VARUNI SARWAL

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ACADEMIC DETAILS

Indian Institute of Technology, Delhi *2016 - 2020*

Bachelor of Technology, Biochemical Engineering and Biotechnology GPA: 8.4/10, Rank: 3/60
Minor in Computer Science

RESEARCH INTERNSHIPS

Investigating Effects of Insulin Estimation on Insulin Sensors Design May 2019 - Present
Frank Doyle, Harvard SEAS *The Doyle Group, Harvard*

- Modified the Zone Model Predictive Control and PID controller algorithms of the artificial pancreas simulator to use kalman-filter based insulin estimates as a feedback-based threshold suspend safety layer to prevent hypoglycemia
- Performed a Control-Variability Grid Analysis (CVGA), and Return on Investment (ROI) for ten subjects and three meal scenarios for seven insulin measurement intervals to determine the optimal insulin measurement frequencies [3]

Comprehensive benchmarking of WGS-based structural variant callers May 2018 - Present
Eleazar Eskin, Computer Science, UCLA *Zarlab, UCLA*

- Developed a pipeline for comparing the performance of Structural Variant detection tools on mouse chr19 and hg38 data against a PCR verified gold standard to determine tools with the best match of precision and sensitivity
- Studied the effect of the coverage of data and deletion length on the accuracy of each tool under various thresholds [4]

Comprehensive analysis of the usability and archival stability of omics tools Jan 2018 - June 2019
Eleazar Eskin, Computer Science, UCLA *Zarlab, UCLA*

- Ran a standard installation test on various published software tools to determine the archival stability and installability
- Analyzed relationships b/w factors such as number of citations, year of release, ease of installation, open source, source control, manual intervention, number of installation commands, undocumented commands and installation time [1]

RESEARCH PROJECTS

Machine learning approaches to improve the specificity of CRISPR-Cas9 Aug 2019 - Nov 2019
Durai Sundar, Bioinformatics, IIT Delhi *Senior Thesis, IIT Delhi*

- Developed a new scoring scheme for sgRNA sequences based on number of off-targets sites using K-means clustering
- Analyzed the position specific mismatch tolerance ability of each nucleotide in the seed and non seed regions of sgRNA

Implementation of machine learning algorithms Jan 2019 - May 2019
Parag Singla, Computer Science, IIT Delhi *Course project, IIT Delhi*

- Implemented Naive Bayes for classifying 5MM Yelp reviews; multiclass gaussian kernel SVM's for MNIST digits
- Determined credit card defaulters from the UCI database using feature selection by decision trees and random forests
- Predicted the reward from a sequence of frames in Atari Breakout using PCA+SVM, Neural Networks and Keras CNN

Basic Logic Assesment and Signalling tools: BLAST May 2017 - Nov 2017
Shaikh Z. Ahammad, Biochemical Engineering and Biotechnology, IIT Delhi *iGEM, IIT Delhi*

- Designed a bacterial square wave generator by constructing a 5 node repression based ring oscillator circuit in *E. coli*
- Modelled the circuit's response through simulations in MATLAB to produce a square wave response using orthogonal repressors with high cooperativity, time delay, rapid degradation and noise reduction.

Computational prediction of the origin of replication of DNA May 2017 - October 2017
Kushal Shah, Electrical Engineering, IIT Delhi *Design Innovation Summer Award, IIT Delhi*

- Modified the existing auto-correlation method of prediction of DNA replication, to develop a new method, iCorr, which exploits spatial information about the position of nucleotides by using complex number representation [2]
- Designed and implemented a software that could automatically optimize window and shift size parameters for iCorr

