Fnu Mohbat

518-961-8486 – mohbaf@rpi.edu – Troy, NY, 12180
Website: mohbat.weebly.com – GitHub: github.com/mohbattharani – Google scholar, – LinkedIn

Education

Ph.D. Computer Science, *Rensselaer Polytechnic Institute, Troy, NY* 01/2021 - 05/2025
Research Focus: *Enhancing Large Language Models with Knowledge Graphs for Food Computing.*
Advisor: *Mohammed J. Zaki*

MS Electrical Engineering, *Lahore University of Management Sciences (LUMS)* 06/2018
Thesis: *Content Based Image Retrieval Through Deep Learning.*

BS Electrical Engineering, *COMSATS Institute of Information Technology* 06/2014
Undergraduate Exchange, *Ivy Tech Community College, Fort Wayne, IN* 08/2012 - 05/2013

Research Experience

Rensselaer Polytechnic Institute Troy, NY
Graduate Research Assistant, Advisor: Mohammed J. Zaki 08/2021 - Present
- Conducting research to enhance Large Language Models (LLMs) and Multi-Modal Models (MMMs) using Knowledge Graphs (KGs) and Retrieval-Augmented Generation (RAG) for food computing applications.
- Developing innovative methods to improve document understanding, caption generation, and text summarization through LLMs and MMMs.
- Fostered synergy between academic and industry expertise through dynamic collaboration with researchers at IBM Research and Rensselaer (2021-2023).

IBM Thomas J. Watson Research Center Remote
Summer Extern, Mentors: Keerthiram Murugesan, 05/2023 - 08/2023
- Investigated the impact of stable diffusion techniques on manipulating visual concepts within MMMs to produce targeted text such as stories and summaries.

IBM Thomas J. Watson Research Center Yorktown Heights, NY
Summer Extern, Manager: Ashish Verma 05/2022 - 08/2022
- Conducted research on visually rich document understanding by modeling documents as graphs and learning their embeddings using Transformer and Graph Neural Networks (GNNs) for downstream tasks.
- Enhanced the generalization capability of document AI models, improving their performance on out-of-distribution data by $10-30\%$.

IBM Thomas J. Watson Research Center Remote
Summer Extern, Mentors: Ashish Verma, Catherine Finegan-Dollak 05/2021 - 08/2021
- Developed and trained transformer models and object detection models for document text understanding, focusing on classification and key-value prediction.
- Annotated a proprietary dataset, training and trained and tested visual-language models on this data.

Lahore University of Management Sciences Lahore, Pakistan
Research Associate in National Agriculture Robotics Lab 04/2019 - 12/2020
- Lead a team of 5-10 researchers in developing deep learning and IoT-based solutions for water quality assessment.
- Researched model compression techniques, developing a Teacher-Class network that significantly enhanced accuracy and reduced parameters by 10-30x compared to traditional single-student methods.
- Co-supervised undergraduate and master's students, and drafted research grant proposals and fostered industrial collaborations.

Lahore University of Management Sciences Lahore, Pakistan
Research Assistant in Computer Vision & Graphics Lab 06/2017 - 03/2019
- Researched unsupervised feature learning, image retrieval, and object detection methodologies.
- Developed a fixed-wing V-TOL UAV for autonomous tasks as part of an eight-member team.
- Conducted class tutorials and provided mentorship for senior year projects.

Publications

9. **LLaVA-Chef: A Multi-modal Generative Model for Food Recipes**,
Fnu Mohbat, Mohammed J. Zaki. Proceedings of the 33rd ACM International Conference on Information and Knowledge Management (CIKM), 2024.
8. **Beyond Visual Augmentation: Investigating Bias in Multi-Modal Text Generation**,
Fnu Mohbat, Vijay Sadashivaiah, Keerthiram Murugesan, Amit Dhurandhar, Ronny Luss and Pin-Yu Chen. Fourth Workshop on Trustworthy Natural Language Processing (TrustNLP), 2024.
7. **GVdoc: Graph-based Visual Document Classification**,
Fnu Mohbat, Mohammed J. Zaki, Catherine Finegan-Dollak & Ashish Verma. Findings of the 61^{st} Annual Meeting of the Association for Computational Linguistics (ACL), 2023

