Pranav Mahajan

Final year Undergraduate, BITS Pilani, K.K. Birla Goa Campus.
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Education

May 2021 (Expected) — B.E. (Hons.) in Electronics and Communications Engineering. Birla Institute of Technology and Science, Pilani, Goa (India). **CGPA**: 9.1/10

Work and Research Experience

July 2020 -Present — Nuffield Department of Clinical Neurosciences, University of Oxford
Undergraduate thesis, Advisor: Dr. Ben Seymour
- Understanding pain systems in neuroscience and building safe reinforcement learning algorithms inspired from neuroscientific evidence.

April-June 2020 — NVIDIA, Bangalore
report
Engineering Intern, Supervisor: Raghuram L
- Understood the performance scalability issues with synchronous SGD and how researchers have attempted to solve it via asynchronous techniques.
- Implemented basic asynchronous SGD in Apex for a distributed data parallel training regime for the SSD network. Evaluated convergence and performance using profiling tools like Nsight.

May-July 2019 — CSIR - Central Electronics Engineering Research Institute
abstract
Summer Research Intern, Supervisor: Dr. Sanjay Singh
- LG funded research project with a focus on deep learning based Face Anti-spoofing using auxiliary supervision.
- Formulated and trained a novel video based depth-estimator using 3D CNN autoencoder and compared with CNN-LSTM based autoencoder networks
- Experimented with automatic mixed precision to improve training time while maintaining the same target accuracy.

May-June 2018 — Mitera Tech, Birmingham
github
Summer Intern
- Designed and coded a general IOT framework for home automation linking Raspberry Pi, Arduino with a real-time database and developed an Android app which used Google Firebase.
- Implemented K-means clustering to make thermostat smarter by learning from less data and more specific to each user's actions.

Selected Projects

Sep'19 - Oct'20 — Alzheimer's Dementia (AD): Early detection and tracking progression
preprint
Supervisor: Dr. Veeky Baths
- **Early Detection:** Participated in ADReSS challenge in INTERSPEECH 2020 to detect AD from spontaneous speech. Re-implemented existing NLP based CNN-LSTM approaches on ADReSS dataset and explained their performance.
- Extended it by introducing a Speech-GRU stream for combining acoustic features into a common vector which was further enriched by dementia specific features, eventually performing significantly better than the acoustic feature only baseline.
- **Progression tracking:** Showed percolation centrality value of certain nodes in our brain networks (constructed from PET images) is an reliable predictor of AD, MCI and CN.
- Further strengthened the study by finding influential nodes relevant to the AD network as well as quantified contribution of each node using multi-linear regression.

July '19-Present — Phase synchronization in bio-inspired neural networks
abstract
Supervisor: Dr. Basabdatta Sen Bhattacharya
- Quantifying synchronization and information flow in a thalamocortical neural mass model by estimating various synchronization measures such as Phase-locking values, spectral coherence, Transfer entropy etc.
- Implemented SyncBox: A synchronization measures toolbox for improved interpretability and valdation of models with real data.
- Learning the effects of this synchronization to understand possible stimulus-based therapeutics in brain diseases spanning Parkinson's, Sleep apnea etc.

Dec 2019 | report

Distributional Successor features

NeurIPS reproducibility challenge 2019

- Partially reproduced and re-implemented baselines from this paper.
- Identified which parts of the contribution could be reproduced at what costs in terms of resources (time, computation, efforts, communication with authors) .

Apr 2019 - May 2019

Chaotic time-series: System identification and Prediction

Course Project for Nonlinear dynamics and Chaos course by Dr. Chandradew Sharma

- Reproduced this paper, by implementing simpler nonlinear predictive models and benchmarking on Mackey glass equations. Explored the newer Neural ODEs and Latent ODEs.

Mar 2020 | abstract

Optimal sub-goal settings under myopic planning horizons

Hobby Project, Interactive talk at Neuromatch conference 3.0

- Formalized the concept of blocker tasks we face in daily life. Showed that prioritizing these blocker tasks is one of the best candidates for sub-goals using simulation studies on the Tower of Hanoi environment.

Oct 2018 | github

Twitter based NLP bot for disaster management

Microsoft Codefundo++ Hackathon submission

- Cleaned earthquake related tweets, and trained a vanilla neural net with 89% accuracy to classify them into 4 sets depending on the type of information the tweets offer.
- Summarized each of the 4 sets using ILP and encoder-decoder architecture to maintain order in the end real-time summary. Built and deployed to Azure in 4 weeks.