PUBLICATIONS

[1] Mangul, S., Mosqueiro, T., Abdill, R.J., Duong, D., Mitchell, K., **Sarwal, V.**, Hill, B., Brito, J., Littman, R.J., Statz, B. and Lam, A.K.M., 2019. Challenges and recommendations to improve the installability and archival stability of omics computational tools. PLoS biology, 17(6), p.e3000333.
[2] Kundal, S., Lohiya, R., Bansal, H.*, Johri, S.*, **Sarwal, V.*** and Shah, K., 2019. Computational prediction of replication sites in DNA sequences using complex number representation. arXiv preprint arXiv:1909.13751.
[3] **Sarwal, V.**, Wolkowicz, K., Deshpande, S., Wang, J., Pinsker, J., Laffel, L., Patti, M.E., Doyle, F.J. and Dassau, E., 2019. Investigating Effects of Insulin Estimation on Future Insulin Sensors Design and Implication for AP Diabetes Management (Abstract accepted in the International Conference on Advanced Technologies & Treatments for Diabetes)
[4] **Sarwal, V.**, Chang, S., Ayyala, R., Roskosch, S., Distler, M., Littman, R.J., Chikka, R., Maher, N., Jensen, S., Eskin, E., Mangul, S.* and Flint, J.* A benchmarking of WGS-based structural variant callers (In preparation)
* denotes equal contribution

SCHOLASTIC ACHIEVEMENTS, AWARDS AND SCHOLARSHIPS

- **Department Rank 3 (Spring 2019):** Ranked 3 amongst 60 students in the department for three consecutive years
- **Best poster, BIG Summer (2018):** Won award at UCLA QCBio Bruins in Genomics Summer poster session [4]
- **Charpak Scholar, Embassy of France (2018):** 1 of 12 students nationally to be awarded the Charpak Semester Exchange Scholarship by the French Government for a funded 4 month semester exchange at INSA Toulouse, France
- **International Exchange Program, IIT Delhi (2018):** Among 4 students selected from 300+ applicants, following a 3-tier evaluation process, for a semester exchange at Institut national des sciences appliques de Toulouse, France
- **Bronze medal in iGEM at MIT**: Awarded for the project 'Basic Logic Assesment and Signalling tools: BLAST'
- **Design Innovation Summer Award, IIT Delhi (2017):** Awarded a grant by the Ministry of Human Resource Development for innovative research during the summer of 2017 [2]
- **Cluster Innovation Center, Delhi University (2016):** Secured All India Rank 4 in B.Tech entrance examination
- **KVPY Scholar (2016):** Selected for Kishore Vigyanik Protsahan Yojana (Young Scientist) fellowship, by the Department of Science and Technology, Government of India (99.6 percentile)
- **National Talent Search Examination (NTSE) Scholar (2014):**Awarded by the National Council for Educational Training and Research (NCERT), Government of India (99.9 percentile)

TECHNICAL SKILLS

Languages: R, Python, Java, C, C++, Bash, HTML, CSS, Javascript, MATLAB **Frameworks:** Django

COURSEWORK

- **Computer Science, Electrical Engineering and Mathematics :** Special Topics in Machine Learning*, Special Module in Algorithms*, Advanced Functional Brain Imaging*, Design Practices*, Machine Learning, Theory of Computation, Discrete Mathematics, Data Structures and Algorithms, Differential Equations, Probability and Stochastics, Linear Algebra, Calculus, Process Dynamics and Control, Basics of Electrical Engineering, Basics of Computer Science
* denotes courses to be completed by May, 2020
- **Biology:** Bioinformatics, Molecular Biology and Genetics, Recombinant DNA Technology, Mass and Energy Balance.

EXTRACURRICULAR ACTIVITIES

Mentorship, Teaching and Justice Dec 2016 - Present

- Member of the Internal Complaints Committee (ICC), IIT Delhi. Mentoring 6 IIT freshmen, 3 international students
- Mentored and taught math and science for IIT-JEE prep to 20 high school students from an underprivileged background
- Founded a youtube channel, Science Boom with educational math and science videos. Global viewership of 12k+

Tryst IITD Web Developer Dec 2017 - Feb 2018

- Developed the official website for Tryst IIT Delhi 2018, North India's largest techfest with an attendance of 45,000+
- Website managed event schedule, guest speakers, registrations and event passes. Coded in Javascript, CSS and HTML

Debating and Art May 2017 - May 2018

- Debating representative of Himadri Hostel, IIT Delhi, mentored and taught 800+ freshmen debating
- First position in Himadri intra-hostel British Parliamentary debating tournament, freshers Just a Minute competition
- Voice over artist for IIT Delhi based tech startups Astanite and Triton Shoes