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An Effective Diagnosis of Alzheimer's Disease with the Use of Deep Learning based CNN Model

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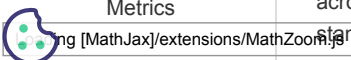
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Abstract:
In recent years, Alzheimer's disease has become a major health concern. Over 45 million individuals worldwide suffer from this illness. Alzheimer's disease is a neurodegenerative illness of unidentified etiology and process that causes cognitive deterioration, and it mostly affects the elderly. Dementia, the gradual and irreversible loss of brain cells, is the leading cause of Alzheimer's disease. Those with this illness lost the ability to think, read, and do other basic tasks. A machine learning system may aid in this situation by making accurate predictions about the onset of illness. Dementia diagnosis in a broad patient population is the major objective. This research presents the findings and analysis of many Machine Learning models for identifying dementia. To alleviate this obstacle and help in the diagnosis of AD will create a deep-learning architecture that uses stacked auto-encoders and a softmax output layer. The proposed technique can analyze numerous classes in a single setting, unlike earlier procedures, and only needs a small number of labeled training samples and basic domain expertise to get started. In the present studies, a substantial improvement in performance when it came to classifying all diagnostic subgroups. Using the proposed technique can run these time series through a Convolutional Neural Network (CNN) and ResNet50 model to extract the distinguishing patterns across stages. With an F1-score of 0.99 and an accuracy of 99.91 percent, the CNN-based technique outperformed the standard feature-based classifiers by a significant margin.

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I. Introduction

Memory loss is the primary symptom of the mild cognitive impairment (MCI) phase of Alzheimer's disease (AD), which precedes the more severe Dementia stage [1]. As AD progresses, the MCI stage gives way to the more severe Dementia stage, and eventually full-blown Alzheimer's disease. Nevertheless, not all people diagnosed with MCI ultimately progress to AD [2]. Only a minority of those diagnosed with MCI progress to full-blown Alzheimer's disease dementia, and many more remain steady in the MCI stage without ever developing dementia [2]. Even though there is currently no treatment for Alzheimer's disease, it is still crucial to identify those in the MCI stage who will go on to progress AD. Concurrently, it would be perfect to accurately classify individuals in the MCI stage who do not progress to AD, sparing them from unnecessary pharmacologic therapies that may provide minimal benefit at best and potentially harmful side effects at worst. Therefore, much effort has been put into emerging early detection tools, mainly in pre-symptomatic phases, to lessen or stymie the progression of the illness. Magnetic Resonance Imaging (MRI) examples of Advanced neuroimaging methods have been utilized to locate anatomical and molecular indicators of Alzheimer's disease (AD) [3].

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