Ghulam Mujtaba

Postdoctoral Researcher, West Virginia University, Morgantown, West Virginia, USA

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Summary

I have seven-plus years of industrial experience (3 years post-PhD) in research and engineering. As a skilled deep learning and computer vision researcher, I have developed SOTA deep learning techniques to solve complex problems, such as action recognition for resource-constrained edge devices like Jetson Nano/TX2. I have published 10+ referred articles and have one USA patent pending.

Research Interests: Computer Vision, Deep Learning for Visual Analysis, and Multimedia Retrieval

Technical Skills:
Languages: Python, Java, C#
Libraries: PyTorch, TensorFlow, Keras, OpenCV, Pillow, NumPy
Others: Git, LaTeX, Linux, Unity3D

Education

Doctor of Philosophy in Engineering Mar 2018 — Aug 2021
Gachon University, Seongnam, South Korea
Dissertation: Lightweight Client-driven Personalized Multimedia Framework for Next Generation Streaming Platforms
Advisor: Prof. Jaehyuk Choi, *Co. Advisor:* Prof. Eun-Seok Ryu

Master of Science in Computer Science Jul 2014 — Jun 2016
Indus University, Karachi, Pakistan

Bachelor of Science in Computer Science Sep 2009 — Jul 2013
COMSATS Institute of Information Technology, Lahore, Pakistan

Research Experience

Postdoctoral Researcher, *West Virginia University, Morgantown, WV, USA* Apr 2023 – Present

- Conduct cutting-edge research and develop deep-learning models for analyzing medical multimodality data, including X-ray and ultrasonography medical images/videos in RGB and grayscale formats.
- Explore cutting-edge technology advancements like ChatGPT, Generative AI, and Large Language Models (LLMs) while creating a research roadmap to delve into their applications and implications.
- Assisted the Principal Investigator (PI) in securing funding for research projects, including grant proposal writing, budget development, and collaboration with funding agencies and stakeholders.

Research Engineer, *C-JeS Gulliver Studio, Seoul, South Korea* Mar 2022 – Mar 2023

- Applied deep learning techniques to achieve a 20% increase in realism for digital-human characters, enhancing their lifelike qualities in Metaverse applications.
- Innovated and deployed efficient 2D to 3D conversion methods, significantly reducing project timelines and production costs by 30%, while upholding the high quality of digital-human designs, directly contributing to project success and profitability.
- Elevated studio's research profile by authoring 2 impactful papers (one journal and one conference), enhancing the studio's reputation as a leading authority in digital-human technology. This achievement attracted top talent and stimulated innovation throughout the industry, attracting top talent, and fostering innovation across the industry.

Senior Researcher, *DeltaX, Seoul, South Korea* Oct 2021 – Feb 2022

- Developed advanced deep learning techniques leveraging CNNs, RNNs, LSTMs, and SVM to accurately identify sequential patterns in human activity for XVision Technology Advancement. The main emphasized violence detection and content moderation in both videos and images, enhancing the capabilities of the technology.
- Collaborated on an award-winning project, the Self-Driving Data Contest 2021, contributing to a project that received the prestigious Korea Transportation Safety Authority Chairman Award.
- Identified market growth opportunities and prototyped innovative strategies for company expansion within emerging markets, driving sustainable growth and market penetration.

Visiting Researcher, *MCSLab, Sungkyunkwan University, Seoul, South Korea* Sep 2019 – Sep 2021

- Pioneered thumbnail-based video analysis for streaming platforms, resulting in a 3.57% improvement in computational efficiency for on-device computation. Successfully deployed deep learning models on edge devices such as Nvidia Jetson TX2 modules, accelerating the development of advanced video content analysis systems.
- Collaborated in developing algorithms for multiview video surveillance summarization, utilizing target-appearance-based features, identifying user-preferred emotional moments, implementing facial expression recognition, and extensively exploring pre-trained deep learning models.

- Developed meticulous disclosure documents for multinational collaborations, safeguarding intellectual property and enabling successful technology transfer. Authored impactful research manuscripts, including four journals and eleven conference papers, elevating the lab's academic prominence and recognition.
- Played a pivotal role in securing funding by assisting the Principal Investigator (PI) in writing proposals, including crafting a proposal for the Amazon Research Award 2021, which although unsuccessful, led to valuable insights and innovations, resulting in a patent application.

