

Eashan Gupta

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University of Illinois Urbana-Champaign

Master of Science in Computer Science

2021-2023 (Expected)

GPA: 4.0/4.0

Indian Institute of Technology Bombay

Bachelors of Technology in Computer Science with Honours

2016-2020

GPA : 9.13/10.0

Research Interests

Networks, Distributed Systems, Theoretical Computer Science, Reinforcement Learning

Publications

- Rethinking Cloud-hosted Financial Exchanges for Response Time Fairness [[paper](#)]
Prateesh Goyal, Ilias Marinos, **Eashan Gupta**, Chaitanya Bandi, Alan Ross, Ranveer Chandra
HotNets'22: Proceedings of the 21st ACM Workshop on Hot Topics in Networks, Austin, TX
- DBO: Response Time Fairness for Cloud-Hosted Financial Exchanges [submitted]
Eashan Gupta, Prateesh Goyal, Ilias Marinos, Chenxingyu Zhao, Radhika Mittal, Ranveer Chandra
- Some Upper Bounds on the Running Time of Policy Iteration on Deterministic MDPs [[paper](#)]
R. Goenka, **Eashan Gupta**, S. Khyalia, P. Agarwal, M.S. Wajid, S. Kalyanakrishnan

Work Experience & Internships

Research Intern, Microsoft Research, Redmond

May 2022-Aug 2022

Networking Research Group

[[paper](#)]

- Simulated and refined protocols to host Financial Exchanges on Cloud based on Response Time Fairness
- Implemented a **PoC** prototype of a Cloud-hosted Financial Exchange using a **DPDK** platform
- Proved the feasibility of enforcing fairness on **Azure** data centres to mitigate inherent latency variations
- Implemented a prototype system with an end-to-end latency of $150\mu s$ and ensure a fairness ratio of more than 99% for a 2-client system and $125k$ trades per second

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
- Managed a new version release including testing and publishing to production; Handled Customer Oncalls

Automation of Timing Performance Checks

May-July 2019

Summer Internship

Tower Research Capital, Gurugram

- 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

Research Experience

Improving upper bounds of Policy Iteration Algorithm in RL [[paper](#)]

Feb-June 2020

Guide: Prof. Shivaram Kalyanakrishnan

IIT Bombay

- Proved exponentially better upper bounds for number of steps taken by Policy Iteration Algorithm (**PI**) to determine the optimal policy in deterministic Markov Decision Processes by counting tadpole subgraphs
- Partially resolved a conjecture about Howard's PI taking at most order Fibonacci steps on 2-action MDPs by establishing upper bounds for DMDPs

- 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
- NLNet: Configuring Networks with Natural Language** Jan-May 2022
Guide: Prof. Matthew Caesar University of Illinois Urbana-Champaign
- Developed methods to convert high level invariants in natural language to appropriate network function calls to configure a network
 - Used AMR parsing to model a classification task based on the network API documentation and improved accuracy using feedback from network verification rules
- 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**
- 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
- ## Technical Skills
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- | | |
|------------------------|---|
| 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: | Advanced Operating Systems, Distributed Systems, Computer Security, ML for Signal Processing, Efficient & Predictive Vision, Knowledge-driven Natural Language Generation, Advances in Intelligent and Learning Agents, Advanced Machine Learning, Functional Programming Languages, Web Search & Information Retrieval, Digital Image Processing, Artificial Intelligence, Computer Graphics, Graph Theory |
- ## Teaching & Mentoring Experience
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- **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

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

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**

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

Team Member, ADCS, Advitiy

Feb-Dec 2017

Advitiy is the 2nd student satellite of IITB, technically advanced and efficient version of the 1st, 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)
- 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)