Eashan Gupta

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Indian Institute of Technology Bombay **2016-2020**
Bachelors of Technology in Computer Science with Honours *GPA : 8.99/10.0*

Interests

Artificial Intelligence, Machine Learning, Theoretical Computer Science, Program Verification

Internships and Research Experience

Automation of Timing Performance Checks **May-July 2019**
Summer Internship *Tower Research Capital, Gurgaon*

- Automated the performance **testing platform** for the software processing the order book data broadcast by market exchanges and reported the performance statistics
- Simulated environment similar to market exchanges by broadcasting old data and processing it
- Upgraded the current system to run tests using new **Bash** and **Python** scripts and API's for automation
- Experimented over various environments using different configurations of **cache allocation technology** and running processes in parallel to observe performance statistics and any dependency patterns

Reduction in Games played on recursion schemes | Theoretical CS **May-July 2018**
Guide: Prof. Roland Meyer | Summer Internship *TU Braunschweig, Germany*

- Worked on the reduction of parity games to safety games played on **higher order recursion schemes** (HORS), using similar results on reduction in the games played on **collapsible pushdown automata**
- Proposed a new approach to model games on recursion schemes using **computation trees** of the higher order recursion schemes
- Studied the equivalence between HORS to collapsible pushdown automata (CPDA) using **Krivine machines** and lambda-labelled deterministic digraph
- Worked to improve the lower bound on the number of counters used in the reduction from parity to safety games

Implementation of Abstract Domains for Program Verification **Jan-May 2019**
Guide: Prof. Supratik Chakraborty | Research Project *IIT Bombay*

- Studied abstract interpretation for program verification using domain specific techniques and fixed point analysis
- Implemented the **congruence** abstract domain and **array** abstract domain using **C++** to be integrated in the **CAnalyzer** tool
- Engineered the array domain by mapping **segments** of an array to bound sets and sets of intervals stored in the form of variable expressions
- Utilized **context-free** comparisons between variable expressions to complete operations in the array abstract domain

Awards and Scholastic Achievements

- Secured **All India Rank 38** in **IIT JEE Advanced** among 200 thousand candidates (2016)
- Secured **All India Rank 122** in **IIT JEE Mains** among 1.2 million candidates (2016)
- Received Gold medal for being in the **top 35** students in **Indian National Physics Olympiad** (2016)
- Amongst the **top 30** students selected to attend Orientation cum Selection Camp of **INAO**, Indian National Astronomy Olympiad (2016)
- Recipient of **Kishore Vaigyanik Protsahan Yojna Fellowship** (KVPY) with an **All India Rank** of **121**, instituted by the Department of Science and Technology, Government of India (2015)
- Recipient of **National Talent Search Examination** Scholarship awarded by the Govt. of India (2014)

- Amongst the **top 1%** students in **NSEC**, National Standard Examination in Chemistry (2016)

Teaching & Mentoring Experience

- **Teaching Assistant** - Selected to manage and clear doubts in a class of 100 first-year students for the basic undergraduate course on Computer Programming and Utilization. Coordinated with the Computer Science Dept. to conduct regular **lab sessions** & **evaluate exam papers**
- **Teaching Assistant** - Managed the forum for the **online course** Soft Skills on the online platform IITBombayX MOOC. Tasked to create questions and such material for the same course.

Notable Projects

Near-Optimal Arm Identification in Continuum-Armed Bandits July-Nov 2019
Guide: Prof. Shivaram Kalyanakrishnan | Course Project IIT Bombay

- Derived a lower bound for the probability of determining an epsilon-optimal arm based on simple regret from continuous-armed bandits for any mean distribution
- Explored various sampling strategies, both fixed and adaptive, and tested them empirically over various mean functions for simple regret and analyzed them

Monadic Parser for Core Functional Language July-Nov 2019
Guide: Prof. Amitabha Sanyal | Course Project IIT Bombay

- Modernised the parser implementation for core language in **Haskell** to a monadic parser
- Studied the various monads to use them to use them for structured error handling and parsing

Handwriting synthesis using RNNs Mar-May 2019
Guide: Prof. Sunita Sarawagi | Course Project IIT Bombay

