

# Ishaant Agarwal

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## EDUCATION

### **BITS PILANI | BENG. IN ELECTRICAL AND ELECTRONICS ENGINEERING**

Expected May 2021 | Goa, India

### **BITS PILANI | MSc. IN PHYSICS**

Expected May 2021 | Goa, India

## EXPERIENCE

### **ETH ZÜRICH | VISITING STUDENT/RESEARCHER**

Dr Simon F. Nørrelykke, Image and Data Analysis Group | May 2020 – Present | Zürich, CH

- Developing novel deep learning techniques to denoise 3D distributions like MRI and cryo-EM images as part of my thesis.
- Researching AI solutions to help process complex image data for scientific groups throughout ETH Zürich.

### **ESPCI PARIS | RESEARCH INTERN**

Dr Gisella Vetere, C4Lab | May 2019 – December 2019\* | Paris, FR

- 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**

Dr Balakrishnan Ashok | May 2018 – Aug 2018 | Bangalore, IN

- 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.
- Assisted students in completing design projects as a part of the course.

## 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

(\*) - ongoing

### 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