Shabnam Sahay

Trainee, IMBA, Vienna BioCenter

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RESEARCH INTERESTS

Computational and Systems Biology, Biological Networks, Cell Cycle, Chromatin Organization

EDUCATION

Indian Institute of Technology Bombay *2019-23*
Bachelor of Technology (Honors) in Computer Science and Engineering | GPA: 9.16/10
Minor in Biosciences and Bioengineering | GPA: 9.80/10

PREPRINTS/PUBLICATIONS

- **S. Sahay**, S. Adhikari, S. Hormoz, S. Chakrabarti. "An improved rhythmicity analysis method using Gaussian Processes detects cell-density dependent circadian oscillations in stem cells." bioRxiv 2023.03.21.533651

RESEARCH EXPERIENCE

Estimating the Dynamics of Large Boolean Networks *Ongoing*
Undergraduate Thesis | Guide: Prof. Ganesh Viswanathan, IIT Bombay
- Incorporating random asynchronous update schemes to reflect the stochastic nature of biological networks
- Constructing partial state-transition graphs with minimal permutations recapitulating true network dynamics
- Manipulating steady state properties of the network (corresponding to cell fate) via probabilistic edge tuning

Agent-Based Modelling of Cellular Proliferation and Movement Dynamics *Ongoing*
In-Semester Undergraduate Research Programme | Guide: Prof. Sandip Kar, IIT Bombay
- Modelling heterogeneous single cells as hexagonal lattice agents having contact-based migration propensities
- Analysing corresponding experimental time-lapse microscopy data to extract information for model validation
- Inferring the interplay between cell cycle phase duration and movement under varying culture conditions

Effects of Chronic Hypo-Osmotic Stress (CHS) on Suspension Cells *2022*
MUST Programme | Guides: Dr. Bin Shen Wong & Prof. Rong Li, MBI, NUS
- Compared the effects of CHS on cell cycle and growth in suspension (Nalm6) cells and adherent (RPE) cells
- Characterised variations in population growth and viability through cell counting and time-lapse microscopy
- Performed western blotting independently with positive controls to quantify upregulation in p53 expression
- Identified significant increase in cell cycle arrest of RPE cells relative to Nalm6 cells under CHS via FACS

Detecting Oscillations in Biological Data with Gaussian Processes *2021–22*
Guide: Prof. Shaon Chakrabarti, Simons Centre, National Centre for Biological Sciences
- Developed an R package combining GP regression with Bayesian model selection to detect noisy oscillations
- Identified and adapted gaussian process kernels best-suited for capturing non-stationary oscillatory patterns
- Evaluated performance against existing methods on experimental data and exhaustive simulated datasets

WORK EXPERIENCE

Software Engineering Intern | *Hyperscale Networking Team, Microsoft RnD India* *2022*
- Built a predictive maintenance model for optical link flaps with device metrics and link configuration data
- Designed custom features to enable forecasting and evaluated multiple classifiers for maximal f1-scores
- Deployed the optimised model as a web-service for real time predictions of flaps achieving $\geq 70\%$ accuracy

Engineering Research Intern | *Applied and Plasma Physics Lab, University of Sydney* *2022*
- Built, tested, and refined a deformable mesh model in C++ to simulate the rolling-adhesion of leukocytes
- Utilised a variable mesh to enable design of DNA origami nanorobots that can act as synthetic leukocytes

Undergraduate Teaching Assistant | *IIT Bombay* *2021-23*
- Courses: Biology, Quantum Physics, Computer Systems Bootcamp, Mathematical Foundations of AI & ML
- Designed and verified problem statements, conducted tutorials and help sessions, and graded examinations

ACADEMIC ACHIEVEMENTS

- Achieved **All India Rank 10** among over 240,000 aspirants in the JEE Advanced *2019*
- Attained the **Highest Mark in India** in A-Level Physics in March-June Cambridge Examinations *2019*
- Secured **3rd Place in India** for Best Across 3 A-Levels in March-June Cambridge Examinations *2019*
- Scored 120/120 in TOEFL iBT, and 170/170 (Quantitative) + 164/170 (Verbal) in GRE General *2022*
- Awarded the AP grade for exceptional performance (**top 8** out of 295) in Environmental Studies *2022*
- Achieved All India Rank 256 in the KVPY Fellowship Examination conducted by IISc Bangalore *2018*

SCHOLARSHIPS

- Awarded the MUST Programme Fellowship by the National University of Singapore *2022*
- Received the Engineering Vacation Research Scholarship from the University of Sydney *2022*
- Offered the MtL-URO Fellowship by the Max Planck Institute for Medical Research *2021*
- Awarded the prestigious Aditya Birla Scholarship (**top 16** engineering students across India) *2019*
- Received the Desai-Sethi Family Scholarship for ranking **1st** among all females in JEE Advanced *2019*

WORKSHOPS AND CONFERENCES

- Attended the IIT Delhi Theoretical Computer Science Winter School as one of 40 selected students *2022*
- Presented a poster at the Simons Symposium: Cellular Lineages & Development, Alleppey, India *2022*
- Presented a poster at the MBI MUST Programme Poster Session, National University of Singapore *2022*

TECHNICAL PROJECTS

Generating 3D Chromatin Configurations | *Guide: Prof. Ranjith Padinhateeri, IIT Bombay* *2022*

- Constructed 3D SBS polymer ensembles modelling chromatin loci corresponding to experimental Hi-C input
- Implemented Simulated Annealing Monte Carlo optimization to derive the model best describing the input

Compiler for a C-Like Language | *CS316: Implementation of Programming Languages Lab* *2022*

- Built a compiler to generate Abstract Syntax Tree, Three Address Code, and Register Transfer Language
- Integrated support for arithmetic and relational expressions, control flow statements, and function usage
- Implemented the scanner in lex, parser in yacc and constructed an object-oriented AST representation
- Developed an efficient procedure for conversion from AST to RTL through appropriate register allocation

Anti Tic-Tac-Toe | *CS747: Fundamentals of Intelligent and Learning Agents* *2021*

- Encoded Tic-Tac-Toe with the winning conditions reversed into a Markov Decision Process for each player
- Derived each player's optimal MDP policy utilising Howard's Policy Iteration given a fixed opponent policy
- Implemented an iterative reward-maximisation algorithm to compute the best possible policy for both players

KEY COURSEWORK

Computer Science: Data Structures, Design & Analysis of Algorithms, Geometric Algorithms, Logic for Computer Science, Automata Theory, Implementation of Programming Languages, Data Analysis & Interpretation

Biology: Cell and Molecular Biology, Metabolism and Bioenergetics, Immunology, Biochemistry, Molecular Biophysics, Topics in Evolution, Bioinformatics, Quantitative Biology Workshop (MITx on edX)

TECHNICAL SKILLS

Programming: C++, C, Python, Perl, Java, R, Bash, Awk, Numpy, Scipy, Matplotlib, SQL, Pandas
Software: LaTeX, Git, MATLAB, PyMOL, BLAST, LAMMPS, ImageJ, Doxygen, Beamer

EXTRACURRICULAR ACTIVITIES

- Trained for 9+ years and completed **Arangetram** (graduation) in the classical dance Bharatanatyam *2015*
- Awarded **1st Position** among all freshmen at IITB in the Solo Classical and Folk Dance competition *2019*
- Choreographed and performed classical dance in IITB's Annual Dance Show for a 2000+ audience *2023*
- Member of the IITB contingent securing **runner-up** position in the **Inter-IIT** Scrabble League *2021*
- Secured **2nd runner-up** position in IITB's Institute Scrabble League among 80+ participants *2021*