Atharva Chougule

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Research Interests

Distributed and data-intensive Systems, Security, Compilers, High-Performance Computing, Operating Systems, Databases

Education

Indian Institute of Technology Madras *July 2019 – May 2023*
Bachelor of Technology with Honors in Computer Science and Engineering

- GPA: **9.79/10**
- **Gold Medalist** for being the student with **highest GPA** in Computer Science Department.

Work and Research Experience

Rubrik, Inc *Bangalore, India*
Software Engineer | Rubrik Security Cloud Private (RSC-P) - Platform Team *June 2023 - Present*

- Designed and implemented a **horizontally scalable architecture** for RSC-P as part of the **RSC-P Multi-Node Project** using **Kubernetes**. Expanded the scale of RSC-P to more than **5 times**. Hardened the security of RSC-P Multi Node by designing mechanisms for authentication, firewall access, and secret rotation across nodes.
- Designed and implemented a **state machine** for running cluster upgrades of RSC-P. Further, **improved the system stability** of RSC-P by identifying and addressing various security gaps, optimizing the use of resources, stabilizing and improving the upgrade performance, etc.
- Analyzed **mysql database** on RSC-P and identified that we could optimize the storage usage and boost performance by **reducing fragmentation**. Build tools for defragmenting the mysql database to **reduce storage usage by more than 50%**.
- Led a hackathon project for evaluating different **Kubernetes distros** and migrating the RSC-P architecture to **Rancher Kubernetes Engine**.
- Currently leading a project for further hardening **security and data resilience** of RSC-P by **enforcing backups and automating disaster recovery** for RSC-P.

Code Generation for Distrbuted Graph Algorithms *IIT Madras*
Bachelors Thesis | Guide: Prof. Rupesh Nasre *Dec 2022 - May 2023*

- Re-architectured and built a **compiler** for the **distributed systems backend** of **STARPLAT** - a DSL for graph analytics, a project funded by India's National Supercomputing Mission (NSM).
- Developed a **graph representation** by modifying the Compressed Row Format (CSR) representation for storing **dynamic graphs** over a **distributed network**.
- Generated code in **MPI** for dynamic graph algorithms and evaluated performance for generated graph algorirhms like **Page Rank**, **Betweeness Centrality**, **Triangle Counting** and **Single Source Shortest Path**. Used **MPI RMA** for decoupling data movement and process synchronization for graph algorithms.
- Demonstrated that specialized **dynamic graph algorithms** can **perform better** than conventional static algorithms for dynamic graphs **up to a certain percentage of updates on the graph**.

Evaluating Byzantine Fault Tolerance for a new model of distributed computing *IIT Madras*
Research Project | Guide: Prof. John Augustine *Aug 2022 - Nov 2022*

- Modeled a new framework called **Cloud-MPC** for **distributed computing** where, unlike the traditional MPC model, **data is decoupled from the distributed network** and is stored in an external entity like the Cloud.
- Analyzed **Byzantine Fault Tolerance** in the new framework. Developed a **Conversion theorem** for converting any algorithm in the classic MPC model to the new framework.
- Developed a **randomized algorithm** for **fundamental boolean problems** like **AND** and **XOR** on N bits of data stored in the cloud in the new model. Generalized this algorithm to any boolean circuit on N bits by using **the idea of committee elections** in a Byzantine network.

Rubrik, Inc *Bangalore, India*
Software Engineer Intern | Rubrik Cloud Vault(RCV) *May 2022 – July 2022*

- Designed a framework for syncing customer cost metrics for **Rubrik Cloud Vault(RCV)**. Built a general framework to sync cost data from **Microsoft Azure** using Azure Cost API. Used the synced data to **analyze the early deletion penalty incurred to a customer** due to early data deletion in RCV and alert them regarding the same.

- Implemented a feature to allow **cleanup of archived blobs of data stored** in Rubrik Cloud Vault past their immutability period. This helped **save and optimize the storage costs** incurred on Azure.

Library for popular Graph Matching Algorithms *IIT Madras*
Research Assistant | Guide: Prof. Meghana Nasre *Mar 2021 – May 2021*

- Investigated and surveyed literature on **Stable Matching** and **Rank Maximal Matching** Algorithms on Bipartite Graphs.
- Helped in **building and testing a library** for various **graph-matching algorithms**.

Key Projects

Decentralized Oracle *Winter 2022*
Guide: Prof. John Augustine *IIT Madras*

- Implemented a **decentralized Oracle smart contract** using **Solidity** to verify real-world sports event outcomes in a trustless manner.
- Designed the system by including features like **Proof of Work(PoW)** and **stake-based** rewards for accuracy.
- Deployed and Tested the Smart contract on **GoErli TestNet**.

Visualizer for the Hashgraph Consensus Algorithm *Winter 2022*
Course Project: Distributed Trust | Guide: Prof. John Augustine *IIT Madras*

- Implemented the **Hashgraph consensus algorithm** from the orginal paper.
- Built a Visualizer using **graphviz** for visualizing the Hashgraph for various intermediate steps of the consensus algorithm.

