Shaurya Goyal

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Education

Indian Institute of Technology (IIT), Kharagpur **2020 - 2025**
BS-MS in Economics Minors : Math, Biology, Artificial Intelligence CGPA: 8.89

Grade 12 (HSC): 92% **Grade 10 (ICSE)**: 95%

Awards and Scholarships

Summer Research Award, Next Gen Scientists Foundation 2022
International Research Fellowship, IIT Kharagpur Foundation 2022
Selected for the graduate-level inStem workshop on Stem Cell research [funded by Govt. of India] 2022
Selected for the ICTP-ICTS graduate-level Winter School in Quantitative Systems Biology 2021
Shortlisted for Chandralekha Singh and Jeremy Levy Student Excellence Award [declined for MCM] 2021
Top 5% grade across batch of 1800 students in the institute at the end of 1st year 2021
Merit-Cum-Means (MCM) Scholarship, IIT Kharagpur [full tuition + stipend] 2020-Ongoing
Top 1% in JEE Advanced from 150,000 selected students across India 2020
Top 0.4% in JEE Mains from over 1 million students across India 2020
Selected as Times Scholar from 300,000+ students and felicitated by Vice-President of India 2019

Preprints

Subbalakshmi, A.R.*, Sahoo, S.*, Manjunatha, P., **Goyal, S.**, . . . , Somarelli, J.# and Jolly, M.K.#, 2022. The ELF3 transcription factor is associated with an epithelial phenotype and represses epithelial-mesenchymal transition. bioRxiv. doi: https://doi.org/10.1101/2022.08.19.504435

Research Experience

Neuro Inspired Reinforcement Learning **February – September 2022**
Brown University — Prof Michael J Frank

- Developed an actor-critic deep reinforcement learning model motivated by striatum dopamine circuits
- Created a base deep learning architecture using CNNs and RNNs and implemented the model and A2C
- Compared performance with A2C on Atari games sparse rewards and varying reward statistics

White-Grey-Opaque Plasticity in Candida Albicans **June 2022 – Ongoing**
Indian Institute of Science (IISc), Bangalore — Prof Mohit Kumar Jolly

- Constructed gene network controlling white-grey-opaque plasticity in Candida Albicans using literature
- Using non-linear differential equations and machine learning to identify critical links controlling grey state
- Analzying switching dynamics and multistability using bifurcations and stochastic simulations

Epithelial-Mesenchymal (EMT) Plasticity in Cancer **November 2021 – June 2022**
Indian Institute of Science (IISc), Bangalore — Prof Mohit Kumar Jolly

- Examined the effect of ELF3 gene on EMT and compared the MET capacity with KLF4 and GRHL2
- Investigated the clinical outcome of ELF3 expression in ER+ breast cancer and tamoxifen resistance
- Found increased PD-L1 induced immune evasion that was driven by increasing ELF3 levels
- Used Gaussian Mixture Modelling, K-Means Clustering, UMAP, PCA, Regression and bulk & single cell RNA analysis methods like MAGIC algorithm, AUCell, Gene Set Enrichment etc

Phylogenetic Analysis of Eukaryote Evolution **April 2021 – May 2022**
IIT Kharagpur — Prof Riddhiman Dhar

- Conducted a phylogenetic analysis of proteomes to test the inside-out and outside-in cell evolution models
- Developed a pipeline for multiple sequence alignments and phylogentic trees generation
- Used information criterion and bootstrapping for selecting best fit

Graph Fourier Transform **July – October 2021**

IIT Kharagpur — Prof Sanand Athalye

- Implemented an empirically faster version of the parallel approximate graph fourier transform
- Compared running time of single and parallel approximate graph fourier transform for small graph networks
- Theoretically analysed a faster exact graph fourier transform by Haar unit and Givens rotation factoring of graph laplacian eigenspace and reconstructing the graph network

Skills

Programming: Python, R, MATLAB, C/C++, Linux (Bash), HPC (SLURM), PyTorch
Wet Lab: Cell Culturing, RNA Isolation, RT-PCR, Immunocytochemistry, Gel Electrophoresis

Relevant Coursework

Neuro: Computational Neuroscience[1], Computational Cognitive Neuroscience[2], General Psychology
CS: Machine Learning[2], Artificial Intelligence[1], Deep Learning[2], Signals and Systems[2], Algorithms 1[2]
Math: Probability, Statistics, Non-Linear Dynamics[2], Numerical Analysis, Linear Algebra, Advanced Calculus, Ordinary/Partial Differential Equations, Complex Analysis, Discrete Maths[2]
Bio: Systems Biology[1], Computational Biology[2], Molecular and Cell Biology, Genetics[2], Cancer[1]
Other: Econometrics 1 & 2, Data Analysis Lab, Linear Programming, Modern Robotics[3], Schizophrenia[3]

1 *PhD level course,* 2 *Online from Stanford, MITOCW etc,* 3 *Coursera*

Selected Projects

Analysis of Morris Lecar & Hodgkin–Huxley models **2022**

- Used dynamical systems theory to computationally analyze both models and explain neuron physiology

Simulation & Classification of Theta-Gamma Oscillations **2022**

- Simulated LFP signals with multiple slow and fast components corresponding to theta-gamma frequencies
- Identified distinct phase - frequency coupled states using clustering and neural signal processing

Do bike lanes increase bike commuter rates ? **2022**

- Used two-stage multivariate regression and error testing to investigate the causal impact of bike lanes

Computational Neuroscience Mini-Projects **2022**

- Analyzed epilepsy - normal EEG data, Analyzed tuning curve of visual neurons, Estimated auditory receptive field, Perceptron classification, Dimensionality reduction and decoding activity, Simulated a LIF neuron

Reinforcement Learning to Play Pong **2021**

- Built a reinforcement learning agent that uses deep Q-learning and learns from pixel data to play Pong

Workshops / Conferences Attended

Neuromatch Conference 5.0	2022
Alzheimer's Disease (Biology, Pathology & Clinical Treatments) - IIT Kharagpur	2022
Computational Neuroscience - Neuromatch Academy	2022
Essential Stem Cell Lab Techniques - inStem and NCBS, Bangalore, India	2022
Sensorimotor Control - ICTP & ICTS	2021
Neuromatch Conference 4.0	2021
High Performance Computing and AI for Biology - IIT Kharagpur	2021

Volunteer Work

Academic Mentor **January 2022 – Ongoing**

UG Council, IIT Kharagpur

- Mentoring 6 students in their 1st year (now 2nd) to ensure they have a smooth integration to university life and assisting with academic and non-academic matters

English Mentor **January – July 2022**

Student Welfare Group, IIT Kharagpur

- Guided 4 students who struggled with English to learn and get better by providing feedback and solving doubts based on weekly exercises

Teacher(Independent) **October 2019 – December 2020**

- Taught 2 under privileged kids in my locality of grade 5 (to grade 6) math, science and english.
- Led to improved understanding and skill and their grade also improved by nearly 20 percent.

Leadership / Extracurricular

- Active member of Biotechnology Reading Group, IIT Kharagpur
- Represented institue at various national level debate tournaments as a member of the Debating Society, IIT Kharagpur
- Represented institute in the Inter-IIT Scrabble Tournament
- Selected as Times Scholar (2019) by Times of India Group from 300,000+ students across India
- Silver Medal in National Taekwondo Championship (2017) and 1st Dan Black Belt

Other Interests: Guitar, Piano, Trekking, Cooking, Running, Star Wars, Making memes