Eashan Gupta

University of Illinois, Urbana-Champaign

+1 217-979-0079 • eashang2@illinois.edu • eash3010.github.io/
linkedin.com/in/eagupta/ • eash3010

University of Illinois Urbana-Champaign **2021-2023 (Expected)**
Master of Science in Computer Science *GPA: 4.0/4.0*

Indian Institute of Technology Bombay **2016-2020**
Bachelors of Technology in Computer Science with Honours *GPA : 9.13/10.0*

Work Experience

Nutanix Technologies, Bangalore **July 2020-July 2021**
Nutanix is the leading Enterprise Cloud provider based in San Jose, California

- Software developer at Nutanix in the teams Microservices Platform and Karbon (**MSP/Karbon**)
- Used **Kubernetes** to deploy microservices on a Hyper-converged Infrastructure using virtual machines
- Worked to support the Karbon platform on **VMware's hypervisor ESX** other than AHV (in-house)
- Added multiple features to the Karbon controller like migration to **CoreDNS** on k8s upgrade; network segmentation for efficient traffic handling; redacting logs; tracking metrics using **Prometheus** and middlewares
- Wrote test sets and unit tests for various scenarios related to system upgrades, DNS entries and service discovery
- Managed a new version release including testing and publishing to production
- Handled Customer Oncalls and feature bugs

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
- Experimented over various environments using different configurations of **cache allocation technology** and running processes in parallel to observe performance statistics and any dependency patterns

Internships and Research Experience

Self-verification of networks using P4 **Aug 2021-Present**
Guides: Prof. Matthew Caesar *University of Illinois Urbana-Champaign*

- Verifying networks using P4 and network telemetry in a distributed fashion at the switch level

Improving upper bounds of Policy Iteration Algorithm in RL **Feb-June 2020**
Guide: Prof. Shivaram Kalyanakrishnan *IIT Bombay*

- Proved exponentially better upper bounds for the number of steps taken by Policy Iteration Algorithm (**PI**) to determine the optimal policy in deterministic Markov Decision Processes (**DMDPs**) using path-cycles
- Studied literature concerning the structure of policy space of MDPs and simplified their proofs
- Conducted various empirical experiments on lower order AUSOs to observe the family of randomized PI

Towards validation of RTL passes of the GCC compiler **Jan-June 2020**
Guides: Prof. Amitabha Sanyal & Prof. Supratik Chakraborty *IIT Bombay*

- Analysed the various Register Transfer Language (**RTL**) optimization passes in **GCC-4.7.2** and implemented a **block-by-block** validation technique to validate program transformations done by the passes
- Realized obligations based on the return values, heap memory and function calls of programs in the **Z3 Theorem Prover** tool to prove semantic equivalence between different control flow graphs (**CFGs**)
- Studied the internal workings of GCC-4.7.2 compiler and developed various plugin tools for analysis

Optimized DL GPU Task Scheduling for NVIDIA Jetson TX2 **[GitHub] | Aug-Dec 2021**
Guide: Prof. Tianyin Xu *University of Illinois Urbana-Champaign*

- Showed that the Nimble algorithm in **PyTorch** is hardware dependent and is not always successful in improving GPU performance by experiments on the Jetson TX2, a popular embedded AI systems hardware
- Implemented GPU task scheduling algorithms for deep learning inference models based on greedy longest chains and load balancing in PyTorch and improved **performance** on certain models by upto 16% on TX2
- Proposed a **Dynamic Programming** algorithm along with experiments demonstrating **proof of concept**

Self-Supervised Embedded Speech Emotion Recognition **Aug-Dec 2021**
Guide: Prof. Paris Smaragdis *University of Illinois Urbana-Champaign*

- Implemented and trained a **Siamese NN** to distinguish emotions between 2 input speech samples with **test accuracy** 82% on the **CREMA-D** speech dataset
- Used the trained Siamese neural network to identify emotions of unseen classes with upto 54% accuracy
- Trained a classifier based on embeddings learned from the Siamese NN with upto 81% validation accuracy

Reduction in Games played on recursion schemes **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 games played on collapsible pushdown automata (**CPDA**)
- Studied equivalence between HORS and CPDA using **Krivine machines** and λ-labelled deterministic digraph
- Worked to improve lower bound on the number of counters used in reduction from parity to safety games

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

- Studied abstract interpretation of program verification using domain specific techniques and fixed point analysis
- Implemented **congruence** and **array** abstract domains in **C++** for integration into the **CAnalyzer** tool
- Engineered the array abstract domain by mapping segments of an array to their abstract values; bounds of the values stored as variable expressions which are used in **context-free** comparisons to complete operations

Plausible Password Generation using Generative Models **Jan-June 2020**
Guides: Prof. Abir De *IIT Bombay*

- Explored and analysed the latest methods used to evaluate and guess passwords
- Devised and implemented methods to evaluate a password based on the metrics of **guessability** and **memorability** and used them to compare the generative models developed
- Designed methods to take old passwords as input and generate new stronger passwords using different generative models implemented using **RNNs**, variational autoencoders (**VAEs**) and **Grammar VAEs**

Technical Skills

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

Key Courses Undertaken

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

Teaching & Mentoring Experience

- **Teaching Assistant, Applied Machine Learning, UIUC** - Manage the course forum and clear doubts of the students in the online course. Conduct weekly office hours to handle doubts in person.

- **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 Department 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.

Other Notable Projects

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

- Derived a general lower bound for the probability of choosing an epsilon-optimal arm from the continuous-armed bandits problem, based on simple regret for any mean probability distribution of the arms
- Explored various fixed and adaptive sampling strategies and experimented empirically over various mean functions to observe simple regret

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

- Explored and analyzed the various deep learning frameworks for handwriting synthesis
- Trained an **LSTM** to generate strokes for individual letters of the alphabet
- Devised and implemented an algorithm to train the LSTM and an encoder-decoder model in an **adversarial** fashion and used it to string letters smoothly to form complete handwritten words

Lightweight Probabilistic Deep Networks **Oct - Nov 2018**
Guides: Prof. Suyash Awate & Prof. Ajit Rajwade *IIT Bombay*

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

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

Othello | *Prof. Amitabha Sanyal, IIT Bombay* Jan-April 2018

- 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 a winning probability of 0.88 of our single player algorithm against natural greedy algorithm

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)