6. **Teacher-Class Network: A Neural Network Compression Mechanism**,
Shaiq Munir Malik, Fnu Mohbat, & Murtaza Taj. The 32^{nd} British Machine Vision Conference (BMVC), 2021. Link. PDF
5. **Trash Detection on Water Channels**, Mohbat Tharani, Abdul Wahab & Murtaza Taj. International Conference on Neural Information Processing, 2021. , (**Acceptance rate: 32.9%**) PDF
4. **Cross-view Image Retrieval - Ground to Aerial Image Retrieval Through Deep Learning**,
Numan Khurshid, Talha Hanif, Mohbat Tharani & Murtaza Taj. International Conference on Neural Information Processing (ICONIP), Sydney, Australia. Dec 12-15, 2019. (**Acceptance rate: 27.5%**) Link
3. **A Residual-Dyad Encoder Discriminator Network for Remote Sensing Image Matching**, Numan Khurshid*, Mohbat Tharani*, Murtaza Taj & Faisal Qureshi. IEEE Transaction on Geo-science and Remote Sensing, Nov, 2019. Link
2. **Dimensionality Reduction Using Discriminative Autoencoders for Remote Sensing Image Retrieval**, Mohbat, Tooba Mukhtar, Numan Khurshid & Murtaza Taj, The 20*th* International Conference on Image Analysis and Processing (ICAIP), Trento, Itlay, September 9-13, 2019. (**Acceptance rate** for oral & spotlights: **30.7%**) Link
1. **Use of Greendrone UAS System for Maize Crop Monitoring**,
Ahmad Kamal Nasir, & Mohbat Tharani [1], The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, 2017. PDF

Skills Summary

Languages: Python, C/C++, MATLAB, C#, VB .Net
Frameworks: PyTorch, PyTorch-Geometric, Keras, TensorFlow, Caffe, OpenCV, ROS, PCL
Platforms: IBM Power 9, HPC, Nvidia Jetson, Odroid, Raspberry Pi, Arduino, Intel80xx, PLCs

Honors and Awards

- Qualified UAV Medical Express Challenges 2018 in Australia, only 13 out of 55 teams qualified 09/2018
- Received 90% financial aid for Masters degree at Lahore University of Management Science, Pakistan 2016-2018
- Awarded National ICT R&D merit scholarship for the complete bachelor's degree. Selected from 120 out of 7000 applicants across the province **(acceptance rate:** 1.7%**)** 2009-2014
- Selected for the NESA UGRAD Exchange Program 2012-13, a fully funded exchange scholarship to study two semesters in the USA. **Acceptance rate:** 0.06% (3/5000 applicants) 2012-2013
- Achieved the Inspiring Intern certificate from the State Department in recognition of outstanding performance during internships as part of the U.S. exchange program **selection rate of** 3.33% (3 out of 90)

Volunteer Experience

- Reviewer: ACM International Conference on Information and Knowledge Management (CIKM) 2024
- Reviewer: ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD) 2024
- Reviewer: European Conference on Computer Vision (ECCV) 2024
- Reviewer: IEEE Winter Conference on Applications of Computer Vision (WACV): 2020 - 2024
- Founding member and Vice President, Computer Science Graduate Council at RPI 2021-22

Other Experience

Rensselaer Polytechnic Institute, *Teaching Assistant* 01/2021 - 05/2021
- Computer Organization (CSCI-2500); Instructor: Prof. George Slota, Shianne Hulbert

Lahore University of Management Sciences, *Teaching Assistant*
- Deep Learning (CS-437/5317); Instructor: Prof. Murtaza Taj Spring 2019, Spring 2020
- Robot Motion Planning (EE-562); Instructor: Prof. Muhammad Abubakr Fall 2018

Ivy Tech Community College *Teaching Assistant* 09/2012 - 05/2013
- Introduction to database: Oracle 11g; Instructor: Dr. John M. Heise Fall 2012
- Introduction Industrial Technology; Instructor: Dorothy R. Barse Fall 2012, Spring 2013

Agatos Pvt. Pakistan, *Automation Engineer* 08/2014 - 10/2016
- Analyzed project requirements, programmed PLCs, HMI/SCADA systems and commissioned on site, and participated in sales meetings with customers

Pro Shear Corporation, IN, *Intern* 01/2013 - 05/2013
- Developed programming solutions while troubleshooting industrial manipulators, CNCs, and PLCs