DEMENTIA SEVERITY CLASSIFICATION USING MACHINE LEARNING AND DEEP LEARNING

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ABSTRACT

According to statistics from the World Health Organization, dementia is one of the seven leading causes of death worldwide, and there is currently a lack of effective treatments. The transformation stage of dementia patients can be divided into three levels: cognitive normal (CN), mild cognitive impairment (MCI), and Alzheimer's disease (AD). If the accurate prediction of dementia patient levels and corresponding therapeutic interventions are implemented, further deterioration can be slowed down effectively. In the past, questionnaire surveys were primarily used to assess patients with dementia, but this was time-consuming. Research in recent years has shown that analysis using patients' MRI image markers, such as whole brain, hippocampus, and entorhinal cortex atrophy, has been proven to have diagnostic value. MRI images are usually 3D and most existing research methods use 2D images for layer-by-layer analysis, and the anatomical context information in the direction orthogonal to the 2D plane may be lost, preventing the classification accuracy from being improved. This study uses the 3D data of MRI images and AC-PC alignment correction to pre-process MRI image data, and then radiomic features, discretization, and principal component analysis are used for feature selection and optimization of 3D images. Next, machine learning and deep learning methods are used to perform classification training and prediction on MRI image data to determine whether the patient is one of three categories: normal cognition, mild cognitive impairment, or Alzheimer's disease. Experimental results show that the analysis results using support vector machine (SVM) have the best accuracy results among all methods. The results of this study show that using a combination of MRI images and machine learning can predict the severity of dementia more accurately than ever before, which will have a significant impact on slowing the progression of dementia and improving patients' quality of life.

Keywords: Dementia; Alzheimer's disease; MRI; Machine Learning; Deep learning