Manan Mrig

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Research Interests

Human-AI Collaboration, Human-Centered AI, Intelligent Interfaces, Context-Aware Systems with an emphasis on malleable interfaces for user-centric intelligent applications.

Education

University of Minnesota, Twin Cities Minneapolis, MN

Bachelor of Science, Computer Science; GPA: 3.459 / 4.0 *Sep 2020 - May 2024*

- CSE Dean's List recognition for exceptional academic performance in Fall 2020 and Spring 2022.
- Selected Coursework: Artificial Intelligence, Machine Learning, Computer Architecture & Organization, Operating Systems, Distributed Systems, Algorithms & Data Structures, and Software Engineering.

Experience

Software Engineer, Machine Learning Teams June 2024 - July 2025

Target Corporation - Demand Forecasting Engine, Inventory Insights Acquisition *Minneapolis, MN*

- Designed and evaluated interactive systems enabling human-in-the-loop overrides in forecasting applications, exploring trade-offs between model autonomy, user trust, and intervention accuracy.
- Developed and maintained forecasting pipelines leveraging GAMM models and distributed systems to generate item and chain-level demand forecasts for 100K+ SKUs across Target's network.
- Took end-to-end ownership of microservices and automated inventory correction systems supporting data-driven interventions, improving inventory reliability and accuracy across 1,900+ stores.

Software Engineer Intern June 2023 – August 2023

Target Corporation - Paystack *Minneapolis, MN*

- Collected and processed high-volume real-time transactional data to support downstream analytics and monitoring, enabling low-latency processing and reliable payment workflows under production traffic.
- Increased system performance by 40% through unit testing and velocity-powered performance optimization, ensuring efficient data processing under heavy load conditions.
- Collaborated within and through the Paystack Team to build and enhance payment workflows within Target's enterprise infrastructure.

Software Engineer Intern May 2021 – July 2021

Centrl Inc. *Mountain View, CA*

- Assisted in translating legacy BNCF customer administration application built in PHP to Java and Spring Boot, increasing speed and accuracy by 30%.
- Designed and implemented an upgraded authentication system using Google's OAuth2 Authorization Framework in a Spring Boot application that outperformed the original and provided easier authentication to users.
- Aided the deployment process of updated customer administration application used by 50+ active internal users.

Instructional Technology Support Jan 2021 – December 2021

Carlson School of Management, University of Minnesota *Minneapolis, MN*

- Automated administrative tasks like attendance and populating classes in Canvas with Google Scripts/JavaScript reducing faculty administration time by 10 hours per week on average.

Academic Service

Teaching Assistant Jan 2022 – May 2024

University of Minnesota, Twin Cities *Minneapolis, MN*

- Supported instruction across multiple computer science courses:
  - **CSCI 2021: Machine Architecture and Organization**
  - **CSCI 2081: Software Design for Data Scientists**
  - **CSCI 2011: Discrete Mathematics**
- Maximized student learning in labs by reinforcing concepts taught in lectures, covering material from virtual memory, compilers, C and system calls, to software design and engineering practices.
- Revised, validated, published, and graded assignments written in C, Python, Java, and Assembly and resolved students' conceptual questions about Computer Organization, Software Design, and Programming Concepts.

Independent Research and Technical Projects

Personal AI Assistant Ecosystem | *SwiftUI, Kotlin, Python, RunPod, LangChain, & Postgres* 2025

- Designed a personalized AI assistant ecosystem integrating serverless LLMs with a native SwiftUI iOS interface, focusing on persistent context, memory recall, and user-controlled AI behavior.
- Implemented contextual long-term memory via LangChain-PG vector database and designed multimodal workflows enabling natural language, visual, and cross-app interactions.
- Optimized inference latency and memory footprint across distributed endpoints, improving response times by over 40% through custom handler orchestration.

Pro-Posterous: Human–AI Co-Creation Canvas | *Next.js, tldraw, LangChain, Diffusion Models* 2025

- Designed and implemented an interactive human–AI co-creation platform enabling users to iteratively design visual artifacts with AI-assisted generation and refinement.
- Integrated diffusion model pipelines with a real-time canvas, enabling controllable, step-wise interaction rather than single-shot generation.
- Investigated design trade-offs between automation and user control, iterating on interaction workflows based on exploratory use and feedback.

Spotify Bot | *Python, Spotipy, Flask, JSON, REST API, & OAuth2* 2023

- Developed a Flask-based web application using Spotify's Web API and OAuth2 for secure user authentication and data retrieval.
- Processed and visualized user listening data (top artists, genres, and track frequency) through Spotipy and JSON endpoints.
- Built RESTful routes to serve personalized music analytics dashboards and recommend playlists based on recent activity patterns.

Speculative Execution & Timing Attacks on RISC-V Cores | *RISC-V, FPGA, Verilog, Vivado* 2022

- Simulated RISC-V microarchitectures to reproduce speculative-execution and timing side-channel attacks, characterizing exploit vectors and attack windows.
- Synthesized Rocket and BOOM core implementations with Xilinx Vivado and performed on-board validation on FPGA (hardware testing, waveform analysis, and timing measurements).

Technical Skills

Programming Languages: Python, C/C++, Java/Kotlin, JavaScript/TypeScript, SQL, Bash
Machine Learning & Data Analysis: PyTorch, TensorFlow, NumPy, Matplotlib, LangChain
Interfaces & Prototyping: SwiftUI, Next.js, Figma, tldraw, HTML/CSS
Backend & Distributed Systems: Spring Boot, Micronaut, FastAPI, Flask, PostgreSQL, Kafka, Java RMI
Infrastructure & Tooling: Git, Docker, CI/CD, AWS, GCP, Vercel
Platforms: Linux, macOS, FPGA

Community Involvement

Code The Gap | *Instructor* Aug 2023 – Jan 2024

- Taught computer science fundamentals (algorithms, loops, conditionals) to underrepresented middle school students through interactive, hands-on coding activities that fostered curiosity and confidence in STEM.

Beta Chi Theta | *Vice President* Sep 2022 – Aug 2023

- Organized Men's Mental Health Week and other campus-wide initiatives to promote wellness and inclusivity; coordinated inter-fraternity and multicultural collaborations across student organizations.

Asian Student Union | *Events Coordinator* Aug 2021 – Sep 2022

- Planned and executed large-scale social and cultural events, strengthening community engagement and collaboration within the Asian student body.

Awards

CLA Ignition Award (2022): Awarded for completing an early-career internship, recognizing initiative in gaining professional experience and engagement in experiential learning.

Scott Jacobson Writing Award (2021): Awarded by the UMN Writing Program for outstanding written work demonstrating exceptional rhetorical clarity, originality, and depth of insight.