Compiler for MacroJava - a subset of Java *Autumn 2021*
Course Project: Compiler Design | Guide: Prof. Kartik Nagar *IIT Madras*

- Developed a compiler for MacroJava, a subset of Java extended with C style macros, supporting **conditionals, loops, control sequences, classes and scope levels**.
- Implemented a lexical analyser and parser using **Flex** and **Bison** and further used JTB to build an **Abstract Sytnax Tree(AST)** and a **type checker**.
- Translated the AST to an **intermediate representation called microIR**, which was further translated to **miniRA for register allocation** and was finally translated to the **MIPS Assembly**.

Online Multiplayer Tic-Tac-Toe *Summer 2022*
Course Project: Computer Networks | Guide: Prof. Ayon Chakroborthy *IIT Madras*

- Built a multiplayer Tic-Tac-Toe server and client using **socket programming in C++**.
- The server supports **simultaneous games**, along with handling edge cases like **timeouts, abrupt client disconnections, etc.**

Travelling Salesman Problem *Autumn 2022*
Self Project *IIT Madras*

- Investigated and surveyed literature on the **Travelling Salesman Problem(TSP).**
- Implemented an algorithm using the **Lin–Kernighan Heuristic** for TSP and customized it by incorporating ideas from other well known techniques like **simulated annealing, genetic algorithm, etc.**

Othello AI Bot *Autumn 2022*
Course Project: Artificial Intelligence | Placed 1st in the final leaderboard *IIT Madras*

- Created an AI agent to play Othello by using a search algorithm combining **alpha-beta pruning** and **iterative deepening**.
- Used a **dynamic heuristic function** calculated by changing the weights of different individual heuristics like **stability, mobility, corners, coin difference, etc** depending on game progression.
- Optimized the search by experimenting different **heuristics for determining the order of nodes** in the search tree for efficient searching by pruning the tree early.

Image Captioning *Spring 2022*
Course Project: Deep Learning | Guide: Prof C. Chandra Sekhar *IIT Madras*

- Built a model for image captioning by using an **ensemble model** consisting of a **CNN** part as the encoder and a **LSTM** part as a decoder for generating the captions.
- Used the **Resnet50** model along with a **NetVlad** layer for the encoder and used the **GloVe Embeddings dataset** to generate word embeddings.

Song Rating Prediction System *Spring 2021*
Data Contest - Machine Learning Course | Placed 2nd in final leadeboard *IIT Madras*

- Predicting ratings of songs from previous user-item interactions and given metadata by using a **hybrid model combining a latent factor model with a content-based model**.
- Used a hybrid feature set by **combining existing metadata features with the latent features**, learned thorugh **collaborative filtering using PureSVD**.
- Observed that using this combined feature set and using **XGBoost Classification** algorithm on them led to better accuracy than using just one set of features.

Scholastic Achievements and Honors

- Awarded the **B. Ravichandran Memorial Prize** for being the student with **best academic performance** and **highest GPA** in the Computer Science and Engineering Department. *2023*
- Secured **All India Rank 136** in **IIT JEE-Advanced** exam out of **245,000** candidates. *2019*
- Secured **All India Rank 286** in **IIT JEE-Main** exam out of **1.2 million** candidates. *2019*
- Awarded the prestigious **Kishore Vaigyanik Protsahan Yojana (KVPY)** fellowship *2019*

Teaching and Mentoring

- **Mentored an intern** at Rubrik by **guiding him** on the project of Horizontal Pod Autoscaling (HPA) and Smaller Spec Support for Rubrik Security Cloud Private (RSC-P) through his internship.
- **Closely mentored 2 students** for help prepare and succeed in IIT JEE-Main and JEE-Advanced exams.

Coursework

- **Systems:** Distributed Systems, Compilers, Secure Systems Engineering, Computer Organization & Architecture, Operating Systems, Database Systems, Computer Networks, Computer Systems Design, GPU Programming
- **Theoretical Computer Science:** Distributed Trust, Data Structures, Discrete Math, Design and Analysis of Algorithms, Theory of Computation, Paradigms of Programming, Object-Oriented Programming.
- **AI/ML and Math:** Machine Learning, Deep Learning, Artificial Intelligence, Non Linear Optimization, Graph Theory, Probability and Statistics, Combinatorics and Number Theory, Game Theory.

Technical Skills

- **Languages:** C++, C, Java, Go, Python, Scala, Ocaml, Prolog, SQL, React
- **Libraries:** OpenMP, MPI, Pandas, PyTorch, Scikit-Learn, Numpy
- **Technologies:** Kubernetes, Docker, Bazel, CUDA, AWS, Azure, Git

Extracurriculars

- Organized **nation-wide programming contest** as co-coordinator **Coding and Logic Club at Shaastra**, the annual technical event at IIT Madras.