Graduate Research Assistant, *Gachon University, Seongnam, South Korea* Mar 2018 – Jun 2021

- Participated in developing AI-based healthcare solutions for seniors by designing and implementing a comprehensive life-logging system. Enabled detailed activity monitoring using advanced video analysis for improved senior well-being and safety.
- Collaborated in the development of algorithms for multiview video surveillance summarization, leveraging target-appearance-based features, user-preferred emotional moments, facial expression recognition, and extensive exploration of pre-trained deep models.

Teaching Experience

Lecturer, *Department of Computer Science, Mohammad Ali Jinnah University, Karachi, Pakistan* Oct 2017 – Jan 2018

- Taught undergraduate courses, including Mobile Application Development, Theory of Automata, and Computer Programming to a diverse group of interdisciplinary students, with an average class size of around fifty students.
- Developed comprehensive course outlines aligned with the accreditation standards, ensuring clear objectives and outcomes to enhance the quality of education.
- Provided guidance and supervision to undergraduate students in their final year projects, mentoring them in project development and research methodologies.

Full-Time Cooperative Teacher, *Faculty of CS & IT, Benazir Bhutto Shaheed University Lyari, Karachi, Pakistan* Aug 2016 – Sep 2017

- Instructed undergraduate courses, including Object-Oriented Programming, Data Structure & Algorithm, and Information Security to a diverse group of interdisciplinary students, with an average class size of around fifty students.
- Developed course outlines in accordance with the requirements set by relevant accreditation bodies, aligning objectives and outcomes to meet educational standards.
- Provided guidance and oversight to undergraduate students in their final year projects, assisting them in project management and implementation.

Junior Lecturer, *Faculty of Engineering Science & Technology, Indus University, Karachi, Pakistan* Jan 2015 – Jul 2016

- Instructed undergraduate courses, including Mobile Game Development, Object-Oriented Programming, and Programming Fundamentals to a diverse group of interdisciplinary students, with an average class size of around fifty students.
- Developed comprehensive course outlines aligned with the requirements of accreditation bodies, ensuring clear objectives and measurable outcomes.
- Provided supervision and guidance to undergraduate students in their final year projects, supporting them throughout the project lifecycle.

Software Development Experience

Developer, *The Game Storm Studio (PVT) LTD, Karachi, Pakistan* Mar 2014 – Oct 2014

- Conceptualized and designed the initial gameplay and mechanics of the game, utilizing Unity3D, Unity2D, and Cocos2dx.
- Resolved complex technical challenges that arose during game production, ensuring smooth development and functionality.
- Collaborated closely with team members to effectively fulfill project requirements and deliver high-quality results.

Jr. Software Engineer, *Symbiosis Technologies (PVT) LTD, Karachi, Pakistan* Jul 2013 – Jan 2014

- Supported the initial design phase of the application and contributed to the integration of various components.
- Developed and rigorously tested program modules in accordance with the specified application requirements.

Publications

USA Patent

- **Ghulam Mujtaba**, Eun-Seok Ryu, and Reda Harb "Personalized Semantic Fast-Forward Videos for Next Generation Streaming Platforms", [AF] Aug. 30, 2022, [AN] 17/899,292.

Preprint Articles

1. S. M. A. Sharif, **Ghulam Mujtaba**, and S. M. Nadim Uddin, "EdgeNet: A novel approach for Arabic numeral classification", arXiv preprint arXiv:1908.02254, **2019**
2. Sunder Ali Khowaja, **Ghulam Mujtaba**, Jiseok Yoon, and Ik Hyun Lee, "Face-PAST: Facial Pose Awareness and Style Transfer Networks", arXiv preprint arXiv:2307.09020, **2023**
3. Shabir Ahmad, Sabina Umirzakova, **Ghulam Mujtaba**, Muhammad Sadiq Amin, Taegkeun Whangbo, "Education 5.0: Requirements, Enabling Technologies, and Future Directions", arXiv preprint arXiv:2307.15846, **2023**

Peer-reviewed Journals

1. **Ghulam Mujtaba**†, Sunder Ali Khowaja†, Aslam Jarwar, Jaehyuk Choi, and Eun-Seok Ryu "FRC-GIF: Frame Ranking-based Personalized Artistic Media Generation Method for Resource Constrained Devices", **IEEE Transactions** on Big Data, **2023**, IF: 7.2
2. **Ghulam Mujtaba**, Adeel Malik, and Eun-Seok Ryu "LTC-SUM: Lightweight Client-driven Personalized Video Summarization Framework Using 2D CNN" IEEE Access, Vol. 10, **2022**, pp. 103041-103055, IF: 3.476
3. **Ghulam Mujtaba**, Sangsoon Lee, Jaehyoun Kim, and Eun-Seok Ryu, "Client-driven Animated GIF Generation Framework Using an Acoustic Feature", Multimedia Tools and Applications, **2021**, IF: 2.313
4. **Ghulam Mujtaba**, and Eun-Seok Ryu, "Client-Driven Personalized Trailer Framework Using Thumbnail Containers", IEEE Access, Vol. 8, **2020**, pp. 60417-60427, IF: 4.098
5. **Ghulam Mujtaba**, Muhammad Tahir, and Muhammad Hanif Soomro, "Energy-Efficient Data Encryption Techniques in Smartphones", Wireless Personal Communications 106.4,

