Fnu Mohbat

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Summary

Final year PhD candidate in computer science with research experience in multi-modal learning, large language models (LLMs), knowledge graphs (KGs) and graph neural networks (GNNs). Skilled in training and deploying LLMs, vision-language models (VLMs), and retrieval augmented generation (RAG) on multi-GPU systems. *Looking for a machine learning researcher role to leverage and expand my skills.*

Education

Ph.D. Computer Science, *Rensselaer Polytechnic Institute, Troy, NY* 01/2021 - 08/2025
Dissertation: *Knowledge Graph Enhanced Large Language Models for Food Understanding.*
Advisor: *Mohammed J. Zaki*

MS Electrical Engineering, *Lahore University of Management Sciences (LUMS)* 08/2016 - 06/2018
Thesis: *Content Based Image Retrieval Through Deep Learning.*

BS Electrical Engineering, *COMSATS Institute of Information Technology* 09/2009 - 06/2014
Undergraduate Exchange, *Ivy Tech Community College, Fort Wayne, IN* 08/2012 - 05/2013

Skills Summary

Programming Languages: Python, C/C++, MATLAB, C#, VB .Net
AI Frameworks: PyTorch, PyTorch-Geometric, Keras, TensorFlow, langchain, LlamaIndex
CV & Robotics: OpenCV, ROS, PCL
Platforms: IBM Power 9, HPC, Nvidia Jetson, Odroid, Raspberry Pi, Arduino, Intel80xx

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) by integrating Knowledge Graphs (KGs) through Retrieval-Augmented Generation (RAG), achieving a $30-50\%$ improvement in personalized food recipe recommendations.
- Proposed multistage instruction tuning and custom loss for improving language vision models, resulting a 16-point gain in SacreBLEU and a 6-point increase in ROUGE-L scores.
- Improved document understanding, caption generation, and text summarization through LLM (LLaMA, Phi, Mistral) and MMM (LLaVA, miniGPT).
- Facilitated collaboration between IBM Research and Rensselaer Polytechnic Institute, combining academic and industry expertise to foster innovation (2021-2023).

IBM Thomas J. Watson Research Center Remote
Summer Extern, Mentors: Keerthiram Murugesan 05/2023 - 08/2023
- Investigated the impact of Stable Diffusion (SD) generated images on visual concept manipulation in Multi-Modal Models (MMMs), revealing that the biased visuals exacerbate toxicity and bias in generated text compared to unbiased visual and text-only inputs.

IBM Thomas J. Watson Research Center Yorktown Heights, NY
Summer Extern, Manager: Ashish Verma 05/2022 - 08/2022
- Optimized generalization of document AI models by $15-30\%$ on out-of-distribution (OOD) data through novel Transformer-GNN integration, reducing OOD detection error rates and enhancing real-world adaptability.

IBM Thomas J. Watson Research Center Remote
Summer Extern, Mentors: Ashish Verma, Catherine Finegan-Dollak 05/2021 - 08/2021
- Fine tuned transformer models and object detection models for document text understanding tasks including classification and key-value prediction.
- Annotated a proprietary visual documents dataset (10K samples) and fine-tuned and evaluated models such as Bert, LayoutLM, on it.

Lahore University of Management Sciences Lahore, Pakistan
Research Associate in National Agriculture Robotics Lab 04/2019 - 12/2020
- Led 5-10 researchers in developing deep learning and IoT solutions for water quality assessment via foreign object detection, implemented on Raspberry Pi and NVIDIA Jetson Nano.
- 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 4 undergraduate and 2 master's students, drafted proposal for research grant proposals and industrial collaborations.

Lahore University of Management Sciences Lahore, Pakistan
Research Assistant in Computer Vision & Graphics Lab 06/2017 - 03/2019

- Proposed a residual dyad network that amplified image retrieval by 22 mAP points on remote sensing images.
- Developed fixed-wing V-TOL UAV for autonomous target identification, payload delivery (5kg, 10km range), with 60-min flight time.
- Wrote modification codes for GTA-V to collect 100,000 road scene images with car parameters, and trained Convolutional Neural Networks (CNNs) to predict speed and steering angles for autonomous vehicle control within the game environment.
- Conducted tutorials in Computer Vision and Deep Learning classes and mentored senior year projects.

Publications

10. Knowledge Graph-Enhanced LLM for Food Recommendation through Question Answering,
Fnu Mohbat & Mohammed J. Zaki. Towards Knowledgeable Foundation Models at AAAI, 2025. PDF.

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. PDF.

8. Beyond Visual Augmentation: Investigating Bias in Multi-Modal Text Generation,
Fnu Mohbat, Vijay Sadashivaiah, Keerthiram Murugesan, Amit Dhurandhar, Ronny Luss & Pin-Yu Chen. Fourth Workshop on Trustworthy Natural Language Processing (TrustNLP), at NAACL 2024. PDF.

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, 2023. PDF.

6. Teacher-Class Network: A Neural Network Compression Mechanism,
Shaiq Munir Malik, Fnu Mohbat, & Murtaza Taj. The 32^{nd} British Machine Vision Conference, 2021. PDF.

5. Trash Detection on Water Channels,
Mohbat Tharani, Abdul Wahab & Murtaza Taj. International Conference on Neural Information Processing, 2021. 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. 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 $20th$ International Conference on Image Analysis and Processing (ICAIP), Trento, Itlay, September 9-13, 2019. 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

Professional Services

- Served as a session chair at ACM Conference on Information and Knowledge Management (CIKM) 2024
- Reviewer: Computer Vision and Pattern Recognition (CVPR) 2025
- Reviewer: ACM International Conference on Information and Knowledge Management (CIKM) 2024
- Reviewer: ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD) 2024 - 2025
- Reviewer: European Conference on Computer Vision (ECCV) 2024
- Reviewer: IEEE Winter Conference on Applications of Computer Vision (WACV): 2020 - 2024

Honors and Awards

- AAAI 2025 Travel/Volunteer scholarship award ($700 + Registration) 12/2025
- Invited talk and poster at ACM International Conference on AI in Finance (ICAIF), Brooklyn, NY. 2024
- NAACL 2024 registration award for volunteering virtual sessions 06/2024
- Founding member and Vice President, Computer Science Graduate Council at RPI 2021 - 2022
- 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
- National ICT R&D merit scholarship for the complete bachelor's degree. (120/7000 applicants). 2009-2014
- NESA UGRAD Exchange Scholarship (fully funded two semesters) (3/5000 applicants) 2012-2013
- Inspiring Intern certificate from the State Department during NESA exchange program (3 out of 90) 4/2013

Other Experience

Rensselaer Polytechnic Institute, *Teaching Assistant*

- Computational Vision (CSCI-6270); Instructor: Chuck Stewart — Spring, 2025
- Computer Science I (CSCI-1100); Instructor: Uzma Mushtaque — Fall 2024
- Operating Systems (CSCI-4210); Instructor: David Goldschmidt — Summer 2024
- Computer Organization (CSCI-2500); Instructor: Prof. George Slota — Spring 2021

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