Anique Akhtar

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SUMMARY OF QUALIFICATIONS

- **Specialization**: Deep Learning, Machine Learning, Data Compression, Generative Modeling, Point Cloud Processing, 3D Point Cloud Compression (PCC), Dynamic Mesh Encoding, 3D and 2D Semantic Segmentation, Computer Vision, Wireless Networks (LTE & 5G), 3GPP RAN, mmWave Wireless Directional Communication, and IEEE 802.11.
- **Technical Skills**: C/C++, Python (PyTorch, Tensorflow, Keras, Caffee), Knet (Machine Learning library for Julia), R, Java, MATLAB®, LaTeX, VHDL, Assembly Language (MIPS), Django, HTML, CSS, and PHP.

CURRENT OCCUPATION
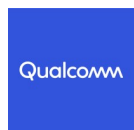
Qualcomm	San Diego, CA
Senior Engineer	*August 2022 - Present*

MPEG WG7 - Coding of 3D Graphics and Haptics: Involved in MPEG working Group 7 - MPEG coding of 3D Graphics and Haptics. MPEG-I: Video-based dynamic mesh coding (V-DMC). AI-based Point cloud compression (MPEG AI-PCC) schemes for sparse LiDAR-based point clouds as well as dense point clouds for AR/VR applications. Advancing work on both traditional as well as AI-based compression schemes for 3D data including geometry as well as attributes.

EDUCATION

Ph.D. Computer and Electrical Engineering	Aug. 2016 - July 2022
- *University of Missouri-KC* (Jan. 2018 - July 2022)	*Kansas City, MO*
University of South Florida (Aug. 2016 - Dec 2017)	*Tampa, FL*
M.Sc. Electrical Engineering	Sep. 2013 - July. 2015
Koc University	*Istanbul, Turkey*
B.Sc. Electrical Engineering	Sep. 2008 - July. 2013
Lahore University of Management Sciences (LUMS)	*Lahore, Pakistan*
Erasmus Mundus Exchange Program in Electrical Engineering	Sep. 2011 - July. 2012
Politecnico de Torino	*Turin, Italy*

PAST EXPERIENCE

Qualcomm	San Diego, CA
Internship	*January. 2022 - May 2022*

- **Dynamic Point Cloud Compression**: Deep learning solution for inter-frame compression of high-resolution point clouds employing P-frame prediction and B-Frame prediction. Proposals submitted to MPEG PCC standard in inter-frame point cloud compression.
- **Dynamic Point Cloud Interpolation**: A first deep learning-based point cloud interpolation framework for photorealistic dynamic point clouds. Given two consecutive dynamic point cloud frames, the framework aims to generate intermediate frame(s) between them.
- **Point Cloud Upsampling**: A sparse convolution-based point cloud upsampling solution that works on synthetic mesh-based datasets, sparse LiDAR-based point clouds, as well as dense high-resolution photo-realistic point clouds. (Project Page)

Tencent	Palo Alto, CA
Summer Internship	*June. 2020 - Aug. 2020*

- **Point Cloud Compression**: Deep learning solution for intra-based compression of high-resolution point clouds.
- **Video-based Point Cloud Compression (V-PCC) Artifact Removal**: Deep learning solution for Video-based Point Cloud Compression (V-PCC) artifacts removal that arises due to quantization. We exploit the prior knowledge of the direction of quantization noise in V-PCC to learn both the direction as well as level of quantization noise by limiting the degree of freedom of the learned noise.

- ○ **Point Cloud Geometry Prediction**: We propose a deep learning solution for point cloud geometry prediction scheme to upsample a lower Level-of-Detail (LoD) point cloud into a higher LoD point cloud. We employ an octree-type upsampling solution to predict geometry across spatial scale.

- **HERE Technologies** — Berkeley, CA
  - *Summer Internship* — *June 2018 - Aug. 2018*
  - *Extended Internship* — *June 2019 - Dec. 2019*
    - ○ **3D Semantic Segmentation**: Summer internship work at HERE technologies on 3D semantic segmentation for large-scale outdoor LiDAR point cloud data. The goal was to accurately annotate a large amount of point cloud data in an automated manner. We created a scalable 3D semantic segmentation technique that processed millions of points per point cloud obtaining exceptional segmentation results. We leveraged the fact that our deep 3D segmentation model results were better than the ground truth to improve the annotation technique for 3D semantic segmentation.
    - ○ **2D Facade Segmentation and Portal Detection**: Performed 2D building facade segmentation to measure the location of windows and portals for large-scale labeling of buildings in 3D maps.
    - ○ **2D Building Tracking, Segmentation, and Instance Segmentation**: Implemented a deep learning-based 2D building segmentation model and used it to clean street-level imagery (SLI). Performed multi-frame building tracking and instant level segmentation on the cleaned SLIs. A network similar to DeepLab was used for segmentation and Mask-RCNN implementation was used for instant-based segmentation.

