UNIVERSITY OF CENTRAL FLORIDA

CENTER FOR RESEARCH IN COMPUTER VISION

Dr. Ajmal Mian

The University of Western Australia

"Efficient graph convolution with spherical kernel for semantic segmentation of 3D point clouds "

Monday, January 27, 2020 · 2:00PM · HEC 101



ABSTRACT

Convolutional Neural Networks (CNN) use rectangular kernels to learn features from data that follow grid like structures such as images. However, 3D point clouds from LiDARs are unstructured. We propose a spherical kernel to directly learn from unstructured point clouds. Our kernel systematically quantizes the local 3D space to identify distinctive geometric relationships in the data. Similar to regular CNN kernels, the spherical kernel maintains translation-invariance and asymmetry properties, where the former guarantees weight sharing among similar local structures and the latter facilitates fine geometric learning. The proposed kernel is combined with octree guided neural networks as well as graph neural networks without edge-dependent filter generation, making it computationally attractive for large point clouds. Inspired from fuzzy clustering, we further extend our spherical kernel to use fuzzy bins to overcome boundary effects and variations in point sampling. We also extend the network architecture to a more efficient graph convolutional network that exploits ResNet like blocks and separable convolutions in the encoder and 1x1 convolutions in the decoder. This network can segment over one million points per second with competitive performance on benchmark datasets such as S3DIS, ModelNet, ShapeNet, ScanNet, and RueMonge2014.

BIOGRAPHY

Ajmal Mian is a Professor of CS at The University of Western Australia. He has received two prestigious fellowships and several research grants from the Australian Research Council and the National Health & Medical Research Council of Australia. He was the West Australian Early Career Scientist of the Year 2012 and has received several awards including the Excellence in Research Supervision Award, EH Thompson Award, ASPIRE Professional Development Award, Vice-chancellors Mid-career Research Award, Outstanding Young Investigator Award, and the Australasian Distinguished Doctoral Dissertation Award. He is an Associate Editor of IEEE Trans on Neural Networks & Learning Systems, IEEE Trans on Image Processing and the Pattern Recognition journal. He was a General Chair of the Int Conf on Digital Image Computing Techniques & Applications (DICTA) 2019, General Chair of the Asian Conference on Computer Vision 2018, Program Chair of DICTA 2012 and Area Chair of WACV 2019, WACV 2018, ICPR 2016, ACCV 2014. Ajmal Mian has supervised 15 PhD students to completion and has published over 180 scientific papers. His research interests are in computer vision, machine learning, 3D point cloud analysis, facial recognition, human action recognition and video analysis.