Publications

Conference posters/Talks:

- **Mahajan P**, Rane AP, Sasi S, Bhattacharya BS (2020) Phase Synchronisation in a thalamocortical neural mass model. Bernstein Conference 2020. doi: 10.12751/nncn.bc2020.0191. *Accepted for Poster presentation*
- **Mahajan P** (2020) Computational investigation of optimal sub-goal settings under myopic planning horizons. Neuromatch conference 3. [abstract, slides] *Accepted for Interactive talk*

Journal preprints/Under review:

- Baboo GK*, Prasad R*, **Mahajan P***, Baths V (2020) Tracking the Progression Influence of Beta-Amyloid Plaques Using Percolation Centrality and Collective Influence Algorithm: A Study using PET images. medRxiv. doi: 10.1101/2020.10.12.20211607 *Under review at European Journal of Neuroscience*
- **Mahajan P**, Baths V (2020) Bimodal Deep Learning Approach for Alzheimer's Dementia Detection from Spontaneous Speech. *Under review at Frontiers in Aging Neuroscience, research topic - ADReSS*
- **Mahajan P** (2019) [Re] A neurally plausible model learns successor representations in partially observable environments. NeurIPS Reproducibility Challenge 2019 [report]

* Equal contribution

Other Projects

Mar 2019	x86 based cash register.	Sep 2018	Touchless 3D tracking interface using capacitive sensing.
Feb 2018	DQN for Ms Pacman AI.	Apr 2015	Android game development using Unity.

Teaching experience

2020	Teaching Assistant for a Reading course on Neuroscience and AI. IC Dr. Veeky Baths
2020	Teaching Assistant for Nonlinear Dynamics and Chaos course. IC Dr. Chandradew Sharma
2020	Co-instructor of Robotics: Control and Automation CTE course.
2019	Co-instructor of Introduction to Machine learning and Deep learning CTE course. Faculty mentor: Dr. Basabdatta Sen Bhattacharya. Batch strength: 120 students.
2018	Mentor for Data science & Machine learning CTE course.

Research Interests

• Human-centric ML • Computational pain neuroscience • Deep reinforcement learning • Dynamical systems •

Relevant Coursework

`Math:` Discrete Mathematics • Multivariate calculus • Linear algebra and complex analysis • ODE • Information theory and coding

`EECS:` Computer Programming • OOP • Computer Architecture • Microprocessors and Interfacing • Digital design • Digital signal processing • Communication Networks • Signals and systems • Electronic devices

`Neuroscience and Physics:` Cognitive Neuroscience • Nonlinear dynamics and chaos • Electromagnetic theory

`Humanities:` Environment development and climate change • Applied Philosophy

`External:` Network management • Reinforcement learning

Technical Skills

Proficient	C, Python, MATLAB
Comfortable	Julia, C++, Java, Bash, Assembly code, Verilog, LaTeX
OS	Ubuntu, CentOS, Windows
Tools	Pytorch, Tensorflow, Git, JAX, Apex, Nsight, ROS, Unity, Android studio, Modelsim, MNE Python, FSL, Freesurfer.

Achievements

Scholarships:

2018 **Merit Scholarship** by BITS Pilani for Fall semester.
2018 Udacity - Google India challenge scholarship for Android development.
2015 Merit Scholarship- Class XI-XII..
2013 Maharashtra Talent Search Scholarship (MTSE) by Govt. of India.

Competitions:

2018 Kaggle Elo merchant competition : **Bronze** medal, Top 10%

Miscellaneous

Ex-Vice President @ Center for Technical Education (CTE), BITS Goa.
Faculty in-charge: Prof. Bharat M. Deshpande. CTE is a student run organisation that provides non-academic skills through courses conducted by seniors based on manual and practical learning usually in the after hours. CTE is involved in various mentoring activities, hackathons every semester and project fundings on campus. Managed a team of 30 motivated students.

Open source contributions to The-Turing-Way.

Technical writer @ Towards Data Science. My articles on model free RL

SAiDL mentor: Mentored multiple juniors embarking on machine learning projects as core member.

Student volunteer: IEEE ANTS Conference, 2019, ACCS 2019.

Student guide: Mentored 8 freshmen students through their first year.

Standardized Scores: **GRE**: 325/340 (AWA: 4.5/6), **TOEFL**: 109/120.

Hobbies: Swimming, sketching, electronic music production.

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