Soham Rajesh Kayal

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EDUCATION

University of California - Santa Cruz ***09/24 - 06/26***

Master's Degree in Computer Science **GPA: 3.96 / 4**

- ML, AI **(A+)**, Analysis of Algorithms (DSA) **(A+)** (Been a TA), Cryptography & Security **(A+)** (TA & Research), Approximation Algorithms (A), Computational Models (A), Advanced Operating Systems (A)

University of Mumbai ***06/20 - 05/24***

Bachelor's Degree in Engineering (***Major*** **-** *Information Technology,* ***Minor*** *- Blockchain*) **GPA: 3.7 / 4**

- Adv. Data Structures & Algorithms, Operating Systems, Computer Networks, Cybersecurity, DevOps, C Programming, System Design, Web development, Mobile App Development, Big Data, ML, AI, Automata Theory

EXPERIENCE

University of California - Santa Cruz ***Santa Cruz, 01/25 – 03/25***

Graduate Teaching Assistant

CSE 102: Introduction to Analysis of Algorithms (With Prof. Sungjin Im)

- Led weekly discussion sections, focusing on core algorithmic concepts and problem-solving strategies
- Held office hours to assist students with doubts and clarify complex topics
- Helped grade midterms and assignments, ensuring fair and detailed evaluations
- Provided prompt support on Piazza, resolving student queries effectively
- Taught concepts like - Asymptotic time complexity, space complexity, master's theorem, recursion tree method for determining time complexity, Sterling's approximation, Sorting algorithms like MergeSort, QuickSort (Randomized and deterministic), BubbleSort, Greedy Algorithms, Dynamic Programming (Top-down/bottom-up), Graph Algorithms like BFS & DFS, bipartite graph (graph coloring problem), Minimum Spanning Trees, Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algo for SSSP, Floyd-Warshall (all-pair shortest path), Ford-Fulkerson's Algorithm.
- Made the students attending my discussion section solve leetcode problems for better understanding which ultimately helped one of the students to pass the coding interviews.

University of California - Santa Cruz ***Santa Cruz, 09/24 – 12/24***

Graduate Teaching Assistant

CSE 108: Algorithmic Foundations of Cryptography (With Prof. Ioannis Demertzis)

- Conducted two discussion sections per week, covering theoretical concepts and practical problem-solving
- Organized dedicated office hours for one-on-one guidance on course material
- Contributed to creating homework assignments and quizzes in line with course objectives
- Provided detailed feedback on submissions, ensuring students understood their mistakes
- Taught concepts like - Analysis of various cryptography techniques and attacks like ciphertext only attack, plaintext only attack, probability revision, pseudo-random functions (PRFs), Pseudo-random generators (PRGs), Pseudo-Random Permutations (PRPs), perfect secrecy, perfect indistinguishability, oracles attacks, hashing.

University of California - Santa Cruz ***Santa Cruz, 04/25 - 06/25***

Graduate Student Researcher at Prof. Hamid Sadjadpour's lab @UCSC

Go, C++, Google Cloud APIs (& IAM),Next.js, Node.js, Express.js, Chakra UI, HTML, Tailwind CSS, Supabase (SQL), Git, Linux

- Cloud encryption schemes used everywhere like **AES offer only computational security** and remain vulnerable to **quantum attacks**.
- Developed an encryption algorithm to counter quantum attacks based on the research paper (Link); optimized and scaled it for real-time encryption.
- Developed a C++ service for high-entropy initial key generation and encryption; also built a go microservice for parallel final key generation.
- Built a **Node.js/Express** backend orchestrating frontend with all the services and user and document metadata management.
- Used React and CSS in frontend; supabase for storing user and document metadata; achieved the speed of **less than 15ms for 150kb of files**.

University of California - Santa Cruz ***Santa Cruz, 09/25 – 12/25***

Group Tutor

CSE 101: Introduction to Data Structures and Algorithms (With Prof. Niloofar Montazeri)

- Conducted two office hours per week, covering concepts like linked lists, stacks, queues, trees, graphs and other data structures.
- Helped in proctoring the tests and plagiarism detection.

University of California - Santa Cruz *Santa Cruz, 09/25 – 12/25*

Grader

CSE 101m: Mathematical Thinking for Computer Science (With Prof. Vaggos)

- Graded multiple induction proofs in all the homeworks including midterms and finals.

University of California - Santa Cruz *Santa Cruz, 01/26 – Present*

Graduate Teaching Assistant

ART 10E: 3D Foundations (With Prof. Anja Ulfeldt)

- **Led two discussion sections (each two hours long) and Office Hours per week.** Facilitated studio sections and Silent Looking critiques, guiding students through the transition from object-based sculpture to spatial experience.
- Taught and evaluated concepts across three major modules: **Assemblage**, **Installation Art** (Suspension, Tension, Relational Aesthetics, Expanded Field), and **Land Art** (Entropy, Site-Specificity, Ephemerality, Indigenous Land Knowledge).
- Guided execution of technical projects including: **Self-Portrait with Objects** (identity construction via found materials), **Connection** (collaborative spatial intervention using linear materials), and **Walking as Practice** (site-responsive ephemeral earthworks).
- Managed grading for reading responses (Claire Bishop, Rebecca Solnit) and ensured safety protocols for sculpture fabrication.