- **University of Missouri-KC** — Kansas City, MO
  - *Research Assistant* — *Jan. 2018 - Present*
    - ○ **Point Cloud Compression**: Proposed a deep learning-based inter-frame as well as intra-frame point cloud compression scheme for dynamic point clouds. Proposed deep learning solutions for dynamic point clouds for I, P, and B frame encoding.
    - ○ **Deep Learning Solutions for Point Cloud Processing**: In collaboration with Dr. Zhu Li on deep learning solutions for point cloud processing problems such as: Segmentation, Upsampling, Denoising, Compression, etc.
    - ○ **Low Latency Point Cloud Communication for Autonomous Driving**: In collaboration with Dr. Zhu Li on low latency point cloud communication. We proposed an error-resilient and scalable point cloud source coding that is layered for different quality of service requirements. We provide joint source-channel coding for robustness to different channel conditions while providing low latency adaptive random network coding for V2V as well as V2I communication.

- **University of South Florida** — Tampa, FL
  - *Research Assistant* — *Sep. 2016 - Dec. 2017*
    - ○ **5G and Beyond**: In collaboration with Dr. Huseyin Arslan in Wireless Communications & Signal Processing Group. Contributed to the field of OFDM, Waveform design, Flexible PHY layer for next-generation cellular networks, 3GPP RAN, Resource Allocation, and Packet Scheduling in Multi-Numerology 5G networks.
    - ○ **Machine Learning in Wireless Communication and Network Science**: Collaborated with Dr. Kwang-Cheng Chen on wireless network parameter estimation and channel estimation using Support Vector Machines, Hidden Markov Models, Expectation Maximization and Gaussian-Mixture Bayesian Learning.
    - ○ **Market Trend Prediction for Cryptocurrency using Machine Learning**: In collaboration with Dr. Yasin Yilmaz. We employed Random Forest, Naive-Bayes, Artificial Neural Network, Extreme Learning Machine techniques among others to predict the future stock price of different cryptocurrencies including bitcoin.

- **Koc University** — Istanbul, Turkey
  - *Research Assistant* — *Sep. 2013 - Aug. 2016*
    - ○ **mmWave technology in Next Generation WiFi Networks**: In collaboration with Dr. S. Coleri Ergen on different projects and publications in mmWave communication. The work was done on directional MAC protocols, Beamforming, Wireless Sensor Networks, and Directional communication.

PUBLICATIONS

- **A. Akhtar**, Z. Li, and G. Van der Auwera, "Inter-Frame Compression for Dynamic Point Cloud Geometry Coding"
  IEEE Transactions on Image Processing (TIP). vol. 33, pp. 584-594, 2024.

- **A. Akhtar**, Z. Li, G. Van der Auwera, L. Li, and J. Chen, "PU-Dense: Sparse Tensor-based Point Cloud Geometry Upsampling" ([Project Page](#))
  IEEE Transactions on Image Processing (TIP). vol. 31, pp. 4133-4148, 2022

- **A. Akhtar**, Z. Li, G. Van der Auwera, and J. Chen, "Dynamic Point Cloud Interpolation"
  IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP). 2022.

- **A. Akhtar**, W. Gao, L. Li, Z. Li, W. Jia, and S. Liu, "Video-based Point Cloud Compression Artifact Removal"
  IEEE Transactions on Multimedia (T-MM), 2021.

- W. Jia, L. Li, **A. Akhtar**, Z. Li, and S. Liu, "Convolutional Neural Network-based Occupancy Map Accuracy Improvement for Video-based Point Cloud Compression"
  IEEE Transactions on Multimedia (T-MM), 2021.

- **A. Akhtar**, W. Gao, L. Li, Z. Li, X. Zhang, and S. Liu, "Point Cloud Geometry Prediction Across Spatial Scale using Deep Learning"
  IEEE Visual Communication & Image Processing Conf (VCIP), Hong Kong, 2020.

