

Mohit Kulkarni

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EDUCATION

Indian Institute of Technology, Kanpur <i>B.S., Mathematics and Computing. Minor in Cognitive Science</i>	2019-2023 (<i>expected</i>)
Vidyadham Junior, Aurangabad <i>Maharashtra State Board of Higher Secondary Education</i>	2019
Podar International School, Aurangabad <i>Indian Certificate of Secondary Education</i>	2017

SCHOLARSHIPS AND GRANTS

- *Mar 2022:* Awarded the Undergraduate Travel Grant for **COSYNE 2022** in Lisbon, Portugal
- *2019-Present:* Awarded **INSPIRE Scholarship** by the Department of Science and Technology, Government of India

RESEARCH INTERESTS

Dynamical Systems, Theoretical Neuroscience, Machine Learning, Neural Networks

RESEARCH EXPERIENCE

Research Assistant, Allen Institute for Neural Dynamics Research Assistant, Svoboda Lab Dr. Karel Svoboda	Jan 2022 – Present Sep 2020 – Dec 2021
<ul style="list-style-type: none">• Working on dynamics of learning and plasticity in the Somatosensory cortex.• Experimented with more biologically plausible learning algorithms such as Feedback Alignment, localised hebbian learning etc.• Currently working with recurrent and chaotic models of learning(FORCE etc.)• Data analysis techniques such as PCA, GPFA, Correlation analysis were used	
Visiting Researcher, Imperial College London Prof. Dan Goodman and Dr. Friedemann Zenke(FMI, Basel)	Jun 2021 – Sep 2021 SNUFA ↗
<ul style="list-style-type: none">• Worked on creating 2 new datasets for a Spiking Neural Network(SNN) challenge, SNUFA• The datasets, derived from LibriSpeech ASR Corpus, are based on spike trains converted from auditory data• The first challenge, SNUFA100, is a word spotting challenge, while the second challenge SNUFA100_sentences is based upon keyword spotting• Used Surrogate gradient learning based SNN models for our baseline	

SELECTED PROJECTS

Neural Turing Machines <i>Course Project, Computational Cognitive Science</i> Prof. Nisheeth Srivastava, <i>Dept. of Computer Science and Engineering, IIT Kanpur</i>	<i>Documentation</i> ↗
<ul style="list-style-type: none">• Explored Neural Turing Machine as a memory augmented neural network• Conducted a literature review on models prior to NTM and those developed further due to NTM(For e.g. Differentiable Neural Computers(DNC))• Built upon an existing open-source implementation to add priority & lexicographic sort tasks and added GPU support. Also experimented with memory initialisation.	
The Omniglot Project Brain and Cognitive Society, IIT Kanpur	<i>Overview</i> ↗
<ul style="list-style-type: none">• This project was aimed at understanding and solving the problem of one-shot learning using the Omniglot Dataset of handwritten characters• Implemented SOTA meta-learning models, such as MANN, to solve one-shot classification and generative problem.• Used architectures like GANs, VAEs, LSTMs and bayesian statistics to develop models in PyTorch.	
Autonomous Humanoid(AUTOMI) Team Humanoid, IIT Kanpur	<i>Github</i> ↗

- Involved in the development of a complete, highly optimised software stack for **AUTOMI**
- AUTOMI v1 is designed for autonomous navigation in a static environment using techniques like **depth estimation, SLAM, object recognition, avoidance, lane detection** etc.
- The software stack is based on **ROS**, with image processing using **OpenCV**.

PETcat

Github 

Robotics Club, IIT Kanpur

- Aimed at developing a biologically inspired robotic cat.
- Simultaneous Localization and Planning Algorithms like **orb-SLAM, gmapping, roVIO** were implemented and benchmarked.
- Currently involved in optimization of software stack using **storage optimization, multi-threading** etc.

RELEVANT COURSES

Linear Algebra, Analysis-I, Neurobiology, Differential geometry, Probability and Statistics, Fluid Mechanics, Data Structures, Computational Cognitive Science, Complex Analysis, Optical Imaging, Quantum Physics

TECHNICAL SKILLS


Programming: Python, C/C++, R

Tools: L^AT_EX, Bash, Git

Libraries: Pytorch, Tensorflow, OpenCV, Numpy, Gazebo, ROS

TALKS AND MENTORSHIP

Does the Brain do Backpropagation | *BCS, IIT Kanpur*

Recording and Slides 

- Journal Club talk at BCS, IIT Kanpur, where we discussed biologically plausible learning rules and future directions the field can take.

Dynamics of Life | *Stamatics, IIT Kanpur*

Outline 

- Mentored a group of 30 Freshman and Sophomores in a reading project on Nonlinear Dynamics and Chaos in Nature
- Primarily based on Steven Strogatz's Nonlinear Dynamics and Chaos.

Models of Memory | *BCS, IIT Kanpur*

Documentation and Poster 

- Looked at some classical memory retrieval methods like hopfield model and mean-field theory
- Also worked with a more realistic sequential neural network model for recall tasks(For eg, NTM, MANN etc)

EXTRA-CURRICULAR ACTIVITIES

Group Leader | *Brain and Cognitive Society, IIT Kanpur*

May 2021 – Present

- Overall Head for all activities BCS conducts such as Journal Clubs, Research Symposiums etc
- Conducted 7 projects related to Neuroscience and sister fields in the summer of 2021

Secretary | *Robotics Club*

Apr 2020 – Apr 2021

- Part of a 25 member team responsible to suggest and execute ideas to increase participation in robotics related activities.

Student Guide | *Counselling Services*

Nov 2020 – Present

- Helped 6 freshmen students get used to campus life and quickly adjust to college environment

CAMPS AND WORKSHOPS

COSYNE 2022 | Lisbon, Portugal

Mar 2022

Recurrent Neural Networks for Neuroscience | *COSYNE Tutorial*

Feb 2021

Neuromatch Academy

July 2020

Vijyoshi Camp 2019 | *IISER, Kolkata*

Dec 2019