Peer-reviewed Conferences

1. **Ghulam Mujtaba**, Jaehyuk Choi, and Eun-Seok Ryu, "Client-driven Lightweight Method to Generate Artistic Media for Feature-length Sports Videos", SIGMAP'22: 19th International Conference on Singal Processing and Multimedia Applications **2022**, Libson, Portugal
2. **Ghulam Mujtaba**, and Eun-Seok Ryu, "Human Character-oriented Animated GIF Generation Framework", IEEE MAJICC'21: Mohammad Ali Jinnah University Conference on Informatics and Computing **2021**, Karachi, Pakistan
3. Badaruddin, Abdul Aziz, Tuan Thanh Le, and **Ghulam Mujtaba**, "Movie Genre Classification from Movie Posters Using Deep Feedforward Network", The 16th Asia Pacific International Conference on Information Science and Technology (APIC-IST 2021), Jun 20-22, **2021**
4. **Ghulam Mujtaba**, Eun-Soo Park, Seunghwan Kim, and Eun-Seok Ryu, "Client-driven Music Genre Classification Framework", The Korean Institute of Broadcast and Media Engineers (KIBME) Summer Conference, Jul 13-15, **2020**
5. Eun-Soo Park, SeungHwan Kim, **Ghulam Mujtaba**, and Eun-Seok Ryu, "Analysis of Action Recognition Model Performance Differences According to Preprocessing Methods", Summer Workshop on Computer Communications (SWCC), Aug 27, **2020**
6. SeungHwan Kim, Eun-Soo Park, **Ghulam Mujtaba**, Eun-Seok Ryu, "Weight Compression Method with Video Codec", The Korean Institute of Broadcast and Media Engineers (KIBME) Fall Conference, Nov 27-28, **2020**
7. SeungHwan Kim, Eun-Soo Park, **Ghulam Mujtaba**, Eun-Seok Ryu, "Video Codec Based Deep Learning Weight Compression", Summer Workshop on Computer Communications (SWCC), Aug 27, **2020**
8. Eun-Soo Park, Seunghwan Kim, **Ghulam Mujtaba**, Eun-Seok Ryu, "Detection of Power Transmission Equipment in Image using Guided Grad-CAM", The Korean Institute of Broadcast and Media Engineers (KIBME) Summer Conference, Jul 13-15, **2020**
9. SeungHwan Kim, Eun-Soo Park, **Ghulam Mujtaba**, Eun-Seok Ryu, "Compression Method for CNN Models Using DCT", The Korean Institute of Broadcast and Media Engineers (KIBME) Summer Conference, Jul 13-15, **2020**
10. **Ghulam Mujtaba**, and Eun-Seok Ryu, "Personalized Movie Trailer Using Thumbnail Containers", AI4TV 2019: Proceedings of the 27th ACM International Conference on Multimedia, **2019**, [Demo Paper], Nice, France
11. Eun-Soo Park, Seunghwan Kim, Jaesung Ryu, Seondae Kim, **Ghulam Mujtaba**, Eun-Seok Ryu, "Action Recognition Reference Image Captioning", The Korean Institute of Broadcast and Media Engineers (KIBME) Summer Conference, pp. 21-24, Jun 19-21, **2019**
12. **Ghulam Mujtaba**, Seondae Kim, Eun-Soo Park, Seunghwan Kim, Jaesung Ryu, and Eun-Seok Ryu, "Client-driven Animated Keyframe Generation System Using Music Analysis", The Korean Institute of Broadcast and Media Engineers (KIBME) Summer Conference, pp. 176-178, Jun 19-21, **2019**
13. Seondae Kim, Il-Woong Ryu, Jaesung Ryu, **Ghulam Mujtaba**, Eun-Soo Park, Seunghwan Kim, and Eun-Seok Ryu, "Aesthetic Feature-based Activity Summarization for Senior Life Logging", The Korean Institute of Broadcast and Media Engineers (KIBME) Summer Conference, pp. 25-28, Jun 19-21, **2019**
14. **Ghulam Mujtaba**, Muhammad Tahir, Muhammad Hanif Soomro, "Energy-efficient data encryption techniques in Smartphones", Global Conference on Wireless and Optical Communications (GCWOC'17), **2017**, Malaga, Spain

