

MUHAMMAD HASSNAIN

Davis, California, 95616

[\(530\) 760 9401](tel:(530)7609401) [✉ mhassnain@ucdavis.edu](mailto:mhassnain@ucdavis.edu) [🌐 linkedin.com/muhammad-hassnain](https://www.linkedin.com/muhammad-hassnain) [🐙 muhammad-hassnain](https://github.com/muhammad-hassnain)

EDUCATION

University of California, Davis

PhD. in Computer Science

Expected: June 2028

Davis, California

Lahore University of Management and Sciences

Bachelor of Science in Computer Science

Sep. 2019 - May 2023

Lahore, Pakistan

Relevant Coursework: Data Structures, Discrete Math, Algorithms, Operating System, Network Security, Software Engineering, Data Science, Advanced Programming, Human-Computer Interaction, Machine Learning, Speech Processing

TECHNICAL SKILLS

Languages: JavaScript, Python, C, C++, HTML/CSS, Haskell, Java, Rust, Bash, Latex

Frameworks: ReactJS, Node.js, Express.js, AngularJs, Flutter, Bootstrap

Databases: Firebase, MySQL, SQLite, PostgreSQL, MongoDB

Developer Tools: Git, Github, Docker, Heroku, Google Cloud, Trello, Postman, Selenium, Figma, Bind9, AWS

RESEARCH EXPERIENCE

PL Davis | Rust, Python, Bash

Graduate Research Assistant

Sep. 2023 – Present

Davis, California

- **RUST Software Supply Chain Security:** Integrated static code analysis tools to monitor Rust dependencies' evolution, enabling the system to optimize for threat detection and auto-switch to safer versions.
- **RUST Ecosystem Analysis:** Developed a dataset to track function side effects across Rust crates, analyzing their correlation with vulnerabilities to predict future security threats.

Internet Security and Privacy Lab | Bash, Python, Docker, Linux, TypeScript, React, Rust

Undergraduate Research Assistant

May 2022 – August 2023

Lahore, Pakistan

- **Privacy Enhancing Web Refactoring (UC Davis, Virginia Tech, LUMS):** Leveraged program analysis techniques to pinpoint bundled code locations on webpages. Achieved real-time detection with a 98% accuracy rate, then refactored the identified code to retain only functional operations, minimizing tracking actions.
- **Ads Accessibility (University of Washington, LUMS):** Initiated a study on web accessibility for visually impaired users. Constructed a TypeScript and Puppeteer-based ad scraper to probe the top and bottom 10,000 sites from the 1 million Tranco list. Through in-depth data analysis and automation, evaluated accessibility variations across ranks and depths, identifying key ad platform providers and the nature of accessible ads.
- **Git Secrets (Meta, LUMS):** Automated the cloning of the top 1,000 frequently updated GitHub repositories to investigate secret leakages, such as app encryption keys, API keys, and account tokens. Utilized data analysis to parse content and implemented ML models to identify potential secrets within new repositories proactively.
- **NPM Hidden Dependencies (NC State, LUMS):** Investigated undisclosed "hidden dependencies" in NPM packages, which were neither documented nor visible in the node tree. Traced the evolution of these concealed dependencies to understand their progression over time.

Technology for People Initiative Lab | Figma, Angular, Node, Mongoose

Undergraduate Research Assistant

May 2022 – May 2023

Lahore, Pakistan

- Oversaw and enhanced the **Digital Archives of Pakistan** website; navigated legacy code to rectify bugs, modernized features to boost user experience, and reinforced the platform's role as a pivotal digital repository for Pakistan's history

TEACHING EXPERIENCE

Course Instructor – Cohort 1 and 2

Knowledge Streams

June 2023 - Sep 2023

Lahore, Pakistan

- Conducted Cyber Security training with a focus on penetration testing for web and mobile applications. Covered OWASP Top 10 vulnerabilities, proficiency in Burp Suite, PortSwigger labs, and practical experience through various TryHackMe rooms.
- Instructed in React development, teaching HTML, CSS, JS, and React fundamentals. Guided students in project creation and provided targeted preparation for technical interviews in the tech industry.

Advanced Programming – Head Teaching Assistant

Lahore University of Management Sciences

Spring 2023

Lahore, Pakistan

- Managed two sections of the Advanced Programming course, encompassing Haskell, TypeScript, and MERN stack modules, guiding about 140 students and coordinating a team of 10 TAs.

- Oversaw module assignments and developed comprehensive exams with tailored test cases, while providing consistent student support through weekly office hours.

Object Oriented Programming – Head Teaching Assistant

Fall 2022

Lahore University of Management Sciences

Lahore, Pakistan

- Oversaw two sections totaling over 170 students and a team of 12 TAs, conducting weekly tutorials and leading the creation of lab exercises and marking schemes to bolster understanding in object-oriented programming.
- Innovated by automating the lab grading system, significantly enhancing the efficiency and precision of the assessment process.

Computer Science Instructor – National Outreach Program

Summer 2022

Lahore University of Management Sciences

Lahore, Pakistan

- Delivered comprehensive computer science instruction to approximately 600 students selected for the LUMS National Outreach Program, focusing on equipping them with essential skills and knowledge for university entrance exams.
- Designed and implemented a curriculum aimed at deepening students' understanding of various computer science disciplines, fostering an appreciation for the field and preparing them for advanced academic pursuits.