Amazon *Seattle, 06/2025 – 09/2025*

Software Development Engineer (SDE) Intern

Java, JUnit, Spring Web MVC, React, Redux, TypeScript, JavaScript, AWS CDK, CloudWatch, AWS IAM, Docker

- Single-strategy manual allocation in Apply Funds workflow in Amazon Business caused inefficiencies and high customer tickets.
- Built a **cross-service** solution connecting invoicing, invoice-assets, and central invoice services, **resolving CSRF incompatibility** with custom interceptors & annotation overriding methods in Amazon's internal framework **(Avg. P90 latency: 200ms)**.
- Implemented monitoring with **AWS CDK** (metrics, alarms, custom CTI) and custom **CloudWatch** dashboards.
- Launched multi-strategy auto-allocation feature, **eliminating manual effort completely** and **that reduced Apply Funds tickets by 50%**, boosted UX adoption and **saved 6–8 weeks of developer effort, decoupled** existing Apply Funds workflow from invoicing

3XP - SKALE Ecosystem *01/2024 - 03/2024*

Founding Engineer

Next.js/React, TypeScript,Node.js/Express, Solidity, AWS, Supabase (SQL)

- Developed the Minimum Viable Product (MVP) for SKALE ecosystem within three months.
- Built a Full-stack app using Next.js for frontend, Solidity for writing smart contracts, Express.js for backend and Supabase (SQL) as database; deployed using AWS.
- Responsible for bug-fixing and scaling the decentralized app for thousands of metaverse gamers.

Star Union Dai Ichi Life Insurance Company Limited *03/2023 - 12/2023*

Software Engineer Intern

Flask (Python), TypeScript, Next.js, React.js, Tailwind CSS, SMTP, MySQL Workbench, GitHub Actions

- Built Flask REST APIs + SQLAlchemy; modeled workflows and analytics for internal ops at scale.
- Designed MySQL schema and automated processes; improved order throughput (**about 5000+ orders/week**).
- Shipped React + Tailwind pages; optimized DB queries and reduced page load time **about 30%**.
- Set up CI via GitHub Actions; improved release quality and reduced production bugs with consistent checks.

PROJECTS

Hardware Hierarchical Dynamic Structure (HHDS) - Associated with MASC-UCSC ***GitHub Link***

C++, Concurrency (Thread Pools), Bazel, Bit-Manipulation, Smart Pointers

- Built concurrent dynamic graph library for hardware in Bazel monorepo; used thread pools + Decorator pattern modularity.
- Outperformed STL maps via **ankerl::ordered_dense**; improved throughput in hot lookup paths.
- Packed layouts and 64-bit bit-packed deltas; reduced memory **about 40%** with dense 32-byte nodes.
- Managed high-degree nodes using overflow containers + smart pointers; reduced fragmentation and kept updates safe.
- Added incremental topological sort for iterators; preserved correctness under multi-threaded modifications.

Privacy-Preserving Graph Processing on Hardware Enclaves (Intel SGX) ***GitHub Link***

C++, Pointers, DSA (AVL Tree, Graphs, Unordered Map), Intel SGX, Linux (Unix), Git

- Prevented pattern leakage from AES-GCM outsourced graphs by running BFS, DFS, Dijkstra inside hardware enclave (Intel SGX).
- Exposed only $|V|$, $|E|$, query type, and response size; enforced deterministic traces via fixed memory flows.
- Used doubly-oblivious layouts and an Omix++ map; kept access patterns stable under queries.
- Achieved near-linear $\mathcal{O}\big(C\,|E|\log^2|E|\log\log|E|\big)$ with **<15%** overhead; extended to MST via Obfuscuro + Omix++.

AugmentFS: User-Space Integrity File System ***GitHub Link***

C++, FUSE, SQLite, Systems Programming, Data Integrity, ACID Transactions

- Built FUSE file system with embedded SQLite; added queryable metadata on top of legacy FS (ext4).
- Enforced WORM audit logs; used FNV-1a hashes (file + 4KB blocks) to detect silent corruption (bit rot).
- Streamed hashing to decouple DB transactions from write path; cut sequential overhead **2.4x to 1.4x**.
- Ensured crash consistency via WAL and copy-on-write (COW) updates; improved safe recovery on restart.

SKILLS

Programming Languages: C, C++, Go, Java, Python, TypeScript, JavaScript, Solidity, Swift, Objective-C
Libraries & Frameworks: Spring Boot, Spring Web MVC, Node.js, Express.js, React.js, Next.js, Flask, Django, Angular, Tailwind CSS, Chakra UI, UIKit, Redux
Database Management: MySQL (SQL), PostgreSQL, MongoDB (NoSQL), Firebase, Supabase, Redis
Tools: Git, GitHub, Amazon Web Services (AWS), Google Cloud Platform (GCP), Docker, Kubernetes, Terraform, AWS CDK, CloudWatch, GitHub Actions, Linux/Unix, Valgrind
Other Technical Skills: Data Structures & Algorithms (DSA), Problem-Solving, System Design, Web Development, REST API, GraphQL, SDLC, CI/CD, Agile, Test-Driven Development, DevOps, Data Visualization, Power BI

CERTIFICATIONS & ACHIEVEMENTS

- **Knight Badge on LeetCode (Highest Rating: 1873).** Among the **top 5.16%** of LeetCoders; solved **800+ DSA problems**.
- Achieved a **global rank of 1285** in Google Kickstart **(Link)**.
- Achieved first place at IIT Bombay's OPHacks, resulting in a spot in Optimism's accelerator program **(Link)**.
- Won **15 hackathons** (MLH and ETHGlobal), including Hack This Fall, ETHSF (500+ participants per event). **Latest win: Agent Orchestration Hack**
- **Certification:** Completed Google Cloud Facilitator Program (Qwiklabs Profile).
- **Publication:** Presented & published Decentralized Healthcare System paper (ICTIS 2024) - **(Link to the paper)**.