Adeel Ahmad

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EDUCATION

Master of Science *in Computer Science* (GPA: 3.6) January 2021 - December 2024
Georgia Institute of Technology Atlanta, GA, US *(remote)*
Specialized in Machine Learning and Computer Vision, including Computational Photography.

Bachelor of Science *in Computer Science* (GPA: 3.0) August 2014 - June 2018
National University of Computer and Emerging Sciences Islamabad, Pakistan
Thesis: "Analysis of Structure from Motion Techniques" (report)

PROFESSIONAL EXPERIENCE

GÉANT Association Cambridge, United Kingdom
DevOps Engineer October 2023 - *present*

- Managing migration of core services to the **GÉANT Authentication (AAI) platform** to meet the authentication needs of a high-volume, multinational research and education network.
- Leading the transition from **SAML to OIDC authentication protocols** to improve service security compliance and consistency.
- Designing **SQL scripts** to address data inconsistencies in service databases, caused by username format discrepancies between the legacy and new **Identity Provider (IdP)**.
- Collaborating with users from **National Research and Education Networks (NRENs) globally** to ensure alignment of technical requirements and successful service integration.
- Administering **Linux-based systems**, configuring firewalls using **iptables**, and managing reverse proxies with **HAProxy, Nginx, and Apache** to enhance service availability and security.
- Automating configuration management and deployment processes using **Puppet** to ensure consistent and scalable infrastructure management.

European Organisation for Nuclear Research (CERN) Geneva, Switzerland
Software Engineer September 2020 - August 2023

- Designed and implemented **permanent 2FA** for 20k+ CERN users in Keycloak.
- Developed a **compromised password detection system** to secure $100M LHC control machines from unauthorized access, resolving 1,177 compromised accounts.
- Automated Keycloak configuration management using **Puppet** and deployed to cloud with OpenStack.
- Administered **Linux and Windows Server** systems, resolving complex networking issues.
- Built **CI/CD pipelines** with custom **Dockerfiles**, reducing deployment time by 4 minutes.
- Setup **Grafana monitoring** with Prometheus metrics to alert for system downtime.
- Enhanced logging visiblity by creating a custom **Python Flask** JSON logger to improve monitoring in **Kibana**.
- Implemented **Kubernetes Liveness Probe** to automate pod restarts and monitor API health.

European Organisation for Nuclear Research (CERN) Geneva, Switzerland
Security Software Engineer September 2018 - October 2019

- Built an **incidence response system** for copyright infringements (average 50 cases per week).
- Developed an **anomalous login detection system**, alerting users via **email** if they logged in from regions outside of Switzerland/France, enabling identification of potential malicious login attempts.
- Created **Puppet** modules to install and configure RPM packages, reducing manual effort.

Google Summer of Code 2018 (Boost C++ Libraries) *(remote)*
Software Developer (C++) May 2018 - August 2018

- Implemented a distance algorithm in Boost C++ library and demonstrated existing inaccuracy .
- **Improved accuracy by 5%** and **reduced execution time by 10%** over the existing approach.

Google Summer of Code 2017 (Open Astronomy) *(remote)*
Software Developer (Python) May 2017 - August 2017

- Developed a package to visualize astronomical images, supporting numerous geographical systems.
- Used **asynchronous programming** to reduce fetch latency by 75%.

SKILLS

Languages: Python, C++, C#, Java, Bash, SQL
Technologies: Kubernetes, Azure, Puppet, Apache, Grafana
Linux Tools: Systemd, Awk, networking tools, disk I/O and filesystems

COURSE PROJECTS

Machine Learning [Scikit-learn, Pandas]

Each project emphasized algorithm tuning, performance analysis, and practical application to diverse datasets.

- **Supervised Learning:** Conducted experiments with five classification algorithms (Decision Trees, Neural Networks, Boosted Decision Trees, Support Vector Machines, and k-Nearest Neighbors) across two datasets. Tuned hyperparameters and analyzed model performance to understand algorithmic behavior under varying conditions.
- **Randomized Search Optimization:** Implemented four randomized search algorithms (Randomized Hill Climbing, Simulated Annealing, Genetic Algorithms, and MIMIC). Designed three optimization problems to highlight the strengths of each method, showcasing creativity and problem-solving.
- **Unsupervised Learning:** Explored clustering algorithms (Expectation Maximization and K-Means) and dimensionality reduction techniques (PCA, ICA, Randomized Projections, and Manifold Learning). Investigated the impact of dimensionality reduction on datasets from earlier projects, forming and testing hypotheses grounded in theory.
- **Reinforcement Learning:** Designed and solved Markov Decision Processes (MDPs) using value iteration, policy iteration, and a reinforcement learning algorithm. Compared convergence rates and explored strategies for handling MDPs with varying state complexities.

Computer Vision [OpenCV, Scikit-learn]

- **Image Processing Foundations**: Explored Hough transforms, Fourier analysis, and template matching to detect shapes and reduce noise in images.
- **Augmented Reality Applications**: Implemented projective geometry, corner detection, and homographies for image stitching and marker-based transformations.
- **Optical Flow and Motion Analysis**: Designed dense optical flow algorithms using Lucas-Kanade and pyramidal approaches for pixel-level motion tracking.
- **Object Tracking**: Developed Kalman and Particle filters for tracking objects in video sequences.
- **Face Detection Techniques**: Built PCA, Boosting, and Viola-Jones-based algorithms for facial recognition, critically analyzing their strengths and weaknesses.
- **Activity Recognition Final Project**: Designed a motion-classification system leveraging Motion History Images and machine learning to recognize human activities (e.g., walking, running) in video.

Computational Photography [Python, OpenCV]

Implemented an image in-painting algorithm to remove objects from pictures, similar to the Pixel 6 Magic Eraser. Created a pipeline to align and stitch together images using blending to form a panorama.

Advanced Operating Systems [C, Libvirt, OpenMP, MPI]

Implemented a vCPU scheduler and a memory coordinator to dynamically manage CPU and RAM assigned to each guest machine. Created graph plots to analyze usage patterns. Implemented Barrier Synchronization algorithms in OpenMP and MPI.

Software Analysis [C, LLVM]

Wrote LLVM passes in C to perform divide-by-zero runtime checks and report code coverage. Implemented Reaching Definition and Liveness analysis to find unused variables in a program.

BLOG POSTS

Passwordless Logins with Yubikey (CERN Lightning talk) February 2021

Trip Planner – A tool for planning a trip itinerary using Google Maps October 2019
(CERN Lightning talk)

OPEN-SOURCE PROJECTS

Trip Planner [Python] — Queries Google Maps places based on an input query and exports them to a CSV file. (**featured on Hacker News**)

16-Bit Micro Processor Simulator [Assembly x86] — x8086 graphical implementation of a 16-bit micro processor.

Image Edge detectors [Python] — Image edge detection algorithms.