Introduction to Computational Problem Solving – Teaching Assistant

Fall 2021, Spring 2022, Summer 2022

Lahore University of Management Sciences

Lahore, Pakistan

- Served as Head TA twice and guided freshmen in introductory programming through tutorials and office hours, focusing on core CS principles; led a team of 6-8 TAs in coordinating course activities and support.
- Responsible for creating and grading lab assignments, emphasizing the practical application of programming concepts to develop students' problem-solving skills.

PROJECTS

RUST Software Supply Chain Security

Sep 2023 - Present

- Integrated static code analysis tools specifically for monitoring the evolution of Rust dependencies, ensuring real-time tracking of changes and updates.
- Implementing system optimization for enhanced threat detection, enabling automatic transition to safer software versions upon identifying potential vulnerabilities.

RUST Ecosystem Analysis

Dec 2023 - Present

- Created a comprehensive dataset to meticulously track and document the side effects of functions in various Rust crates.
- Conducting an in-depth analysis of the dataset to identify patterns and correlations between function side effects and vulnerabilities, aiding in the prediction of future security threats in the Rust ecosystem.

Anycast Domain Name System | Bash, Virtual Box, Linux, Python, Bind9

Sep 2023 - Dec 2023

- Engineered a distributed DNS framework, enhancing resilience against DoS attacks using a primary-secondary server replication strategy and load balancing, for improved traffic distribution and minimized single point of failure.
- Conducted performance evaluations comparing traditional single-server DNS setup with the distributed model under high-volume traffic scenarios. Demonstrated the robustness of the distributed system with a consistent 100% response rate, showcasing its effectiveness in maintaining uninterrupted internet accessibility under cyber-attack conditions.

Privacy Enhancing Web Refactoring | Bash, Docker, Linux, Python

June 2022 - May 2023

- Constructed a modified browser by leveraging the Brave experimental repository, integrating the ability to generate PageGraphs for detailed analysis of webpage scripts.
- Implemented program analysis techniques within this framework to accurately differentiate between bundled and non-bundled code, achieving a high accuracy rate of up to 98%.

Ads Accessibility | Bash, Docker, Linux, Python, Postgress, TypeScript, HTML

Oct 2022 - May 2022

- Enhanced a Puppeteer and TypeScript-based ad scraper to extract advertisements along with their HTML at varying depths, incorporating PostgreSQL for data management.
- Utilized BeautifulSoup and Seaborn for analysis of the scraped HTML content, focusing on assessing the accessibility of advertisements to understand the user experience of visually impaired individuals.

Git Secrets | Bash, Python

Jun 2022 - Oct 2022

- Cloned the top one thousand most actively updated repositories from GitHub to analyze current software development trends and practices.
- Employed machine learning techniques to identify and extract sensitive information like API keys and application secrets from the repository code, highlighting potential security vulnerabilities.

NPM Hidden Dependencies | Python, Node, Bash, NPM

Sep 2022 - May 2023

- Conducted an in-depth analysis of popular Node.js packages to uncover hidden dependencies, shedding light on the often overlooked aspects of package management and security
- Monitored and documented the evolution of dependencies within widely-used Node.js packages over time, providing valuable insights into trends and changes in the Node.js ecosystem.

Bloodlink : Automated Blood Donation Request System | *Flutter, Node, Mongoose, Git, Trello, Firebase* **Jan 2022 - May 2022**

- **Bloodlink Mobile Application Development:** Managed a team of five developers, transforming focus group insights on blood donation processes into a user-friendly Figma prototype aligned with UI/UX material guidelines.
- **Deployment & Testing:** Successfully transitioned the prototype into a fully-functional mobile application, with comprehensive user testing ensuring optimal functionality. The app is now available on the Play Store.

Keyword Spotting System *Google Colab, Python*

Jan 2022 - April 2023

- Adapted the wave2vec 2.0 model, originally developed by Meta, to fine-tune its performance for the Urdu language, achieving significant advancements in linguistic AI for low-resource languages.
- Attained a high accuracy level of up to ninety percent in keyword spotting for Urdu, developing a system capable of detecting specific words within audio inputs, demonstrating the model's effectiveness in language processing tasks

ASR Model for Urdu Language *Jupyter, Google Colab, Python, PRAT*

Jan 2022 - April 2022

- Developed a comprehensive dataset specifically for an Automatic Speech Recognition (ASR) model, encompassing all phonemes of the Urdu language, facilitating nuanced language processing.
- Constructed an ASR model from the ground up tailored to Urdu, achieving a notably low Word Error Rate (WER) of 0.2, demonstrating high accuracy and efficiency in speech-to-text conversion.

AssistTH: Telehealth Mobile Application

Sep. 2021 - Dec 2021

- Led user-centric research and design iterations, utilizing surveys, interviews, and usability testing across hospitals to refine telehealth solutions.
- Developed a high-fidelity Figma prototype, drawing from comprehensive literature reviews and feedback loops, optimizing patient-physician connections.

AWARDS AND HONORS

- Fellowship at UC Davis (2023)
- Best TA of the Batch Award (LUMS 2023)
- Placed on Deans' Honor List LUMS (2019-2020)
- National Outreach Program Scholarship (2019-2023)
- Merit Based Scholarship for Higher Secondary School (2017-2019)
- 44th position overall in country in High School Exams 44/226,619 (2017)