Zhaobin Zhang

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Summary of Qualifications

- **Specification**: Machine learning, Video coding, Image compression, Visual retrieval and recognition.
- **Technical Skills**: Python (PyTorch, TensorFlow and Caffe), MATLAB, C/C++.

Education

- **Ph.D. Computer and Electrical Engineering** — Aug. 2016 – present (expected graduation May 2020)
  University of Missouri – Kansas City — *Kansas City, MO*
- **M.E. of Electronic and Mechanical Engineering** — Sep. 2012 – Jun. 2015
  Huazhong University of Science and Technology — *Wuhan, China*
- **B.S. of Mechanical Engineering** — Sep. 2008 – Jun. 2012
  Huazhong University of Science and Technology — *Wuhan, China*

Experience

- **Tencent America** — Palo Alto, CA
  Summer Internship — *May 2019 - Aug 2019 AND May 2018 - Aug 2018*
  - **Deep Video Coding with Motion Estimation**: This project is developed on top of DVC, aims at devising an end-to-end video compression framework with motion estimation. The project is still under development.
  - **Performance Comparison and Analysis of Learning Based Image Compression with State-of-the-art MPEG Codecs**: Lack of common test condition makes it difficult to evaluate learning-based compression (LBC) methods, which have attracted quite some attention. Kodak dataset and VVC test sequences are used to compare HEVC, VVC intra coding and the latest LBC methods. LBC methods achieve comparable performance on Kodak dataset, but perform inferiorly on VVC test sequences. Therefore, establishing CTC is important to better facilitate research in LBC area. Run-time complexity is another issue to be resolved for real-world deployment and applications.
  - **Fast AMT for next-generation video coding standard VVC**: This project aims at developing a fast primary transform algorithm for the state-of-the-art video coding codec Versatile Video Coding (VVC) under studying by JVET and MPEG. A fast DST-VII/DCT-VIII algorithm based on partial butterfly with dual implementation is developed which achieves reduced operation counts and run-time cost, yet still maintains comparable coding performance. The experiments show that, the proposed method, comparing with state-of-the-art codec, can provide 7%, 5% and 8% average decoding time savings under AI, RA and LDB VVC common test condition. The proposed scheme was adopted in the 13th MPEG VVC meeting at Marrakesh, Morocco (Jan 2019).
- **University of Missouri-KC** — Kansas City, MO
  Research Assistant supervised by Dr. Zhu Li — *Aug. 2016 - present*
  - **Deep End-to-End Video Coding with Motion Estimation**: This project aims at devising an end-to-end video coding framework with motion estimation supported. The framework is based on the latest end-to-end video coding framework DVC and uses optical flow as motion information. The project is still under development.
  - **Accelerating Deep Neural Networks Training with Graph Embedding**: In this project, we develop a neural network training acceleration scheme by introducing graph analytics tools. Firstly, a geometry-aware tree is developed to split the training set into clusters by taking the geometry structure into account. Secondly, graph analysis is performed on each cluster and achieve the graph degree. In order to exploit the useful information in the graph signal, a fusion block is devised to combine the graph degree and the training loss to derive the sampling probability. Overall, 19%-44% training time savings have been achieved on CIFAR with comparable or even better top-1 test accuracy. On large-scale dataset ImageNet-2012, 0.89% top-1 test accuracy improvement has been observed with a faster convergence rate.
  - **Convolutional Neural Networks for Image Coding**: This is a deep learning-based method for image coding intra prediction. Combining intra block copy (IBC) prediction and neighboring pixels, fully-connected layers and convolutional networks are utilized to further exploit the correlation of reference pixels and IBC prediction, respectively. 1.3% BD-Rate savings have been achieved compared with HEVC reference software HM-16.9.

