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*

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

Relevant Courses

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

*Audited as a Research Scholar at Brown University

Experience

Serre Lab, Brown University

Providence, RI, USA

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

- **Artificial Intelligence with Biological Benchmarks:** Building a benchmark to guide large-scale modeling efforts, with tasks that interrogate independent computational mechanisms, and measure scaling in terms of generalization and learning efficiency.
- **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.*).
- **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.
- **Action Recognition:** Improving vision transformers (MotionFormer and TimeSFormer) by integrating neural circuits (Index-and-Track), and working on improving memory complexity of action recognition by formulating a time-invariant version of CRBP.

Motor Control Group, MIT

Boston, MA, USA (Remote)

Research Collaborator, *Advisor: Nidhi Seethapathi* — *September 2021 - Present*

- Deep Reinforcement Learning and Imitation Learning to build locomotor controllers for agents exposed to stochastic perturbations.

Goldman Sachs

Bangalore, India

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

Real-time Automated Answer Scoring

2018

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

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

Building better artificial intelligence with biological benchmarks *2022*

Manuscript in-progress

Drew Linsley, ***Akash Nagaraj**, Alekh Karkada, Junkyung Kim, Lakshmi Govindarajan, Thomas Serre*

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

Selected Projects

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.

Behavioural Markers of External Cues *2021 (In-progress)*

- Building a behavioral analysis framework to characterize fine-grained differences in behavioral modules and their transitions, scaled to work with over 8000 hours of videos, using Computer Vision and Language Modelling. Working with Dr. Andrew Holmes at the NIH.

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.

r2ic: Rust to Intermediate Code | *2018*

- Compiler to convert constructs of Rust programming language into intermediate code (quadruples). Supports generation of an Abstract Syntax Tree, and code optimizations: constant folding, constant propagation, and loop unrolling.

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	**Third Place**, Indian Institute of Science, Computer Science and Automation Coding Competition	*2000+ participants*

Extracurricular Activities

2021	**Open-source Contributor**, SymPy, MetaBrainz	*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*
2014	**Grade 5 - Piano**, Trinity College, London	*2008 - 2014*

Skills

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