

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
- Some Upper Bounds on the Running Time of Policy Iteration on Deterministic MDPs [Preprint on request]
R. Goenka, **Eashan Gupta**, S. Khyalia, P. Agarwal, M.S. Wajid, S. Kalyanakrishnan

Work Experience

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

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

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

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

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

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

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

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 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

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)