Data Science Seminar Series
Thursday, February 10th, 1:30-2:30 pm, S337

TITLE
Detection of Alzheimer's Disease Using Graph-Regularized Convolutional Neural Network Based on Structural Similarity Learning of Brain Magnetic Resonance Images

SPEAKER
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ABSTRACT
Objective: This paper presents an Alzheimer's disease (AD) detection method based on learning structural similarity between Magnetic Resonance Images (MRIs) and representing this similarity as a graph. Methods: We construct the similarity graph using embedded features of the input image (i.e., Non-Demented (ND), Very Mild Demented (VMD), Mild Demented (MD), and Moderated Demented (MDTD)). We experiment and compare different dimension-reduction and clustering algorithms to construct the best similarity graph to capture the similarity between the same class images using the cosine distance as a similarity measure. We utilize the similarity graph to present (sample) the training data to a convolutional neural network (CNN). We use the similarity graph as a regularizer in the loss function of a CNN model to minimize the distance between the input images and their k-nearest neighbours in the similarity graph while minimizing the categorical cross-entropy loss between the training image predictions and the actual image class labels. Results: We conduct extensive experiments with several pre-trained CNN models and compare the results to other recent methods. Conclusion: Our method achieves superior performance on the testing dataset (accuracy = 0.986, area under receiver operating characteristics curve = 0.998, F1 measure = 0.987). Significance: The classification results show an improvement in the prediction accuracy compared to the other methods.

BIOGRAPHY
Dr. Emad A. Mohammed received his B.Sc. degree in System and Biomedical Engineering – Cairo University, Egypt, in 1999, and his M.Sc. and Ph.D. degrees in Software Engineering – University of Calgary, Canada, in 2013 and 2016, respectively. He is an Assistant Teaching Professor with the Engineering Department, TRU and an adjunct assistant professor with the Department of Electrical and Computer Engineering, Schulich School of Engineering, University of Calgary. He is also a member of the professional engineers Ontario. His interest research fields are information representation, biomedical image analysis, data mining, data fusion, distributed software systems, machine learning, and big data analytics. He received multiple grants and awards including, the Lakehead University – NSERC Enhancement Grant, Lakehead University Teaching and Research Merit Award, NSERC-Alliance COVID-19 Grant, Alberta Innovates Technology Futures (AITF), W21C CRIO – Health Services Research Post-Doctoral Fellow Scholarship, IBM-University of Calgary Energy

Analytics competition, MITACS Accelerate, research productivity, and academic excellence awards.

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