# Ehsan Latif

Postdoctoral Research Associate, AISTEM Education Center, The University of Georgia

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## SUMMARY OF QUALIFICATIONS

Innovative Machine Learning Software Engineer with over 5 years of experience in developing and deploying machine learning models. Proven track record of leading research projects, developing cloud-based solutions, and collaborating with interdisciplinary teams. Experienced in Data synthesis, LLM fine-tuning including GPT-3.5, Llam-2, and BERT. Proficient in Python, C++, AWS, and ROS with strong expertise in data engineering, software development, and applied machine learning.

## TECHNICAL PROFICIENCIES

**Tools/Frameworks**: ROS, ROS2, VSCode, Android Studio, XCode, PyCharm, Linux, Firebase, PyTorch, TensorFlow, AWS-(EC2, S3, Lambda, Sage Maker), Hugging Face, and Git.

**Programming languages**: C/C++/C#, Java, Android, Swift, Python, MySQL/SQL/SQLite/DynamoDB, and Django

## EDUCATION

**The University of Georgia** – Athens, GA January 2021 – August 2023

Doctor of Philosophy in Computer Science

*Dissertation Title:* Collaborative Algorithms for Localization and Exploration in Multi-Robot Systems

Cumulative GPA: 4.00/4.00

**The National University of Computer and Emerging Sciences** – Lahore, PK August 2014 – May 2018

Bachelor of Science in Computer Science

Cumulative GPA: 3.2/4.00

## PROFESIONAL EXPERIENCE

**Postdoctoral Research Associate** – *AI4STEM Research Center* – Athens, GA September 2023 – Current

- Working on an NSF-funded project on designing automatic assessment items, and rubrics and training machine learning models for automatic scoring.
- Investigating the use of large language models for the educational domain.
- Leading a team of graduate and undergraduate students on different tasks such as online platform development, knowledge distillation for ML model deployment, and conducting professional development and school survey sessions.

**Graduate Research Assistant** – *School of Computing and College of Education* – Athens, GA January 2021 – July 2023

- A combined position involve machine learning and robotics research.
- Conducted research on multi-robot systems to improve localization accuracy, efficient Path planning, and exploration in dense and dynamic environments.
- Served as a project leader and software developer for Django, Android, and iOS application for ML Operations.

**Research Associate** – Lahore University of Management Sciences – Lahore, PK January 2019 – December 2020

- Worked at NSG Lab under Dr. Ihsan Ayyub Qazi on a mobile web optimization project.
- Developed Native Android application for memory stress testing on web browser content rendering.
- Collaborate with a team that analyzes mobile web behavior under high memory and processing pressure.

**Software Engineer** – *Strategic Systems International* – Lahore, PK August 2018 – January 2019

- Researched building synchronization framework code items, materials, and similar building plans for heterogeneous systems.
- Implemented a framework to synchronize data from multiple sources.

## RELATED PROJECTS

**Supporting Instructional Decision Making: The Potential of An Automatically Scored Three-dimensional Assessment System**

- **Description:** Developed Android, iOS, Django web application, trained machine learning models for automatic scoring, deployed models to AWS-EC2, integrated with Django application using AWS-Lambda functions, created DynamoDB for datastore, and integrated with each application using Amplify.

- **Technologies:** CNN, BERT, AWS-(EC2, S3, Lambda, DynamoDB), Django, Android, Java, Kotlin, XCode, Amplify, Swift.
- **Outcome:** A complete solution for automatic scoring of science assessments in the form of fully functional web application
- **Model Repository:** https://ai4stem.org/models/
- **Web Application:** https://ai4pasta.org
- **Android Application:** https://play.google.com/store/apps/details?id=com.aistem.astem
- **iOS Application:** https://apps.apple.com/us/app/ai-scorer/id1593460599#?platform=iphone