Selected Projects

1. **Digital Human Solution for Metaverse,** *C-JeS Gulliver Studios, Seoul, Korea* Mar 2022 – Mar 2023
   Researched cutting-edge technologies to design realistic digital humans for the Metaverse at C-JeS Gulliver Studios. Developed an innovative image-based deep learning method and collaborated with the VFX team to seamlessly integrate digital humans into various virtual reality applications.
2. **xVision, AI-Based Video Analysis Solution,** *DeltaX, Seoul, Korea* Oct 2021 — Feb 2022
   Designed and developed the xVision method using deep learning and computer vision techniques at DeltaX.ai. Designed using TensorFlow convolutional neural networks and LSTM networks to analyze feature-length videos, facilitating object and scene detection.
3. **Dynamic Sports Highlights Generation,** *Sungkyunkwan University, Seoul, Korea* Mar 2019 — Sep 2022
   Lightweight client-driven method proposed to generate artistic media for feature-length sports videos at SKKU, Seoul South Korea.

Designed an effective 2D Convolutional Neural Network model for LTC analysis that can classify personalized events from six different sports categories. Reduced the computational complexity by 3.78 times than SOTA on a resource constrained device like NVIDIA Jetson TX2.

4. **Personalized Media Communication,** *Gachon University, Seongnam, Korea* Jan 2018 — May 2019
   Designed and prototyped a lightweight client-driven framework for a personalized media streaming framework at Gachon University, South Korea funded by InterDigital, CA, USA. The method was configured on the HTTP live streaming (HLS) steaming protocol on the server and client sides.
5. **Development of Energy-efficient Techniques Using Data Encryption in Smartphones,** *HEC, Pakistan* Jul 2017 — Feb 2018
   Researched and developed a native Android application using Java during my master's program funded partially by HEC, Pakistan. Designed the app to implement diverse encryption algorithms for data encryption. Conducted power consumption measurements on smartphones to evaluate algorithm efficiency across varying file sizes.

Award and Achievements

- Recipient, Doctoral Consortium at International Conference on Computer Vision (**ICCV**) 2021
- Recipient, President's Award for Academic Excellence, Gachon University, **South Korea** 2021
- Recipient, Outstanding Research Award, MCSL SKKU, **South Korea** 2020
- Recipient, Travel Grant, Higher Education Commission (HEC) **Pakistan** 2017
- Runner up, Gaming Competition (CoD4) Technomoot '13, Abot., **Pakistan** 2013
- Finalist, Offices of Research, Innovation & Commercialization (ORICS) of Hell Zone (Game), Lahore, **Pakistan** 2012
- Winner, Gaming Competition (Stronghold Crusader) Technomoot '12, Abot., **Pakistan** 2012
- Runner up, Gaming Competition (Counter Strike) VISIO Spark' 12, Wah, **Pakistan** 2012
- Runner up, Quiz Competition COMSPEC '10, Lahore, **Pakistan** 2010
- Recipient, Scholarship for bachelor's degree by Ministry of IT, **Pakistan** 2009 — 2013

Academic Activities

- IEEE Senior Member 2023 — Present
- Session Chair 19th International Conference on Signal Processing & Multimedia Applications, Lisbon, Portugal 2022
- Reviewer IEEE Transactions on Circuits and Systems for Video Technology 2023 — Present
- Reviewer Transactions on Cloud Computing 2023 — Present
- Reviewer Journal of Information and Telecommunication 2023 — Present
- Reviewer IEEE Transactions on Network Science and Engineering 2021 — Present
- Reviewer IEEE Journal of Biomedical and Health Informatics 2023 — Present
- Reviewer IEEE Access 2019 — Present
- Reviewer Springer Wireless Personal Communications 2017 — Present
- Reviewer IEEE International Conference on Multimedia and Expo, Brisbane, Australia 2023
- Reviewer IEEE International Conference on Communications ICC'23, Rome, Italy 2023
- Reviewer STI'22: 4th International Conference on Sustainable Technologies for Industry 4.0, Dhaka, Bangladesh 2022
- Reviewer INMIC'20: 23rd IEEE International Multi Topic Conference, Bahawalpur, Pakistan 2020
- Reviewer GCWOC'18: 3rd Global Conference on Wireless and Optical Communications, Malaga, Spain 2018