- **Mobile Visual Retrieval with Grassmann Manifold Embedding**: With the explosive growth of query-by-capture applications, this project aims at devising a compact visual query representation in the context of image retrieval. A non-linear data partition architecture to divide a large-scale dataset to small clusters at different scales. A graph-based transform is achieved for each cluster resulting in multiple transforms at different scales. A novel pruning strategy is devised to search for the optimal transforms. Experiments including pairwise matching and image retrieval on CDVS demonstrate the effectiveness.
- **Point Cloud Attribute Compression using Optimized Graph Transform**: An optimized scheme based of graph transform for point cloud attribute compression is developed. We investigate the parameters affecting the affinity in a graph learning context. A Lagrangian rate-distortion optimization is devised to select the optimal quantization mode.
- **Point Cloud Distortion Metric**: Proposed a curvature-based point cloud distortion metric method. Distortion error has been reduced 45% on the average w.r.t. point-to-point method.

Publications

***Z. Zhang**, X. Zhao, X. Li, L. Li, Y. Luo, S. Liu and Z. Li*, "Fast DST-7/DCT-8 with Dual Implementation Support for Versatile Video Coding", IEEE Transactions on Circuits and Systems for Video Technology (TCSVT), Feb 2020.

***Z. Zhang**, Y. Li, L. Li, Z. Li and S. Liu*, "Multiple Linear Regression for High Efficiency Video Intra Coding", IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), May 2019.

***Z. Zhang**, X. Zhao, X. Li, Z. Li and S. Liu*, "Fast Adaptive Multiple Transform for Versatile Video Coding", IEEE 2019 Data Compression Conference (DCC), Mar. 2019.

***Z. Zhang**, L. Li, Z. Li and H. Li*, "Mobile Visual Search Compression with Grassmann Manifold Embedding", IEEE Transactions on Circuits and Systems for Video Technology (TCSVT), Dec 2018.

***Z. Zhang**, Y. Li, L. Li, L. Zhu, S. Liu*, "Combining Intra Block Copy and Neighboring Samples Using Convolutional Neural Network for Image Coding", IEEE International Conference on Visual Communications and Image Processing (VCIP), Dec 2018.

***Z. Zhang**, X. Zhao, X. Li, and S. Liu*, "CE6-related: Fast DST-7/DCT-8 with dual implementation support", Joint Video Experts Team (JVET) of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11, vol. JVET-K0291, no. Ljubljana, SI, pp. 10-18, Jul 2018.

*Y. Ting, **Z. Zhang**, Z. Li, K. Fan and G. Li*, "Attribute Compression of 3D Point Clouds using Laplacian Sparsity Optimized Graph Transform", IEEE Visual Communications and Image Processing (VCIP), Dec. 2017.

*B. Cheng, Z. Wang, **Z. Zhang**, Z. Li, D. Liu, J. Yang, S. Huang and T.S. Huang*, "Robust Emotion Recognition from Low Quality and Low Bit Rate Video: A Deep Learning Approach", 7th International Conference on Affective Computing and Intelligent Interaction (ACII), Oct. 2017.

***Z. Zhang**, L. Li, Z. Li, H. Li*, Visual Query Compression with Locality Preserving Projection on Grassmamm Manifold, IEEE International Conference on Image Processing (ICIP), Sep 2017.

***Z. Zhang**, L. Li, Z. Li*, Visual Query Compression with Embedded Transforms on Grassmann Manifold, IEEE International Conference on Multimedia and Expo (ICME) Workshop, Jul 2017.

Awards

Most Productive Award of MCC Lab	2018-2019
SGS Research Grant of UMKC	2018-2019
UMKC Ph.D. Fellowship	2018-2019
M.E. Merit Graduate	2015
B.S. Merit Graduate	2012
Samsung Scholarship	2010

Relevant Coursework

- **Machine Learning**: Artificial Neural & Adaptive Systems, Artificial Intelligence, Convolutional Neural Networks for Visual Recognition
- **Multimedia**: Image Analysis and Retrieval, Advanced Multimedia Communication, Digital Signal Processing
- **Data Science**: Knowledge Discovery and Management, Big Data Analytics & Applications

Self Evaluation

- Initiative, self-motivating and have a strong desire to do cutting edge research and publish.
- Team players who are flexible and open for new ideas.