**PhysicsAssistant: An LLM-Powered Interactive Learning Robot for Physics Lab Investigations**

- **Description:** Developed an interactive learning system leveraging YOLOv8 object detection, speech recognition, and large language models (LLMs) to assist students in physics.
- **Technologies:** YOLOv8, Google ASR, BERT, GPT-3.5, and GPT-4.
- **Outcome:** Enhanced the learning experience and provided real-time feedback to students using PhysicsAssistant.
- **GitHub Repository:** https://github.com/ehsanlatif/PhysicsAssistant

**Knowledge Distillation of LLM for Automatic Scoring of Science Education Assessments**

- **Description:** Designed and implemented LLM Distillation using Loss Function Optimization for automatic scoring of unknown student written responses on resource-constraint devices.
- **Technologies:** BERT, Llama-2, GPT-3.5, Tensorflow, Hugging Face, CUDA
- **Outcome:** Reduced trained model size and achieved high automatic scoring accuracy in real-time.
- **GitHub Repository:** https://github.com/ehsanlatif/knowledge_distillation

**G-SciEdBERT: A Contextualized LLM for Science Assessment Tasks in German**

- **Description:** Pre-trained Language Model for German written student responses and fine-tuned for automatic scoring.
- **Technologies:** BERT, G-BERT, PyTorch, Tensorflow, Hugging Face
- **Outcome:** German Science Education BERT Model trained and deployed to Hugging Face for real-time inferencing.
- **GitHub Repository:** https://github.com/ehsanlatif/G-SciEdBERT
- **Hugging Face Model Repository**: https://huggingface.co/ai4stem-uga/G-SciEdBERT

**Fine-tuning ChatGPT for Automatic Scoring**

- **Description:** Implemented fine-tuning techniques on ChatGPT for automating the scoring of educational assessments.
- **Technologies:** GPT-3.5, PyTorch, HuggingFace
- **Outcome:** Achieved significant improvements in the accuracy of automated scoring.
- **Publication:** https://doi.org/10.1016/j.caeai.2024.100210

**SEAL: Simultaneous Exploration And Localization for Multi-Robot Systems**

- **Description:** Created an integrated solution for efficient and GPS-free exploration and localization solution for multi-robot system using graph optimization for localization, Gaussian Process Regression for exploration, and Bayesian fusion and optimization for integration.
- **Technologies:** ROS, G2O, GPR, BO, Python,
- **Outcome:** A complete solution for indoor exploration and localization for multi-robot systems with improved localization accuracy and efficient exploration.
- **Publication:** https://doi.org/10.1109/IROS55552.2023.10342157
- **GitHub Repository:** https://github.com/herolab-uga/ROS-SEAL

**Communication-Efficient Multi-Robot Exploration Using Coverage-biased Distributed Q-Learning**

- **Description:** Created a distributed Q-learning algorithm to improve multi-robot exploration efficiency in dense environments.
- **Technologies:** ROS, Q-learning, MDP, POMDP, Python, Gmapping, Movebase, Rviz
- **Outcome:** Improved exploration coverage and reduced communication overhead.
- **Publication:** https://doi.org/10.1109/LRA.2024.3358095
- **GitHub Repository:** https://github.com/herolab-uga/cqlite

**Instantaneous Wireless Robotic Node Localization Using Collaborative Direction of Arrival**

- **Description:** Developed a system for indoor localization of robotic nodes using collaborative DOA and particle filters.
- **Technologies:** ROS, Wireless Communication, Python
- **Outcome:** Enhanced Localization accuracy for indoor and dynamic environments
- **Publication:** https://ieeexplore.ieee.org/document/10185556
- **GitHub Repository:** https://github.com/herolab-uga/cdoa-localization

## SELECTIVE AWARDS

**Pioneers of Natural Sciences Laboratory Robotics Award** – ICRA-24
**Outstanding Graduate Student Award (Spring 2023)** – School of Computing, University of Georgia
**Open Science Publication Award (2023)** – National Science Foundation
**UGA-Liverpool Research Fellowship (2023)** – School of Computing, University of Liverpool, Manchester, UK
**James L. Carmon Scholarship Award (2023)** – Prestigious Computing Research Award – University of Georgia