sanchika Gupta, Dinkar Sitaram*

Association Rule-based Analysis of *Filarial lymphoedema* *2018*

Presented at 8TH National Colloquium on Evidence Based Integrative Medicine, on ResearchGate

***Akash Nagaraj**, Mukund Sood, Bishesh Sinha, Ashok Raman, Dinkar Sitaram*

Research Preprints

Real-time Action Recognition for Fine-Grained Actions & The Hand Wash Dataset *2020*

Patent-pending, available on arXiv | | |

***Akash Nagaraj**, Mukund Sood, Chetna Sureka, Gowri Srinivasa*

Digital Image Forensics using Deep Learning *2019*

Published in eForensics Magazine-May 2020 Edition, Available on arXiv

***Akash Nagaraj**, Bishesh Sinha, Mukund Sood, Vivek Kapoor, Yash Mathur*

Selected Projects

Sensorium: Visual Cortex Modeling *2022 (In-progress)*

- Accurate predictive models of 28,000 neurons from primary visual cortex responses (captured using calcium imaging) to thousands of natural stimuli. Achieved a single trial correlation of 0.41 using an optimized HMAX model with neural circuits & recurrent connections.

Scar Characterization from Clinical Images *2022 (In-progress)*

- Utilize computer vision to determine the predictive utility of non-suicidal self-injuries using tissue damage and lethality as severity signals derived from clinical self-injury images in predicting prospective suicide attempt risk. Working with Dr. Taylor Burke at Harvard.

Rahat: Disaster Management Platform | | | *2019*

- Multilingual, end-to-end, AI-based disaster management platform using a custom protocol over GSM (no internet required).
- This project was my entry to Microsoft code.fun.do++, and ranked 4th amongst 6000+ entries.

Unvoiced: Sign Language to Speech | | *2019*

- Conversion of sign language into speech using Deep Learning and Image Processing in real-time.
- **The ASL Alphabet dataset** created has 150+ citations, over 37,000 downloads, and has been used in numerous theses.

litFS: FUSE based File System | *2018*

- FUSE file system built using Bazil framework in Go. Apart from providing normal I/O operations on files and directories, it also achieves persistence across machine reboots by emulating a single Unix file as a disk for file system.

Awards & Extracurricular Activities

Awards

2022	**Fourth Place**, NeurIPS Workshop: Sensorium 2022 - Mouse Visual Cortex Modelling	*40+ teams overall*
2020	**First Place**, Cisco Global Intern Case Competition	*100+ teams overall*
2020	**Finalist (top 5)**, Microsoft code.fun.do++ (Final round)	*6000+ teams overall*
2020	**First Place**, Microsoft code.fun.do++ (Regional Round)	*300+ teams overall*
2019	**First Place**, IEEE Cisco Internet of Things Hackathon - 2019	*200 teams overall*
2018	**First Place**, Cisco Data Analytics Hackathon - 2018	*50+ teams overall*
2018	**Ninth Place**, IEEE Signal Processing Society - Camera Model Identification (Student Category)	*581 teams overall*

Extracurricular Activities

2023	**Academic Reviewer**, ICML 2023, NeurIPS 2023 UniReps	*2023 - Present*
2021	**Open-source Contributor**, SymPy, MetaBrainz, OpenMM	*2018 - Present*
2020	**Education Mentor & Tech Writer**, GirlScript Foundation (India's Biggest Tech Education NGO)	*Mar 2020 - Nov 2020*
2020	**Data Structures and Algorithms Mentor**, CodeChef	*Apr 2020 - July 2020*
2018	**Education Support Fellow**, Make A Difference - Grade 10 (400+ hours)	*Jun 2017 - Mar 2018*
2017	**Core-organizer**, The Amateur Scientist, National Science Fest	*6000+ attendees*

Skills

Programming	Python, Java, C++, C, JavaScript, Go, Rust, R, Lua, PHP, HTML, MySQL
Frameworks	PyTorch, Tensorflow, MuJoCo, SpringBoot, Flask, Django, ReactJS, Docker
Technologies	DeepLabCut, Git, AWS, Azure, Collab, GoogleCloud, Jenkins CI/CD