- Explored the various deep learning frameworks for handwriting synthesis and analyzed them
- Trained an **LSTM** to generate strokes for individual letters of the alphabet
- Based on concepts from attention based RNN models and GAN models, designed an algorithm to train the LSTM and an encoder-decoder model, used to string letters smoothly, in an **adversarial** fashion to improve training efficiency

Lightweight Probabilistic Deep Networks Oct - Nov 2018
Guide: Prof. Suyash Awate & Prof. Ajit Rajwade | Course Project IIT Bombay

- Used probabilistic output layers and **Dirichlet** categorical classifier to account for uncertainties in deep networks
- Implemented assumed density filtering using the **Keras** API in **Python** and modified deep network layers to propagate their activation uncertainties
- Performed experiments on some standard databases and measured cross-entropy to compare results

Compiler Design Jan-April 2019
Prof. Supratim Biswas | Course Project IIT Bombay

- Developed a compiler and an interpreter for a subset of C language to generate its assembly code
- Used **lex** and **yacc** for parsing, creating abstract syntax trees, control flow graphs and symbol tables

Cache Timing Attacks on DSA Oct-Nov 2018
Guide : Prof. Bernard Menezes | Course Project IIT Bombay

- Explored and examined various cache timing attacks on implementations of cryptographic algorithms
- Verified the possibility of exploiting the **OpenSSL** library and recover bits of the key in **DSA**
- Studied lattice attacks and hidden number problem to extract the security key using recovered bits

Automated Ticketing System for Car Parking Sept-Nov 2018
Guide : Prof. Kavi Arya | Course Project IIT Bombay

- Built an app to provide automated ticketing service for car parking using the **Flutter** API on Android
- Used **Java servlets**, **PostgreSQL** and **Tomcat** API to manage the database and its interactions with the app

Othello AI Jan-April 2018
Prof. Amitabha Sanyal | Course Project IIT Bombay

- Developed the single player mode for the game of Othello in **Racket**, a multi-paradigm programming language, using concepts of **dynamic weights** and **functional programming**
- Determined the winning probability of 0.88 of our single player algorithm against the natural greedy algorithm

Team Member, ADCS, Advitiy Feb-Dec 2017
Advitiy is the 2^{nd} student satellite of IITB, technically advanced and efficient version of the 1^{st}, Pratham

- Developed a simulation for a simple Feedback Control System for a motor in **MATLAB** and **Simulink** based on the **PID controller** to understand the control law currently employed in Pratham
- Performed **battery simulations** for the satellite in MATLAB to analyze its charging and discharging cycles to validate the control law employed in Pratham and check overall functioning of the satellite

Technical Skills

Programming	C++, C, Python, Java, Bash, Racket, Haskell, Prolog, MIPS, PostgreSQL, LaTeX
Web Development	HTML5, CSS3, JavaScript, Django, PHP, Bootstrap, jQuery
Softwares	MATLAB, Simulink, Gnuplot, Git, Android Studio, Arduino, Xilinx

Key Courses Undertaken

Computer Science	Digital Logic Design, Automata Theory, Logic for Computer Science, Data Structures & Algorithms, Discrete Mathematics, Graph Theory, Design & Analysis of Algorithms, Database & Information Systems, Computer Architecture, Operating Systems, Cryptography and Network Security, Interpretation of Programming Languages, Design & Implementation of Functional Programming Languages
AI & ML	Data Analysis & Interpretation, Fundamentals of Digital Image Processing, Artificial Intelligence and Machine Learning, Fundamentals of Intelligent Learning Agents, Web Search & Information Retrieval, Advanced Machine Learning, Advances of Intelligent Learning Agents*
Mathematics	Calculus, Linear Algebra, Differential Equations, Numerical Analysis
Others	Accounting and Finance, Operations Management, Economics, Operations Analysis

**to be completed by April 2020*

Extracurricular

- Attended **Vijyoshi camp** conducted by IISER, Kolkata which serves as a forum for interactions between bright young students and leading researchers and promotes research among them
- Among top 5 teams in XLR8 competition, building a blue tooth controlled bot during freshman year
- Successfully completed one year training in **lawn tennis** under **NSO**, IIT Bombay
- Consistent scholarly performance at school level in all classes and awarded Scholar Badge for the same
- Stood **first** in the inter-school of **stone painting** competition