Muhammad Khan

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EDUCATION

Loyola University Chicago **Aug 2021 - May 2025**
BS, Software Engineering, Philosophy *Chicago, IL*
- **GPA:** 3.9
- **Achievements:** Summa Cum Laude, Departmental Honors

Harry S Truman College **Jun 2019 - Jun 2021**
Dual Enrollment, Chemical Engineering *Chicago, IL*
- **GPA:** 4.0

PUBLICATION

- M Khan, et al.. Identification and Analysis of the Spread of {Mis} information on Social Media. (CSoNET),* 2023

AWARDS

- **Loyola Outstanding Researcher Award - (2025):**: Award for undergraduates who have conducted exceptional research
- **Dean's List (2021 - 2025):** : Award for full-time undergraduates who earn a GPA of 3.5 or higher in a given semester
- **David Prasse Scholarship (2021 - 2025):** : Scholarship to 5 graduating seniors from Senn High School attending Loyola
- **John Grant Health Equity Award - (2025):** : Award for commitment to and research in health equity
- **Turing High Achievement Award - (2025):** : Top graduating student in Software Engineering
- **Computer Science Departmental Honors (2025):** : Distinction for advanced study and scholarly excellence

Technical Skills & Certifications

- **Languages**: Python, Java, JavaScript, English, Urdu, Bash/Shell, CSS, C++, React
- **Frameworks & Tools**: PyTorch, TensorFlow, MMLabs, Pandas, NumPy, Matplotlib, OpenCV, Hugging Face, Matplotlib
- **Systems & Platforms**: Linux, Git, Docker, Lambda Labs, Polaris Supercomputer, WiFi Pineapple, Raspberry Pi
- **Specialties**: Computer Vision, NLP, Video Transformers, GIS, Misinformation Detection, Research Writing, AI Design

Professional Summary

Innovative Computational Researcher with 4 years of experience in machine learning, cybersecurity, and geospatial intelligence. Demonstrated expertise in developing advanced AI models for violence detection and misinformation analysis, alongside proficiency in computer vision and natural language processing. Recognized for leading interdisciplinary research initiatives that drive ethical AI development and impactful solutions. Committed to leveraging high-performance computing and cloud systems to create technologies that enhance both resilience and intelligence in complex environments.

WORK AND VOLUNTEER EXPERIENCE

The Loyola University of Chicago **Jan 2022 - May 2025**

Machine Learning Researcher **Chicago, IL**

Sensitive Media Analysis
- Trained and fine-tuned spatio-temporal machine learning model, achieving 65% precision in detecting human-initiated violence by integrating UniformerV2 and VideoSWIN for superior spatial-temporal analysis.
- Expanded research to bridge AI, biophysics, philosophy, and psychology, exploring the cognitive mechanisms behind innate human violence detection.
- Created an IRB-approved proposal involving human subjects, reinforcing model performance by incorporating temporal salience data from visual annotations.
- Utilized eye-tracking glasses to collect annotated videos, training models to replicate human gaze patterns and improving violence detection precision.

Malaria Detection & Geospatial Intelligence
- Developed vision model (Mask-RCNN and Faster-RCNN) fine-tuned on satellite imagery with custom spectral-band augmentations, increasing malaria hotspot detection accuracy by 18% across low-visibility regions using localized population density.
- Built a pipeline fusing object detection with pixel-level spectral decomposition to generate spatial disease risk maps, enabling real-time resource targeting in rural Nigeria.
- Extracted and modeled surface-level geospatial indicators (elevation, vegetation index, water proximity) to enrich predictive layers, boosting model robustness against seasonal noise by 27%.

Human Action Recognition
- Designed and deployed a transformer-based HAR framework using VideoSWIN and text-guided prompts, demonstrating a 34% increase in cross-context generalization across three benchmark datasets (Moments in Time, Kinetics, SSV2).

- Diagnosed and resolved persistent GPU instability on Lambda Labs infrastructure by implementing fallback architectures, reducing downtime by 80% and preserving multi-day training runs.
- Refactored MMLabs pipelines for modularity and speed, cutting training time by 30% through efficient batching, lazy evaluation, and hardware-aware optimization.
- Collaborated across research teams to ensure consistent alignment and delivery. Gained deep expertise in video transformers, dataset integration, and high-performance computing.
- Utilized Argonne's Polaris supercomputer to accelerate large-scale training, significantly reducing runtime.

Misinformation Detection & NLP Research

- First-authored a study on COVID-19 misinformation spread, achieving 95% classification accuracy using a fine-tuned BERT pipeline across 50M tweets, contributing to one of the largest undergraduate-led social media datasets
- Directed a multi-level research team and engineered custom Twitter tools using Java and Python, reducing preprocessing latency by 40% and facilitating daily data ingestion at scale.
- Applied coresets and approximate nearest neighbor techniques to configure Twitter API rate limits, increasing usable data volume by 22% without compromising semantic integrity
- Created publication-ready figures using Matplotlib and NumPy, and delivered insights to researchers and professors through conferences.

Tracker Device Detection & Cybersecurity

- Engineered a Bluetooth-based tracking device detection system using Raspberry Pi and WiFi Pineapple for cybersecurity research.
- Designed and implemented Python scripts to identify and classify nearby Bluetooth-enabled devices in real time.
- Enhanced Raspberry Pi hardware capabilities to improve device detection range and accuracy.
- Collaborated on both software development and hardware integration, exploring novel methods for unauthorized device tracking mitigation.
- Demonstrated applied proficiency in embedded systems, wireless communication protocols, and practical cybersecurity tool development.

CERTIFICATION

- **Health Information Privacy and Security (HIPS)**: The CITI Health Information Privacy and Security (HIPS) certification covers the ethical, legal, and technical standards for safeguarding protected health information (PHI).
- **Social & Behavioral Investigators Responsible Conduct of Research**: Equips researchers with essential knowledge and ethical frameworks for conducting human subjects research in social, behavioral, and educational sciences.
- **Human Research - Group 1 Lakeside investigator**: Completion of core training for biomedical researchers conducting studies involving human subjects.