- **A. Akhtar**, B. Kathariya, Z. Li, "Low Latency Scalable Point Cloud Communication"
  IEEE International Conference on Image Processing (ICIP), Taipei, Taiwan. 2019.

- **A. Akhtar**, J. Ma, R. Shafin, J. Bai, L. Li, Z. Li, L. Liu, "Low Latency Scalable Point Cloud Communication in VANETs using V2I Communication"
  IEEE International Conference on Communications (ICC), Shanghai, China. 2019.

- **A. Akhtar**, H. Arslan, "Downlink Resource Allocation and Packet Scheduling in Multi-Numerology Wireless Systems"
  IEEE Wireless Communications and Networking Conference (IEEE WCNC), 2018.

- **A. Akhtar**, S. Coleri Ergen, "Directional MAC Protocol for IEEE 802.11ad WLANs"
  Ad-Hoc Networks, 2018.

- **A. Akhtar**, S. Coleri Ergen, "Efficient Network Level Beamforming Training for IEEE 802.11ad WLANs"
  International Symposium on Performance Evaluation of Computer and Telecommunication Systems (SPECTS 2015) in Chicago, Illinois, US. July 2015.

- N. Akhtar, **A. Akhtar**, "Approach for the formal modeling of requirements, verification, and architecture of a multi-agent robotic system"
  International Journal of Computer Science, 2014.

PATENTS - ONLY PUBLICLY PUBLISHED ONES

- **A. Akhtar**, W. Gao, X. Zhang, and S. Liu, Tencent America LLC, 2024. *Point cloud geometry upsampling.* U.S. Patent 11,893,691.

- **A. Akhtar**, G. Van der Auwera, A.K. Ramasubramonian, M. Karczewicz and L.P. Van, Qualcomm Inc, 2023. *Geometry coordinate scaling for AI-based dynamic point cloud coding.* U.S. Patent Application 18/318,498.

MPEG CONTRIBUTIONS AS MAIN AUTHOR

- **Anique Akhtar**, Geert Van der Auwera, Reetu Hooda, Adarsh Krishnan Ramasubramonian, Marta Karczewicz, "[V-DMC][New] Implementation of Normal Encoding in V-DMC TMM v6.0 ", MPEG-145 Online, Doc. m66553, Jan 2024.

- **Anique Akhtar**, Geert Van der Auwera, Reetu Hooda, Adarsh Krishnan Ramasubramonian, Marta Karczewicz, "[V-DMC][New] On Basemesh", MPEG-144 Hannover, Doc. m65333, Oct 2023.

- **Anique Akhtar**, Geert Van der Auwera, Adarsh Krishnan Ramasubramonian, Marta Karczewicz, "[AI-3DGC][EE 5.5 related] Software release for Hybrid AI-based Geometry + G-PCC Attribute Coding", MPEG-143 Geneva, Doc. m64441, July 2023.]

- **Anique Akhtar**, Geert Van der Auwera, Birendra Kathariya, Adarsh Krishnan Ramasubramonian, Marta Karczewicz, "[AI-3DGC][EE5.3-related] Update on baseline attribute compression for ML-based PCC", MPEG-142 Antalya, Doc. m63255, April 2023.

- **Anique Akhtar**, Geert Van der Auwera, Birendra Kathariya, Adarsh Krishnan Ramasubramonian, Marta Karczewicz, "[AI-3DGC][EE5.3-related] Baseline attribute compression for ML-based PCC", MPEG-140 Mainz, Doc. m61313, Oct 2022.

- **Anique Akhtar**, Geert Van der Auwera, Adarsh Krishnan Ramasubramonian, Marta Karczewicz, "[AI-3DGC][EE5.3 Test 2] Results dynamic point cloud compression", MPEG-140 Mainz, Doc. m61201, Oct 2022.

- **Anique Akhtar**, Zhu Li, Geert Van der Auwera, Adarsh Krishnan Ramasubramonian, Luong Pham Van, Marta Karczewicz, "Dynamic Point Cloud Geometry Compression using Sparse Convolutions", MPEG-137 Online, Doc. m59617, April 2022.

Recent Awards

- Recognized as an IP Contributor for **Qualcomm Inc**. 2023

- Recipient of the Annual School of Science and Engineering award for **Outstanding Doctoral Student in Electrical and Computer Engineering** for the academic year 2021-22.