Anique Akhtar

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Summary of Qualifications

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

Education

- **Ph.D. Computer and Electrical Engineering** — Aug. 2016 - present
  University of Missouri-KC (Jan. 2018 - present) — *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*

Experience

- **Qualcomm** — San Diego, CA
  Internship — *January. 2022 - Present*
  - **Dynamic Point Cloud Compression**: Deep learning solution for inter-frame compression of high resolution point clouds employing P-Frame prediction and B-Frame prediction. Invited by MPEG as a point cloud compression expert to present my work. Submitted an MPEG PCC standard proposal 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 dataset, 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 arise 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 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 labelling 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**: Working 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**: Working 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**: Worked with Dr. Huseyin Arslan in Wireless Communications & Signal Processing Group. Worked on 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**: Worked 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**: Worked 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**: Worked under 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"
  Under review in a Conference. 2022

- **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). 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

- **A. Akhtar**, W. Gao, X. Zhang, and S. Liu, TENCENT AMERICA LLC, 2022. POINT CLOUD GEOMETRY UPSAMPLING. U.S. Patent Application 17/345,063.

MPEG Contributions

- **m59617**. "[AI-3DGC] Dynamic Point Cloud Geometry Compression using Sparse Convolutions"
  Anique Akhtar, Zhu Li (UMKC), Geert Van der Auwera, Adarsh Krishnan Ramasubramonian, Luong Pham Van, Marta Karczewicz (Qualcomm)