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10th Annual Congress on MENTAL HEALTH

March 09, 2023 | Webinar

Dual feature extraction using hybridized exception and vgg model for diagnostic classification of Alzheimer's disease based on brain anatomical magnetic resonance imaging

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Human brain is an exclusive, sophisticated, and intricate structure. Mental health is essential throughout life, from childhood and adolescence to adulthood. Neurodegeneration, the death of neurons, causes brain atrophy and several neurodegenerative diseases. Alzheimer's dementia causes memory, language, and other cognitive declines. Early detection of brain atrophy and cognitive decline is extremely important. Neuro-imaging is the most critical method for the detection Alzheimer's and quantification of brain atrophy. Anatomical magnetic resonance imaging (MRI), are the widely used neuroimaging techniques to image/estimate altered brain tissue and to assess neurodegeneration associated with Alzheimer's. Traditionally, neuro-radiologists incorporate clinically useful information and medical imaging data from various sources to interrelate the structural changes, reduction in brain volume, or changes in patterns of brain activity. Recent developments in computer vision using Deep Learning (DL) have inspired a growing interest in computer-aided diagnostics. These approaches are powerful tools for predicting neurological and psychiatric disorder outcomes. This study presents a multiclass diagnostic approach for identifying Alzheimer's disease (AD), Mild Cognitive Impairment (MCI), and Control Normal (CN) by processing brain structural T1 and T2 weighted MRI scans taken from Alzheimer's disease Neuroimaging Initiative (ADNI) database. The study proposed and validated a novel hybrid transfer learning model named Dual Feature Extraction Using Hybridized Exception and VGG-16 Network (DFE-HEV) for the diagnostic prediction of AD and MCI. DFE-HEV performance was tested and compared with other hybrid models such as Xception-DenseNet and Xception-ResNet. The novel hybridized feature extraction method (DFE-HEV) achieves class-wise accuracy of 98.25% in AD, 98.31% in CN, and 99.05% in MCI. The recall precision and specificity of DFE-HEV are 97.81%, 97.14%, and 98.89 %, respectively. Based on the results, the study concludes that Xception and VGG-16 can extract features of high quality. Overall performance improved by 98.73%.

Biography

Yusera Farooq Khan received B.Tech degree in computer science and engineering from BGSB University, Jammu and Kashmir in 2012, and master degree in computer science and engineering from NIMS University, Rajasthan in 2014. She has cleared GATE from 2014 to 2018; she was an assistant professor at BGSB University, Jammu, and Kashmir, India. She has 04 years of teaching and research experience. Her areas of interest are machine learning, deep learning, transfer learning, neuro image analysis, and computer vision, natural language processing.