

Ishaant Agarwal

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EDUCATION

BITS PILANI | BENG. IN ELECTRICAL AND ELECTRONICS ENGINEERING

Aug 2016 - May 2021 | Goa, India

BITS PILANI | MSc. IN PHYSICS

Aug 2016 - May 2021 | Goa, India

CGPA : 8.1 / 10

EXPERIENCE

ETH ZÜRICH | VISITING STUDENT/RESEARCHER

Image and Data Analysis Group | May 2020 – Present | Zürich, CH

Advisors: *Dr Simon F. Nørrelykke, Dr Andrzej Rzepiela*

- Developing novel deep learning techniques to denoise large 3D distributions like MRI and cryo-EM images for my thesis.
- Used a 3D Unet with domain-adapted loss function to improved SNR metrics by 30% vs. current SOTA (BM3D, LAFTER)

Institute of Neuroinformatics | Dec 2020 – July 2021 | Zürich, CH

Advisors: *Dr Benjamin Grewe, Dr Pau Aceituno*

- Investigated and tested biologically plausible learning rules as compute-efficient alternatives to backpropagation in neural networks
- Trained a classifier using a completely custom unsupervised learning rule on **MNIST** achieving **93%** accuracy.

ESPCI PARIS | RESEARCH INTERN

C4 Lab | May 2019 – December 2019* | Paris, FR

Advisors: *Dr Gisella Vetere, Dr José Casanova*

- Used Calcium Imaging to visualize anterodorsal thalamic activity during memory consolidation in freely moving mice.
- Developed a full package for processing and analyzing video data from a single-photon mini-microscope, that now serves as the default analysis suite for the group.
- Used an RNN along with traditional morphological processing to extract Rols and calcium traces from these recordings and worked to register these cells to track them across sessions individually
- Used a stochastic firing model to quantify neuron behavior and conclusively identify and segregate HD cells

* Remote since August '19

NATIONAL INSTITUTE OF ADVANCED STUDIES, IISC & IIIT-B | SUMMER INTERN

Centre for Complex Systems & Soft Matter Physics | May 2018 – Aug 2018 | Bangalore, IN

Advisor: *Dr Balakrishnan Ashok*

- Researched on the Temperature Size Rule in ectotherms (especially ants and the fruit fly).
- Developed simulations of different non-linear systems that aimed to model the behaviour of organism populations to changes in temperature and extensive study of what the behaviour signified for a particular species.
- Further investigated long term global warming effects on their biomass using the Keeling Curve.

PROJECTS

PERFORMANCE ANALYSIS OF MODULATION TECHNIQUES IN UNDERWATER CHANNELS

Prof. Sarang Dhongdi | BITS Goa

November 2019 – May 2020

We set up an experimental facility, including a waterbed to test the performance various modes of underwater acoustic communication. Conducted a theoretical analysis using different encoding schemes and simulated results for our hardware and verified our findings using UnetStack3. This helped deploy the hydrophone setup at optimal configuration for testing.

MODELLING THRESHOLD DEPENDENT ACTIVE PROCESS IN NUCLEAR TRANSPORT

Prof. Toby Joseph, Prof. Nandakumar P. | BITS GOA

September 2019 – January 2020

We employed times lapse confocal fluorescence imaging to study the transport of dye labeled dextran molecules of different sizes through the nuclear pore complexes. It includes analysis of single photon as well as time-averaged fluorescence data

obtained through a confocal microscope examination of cells during the diffusion process.

AUDITORY TRANSDUCTION MODELLING OF COCHLEAR NEURONS

PROF. TOBY JOSEPH | BITS GOA

August 2019 – November 2019

Developed a highly simplistic (but effective!) and scalable probabilistic model of the inner ear, focussing on cochlear amplification and modelling auditory transduction. The model accurately predicted empirical responses to tones and even exhibited complex phenomena like two-tone suppression.

MONOCULAR DEPTH ESTIMATION

Prof. Ashish Chittora | BITS Goa

September 2019 – October 2019

As a part of the Digital Image Processing course, I studied and implemented two papers on 'Monocular Depth Estimation' (Niantic Labs, ICCV 2019), Monodepth and MonoDepth2. It deals with depth estimation from a single image using a self-supervised learning model.

SYNCHRONIZATION AND COLLECTIVE DYNAMICS OF NON-LINEAR SYSTEMS

PROF. GAURAV DAR | BITS GOA

January 2018 – December 2018

Simulated different non-linear systems in Matlab and extensively studied the synchronization behaviour as seen in the Kuramoto Model for 'n' weakly coupled oscillators. Further searched for and found fixed points and new types of bifurcations corresponding to different parameters in the same model. Also looked into possible modifications to the model to control the generation of fixed points.

TEACHING ASSISTANT

COMPUTATIONAL PHYSICS

Prof. Gaurav Dar | Fall 2019

- Introduced students to numerical methods algorithms and simulations
- Created weekly lab questions to test students on computational physics based problems.

DIGITAL IMAGE PROCESSING

Prof. Ashish Chittora | Spring 2020

- Held weekly labs for undergraduate freshmen as a part of continuous evaluation.
- Taught undergraduate students foundational image processing techniques and algorithms using MATLAB.

RELEVANT COURSEWORK

PHYSICS/NEUROSCIENCE

- Theoretical Neuroscience
- Learning in Deep Artificial and Biological Neuronal Networks
- Non-linear Dynamics and Chaos
- Computational Physics • Optics
- Classical Mechanics • Statistical Mechanics
- Mathematical Methods for Physicists
- Quantum Mechanics I and II

ENGINEERING

- Digital Image Processing
- Computer Vision for Image Recognition
- Optimization
- Control Systems
- Digital Signal Processing
- Communication Systems
- Data Structures and Algorithms

CONFERENCES

ORGANIZED

- Neuromatch 3.0
- IEEE ANTS 2020

ATTENDED

- ICML 2020
- CNS*2020

LANGUAGES

PROGRAMMING

Python • C++ • C • Matlab • R • \LaTeX

Libraries:

numpy • pytorch • sklearn tensorflow • opencv

Version Control:

- Git

Operating Systems:

- Linux • Windows

SPOKEN & WRITTEN

Native fluency:

English, Hindi

Reading fluency:

Assamese