Chapter 6
Blockchain-Based Deep Learning Approach for Alzheimer's Disease Classification

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ABSTRACT

Blockchain is an emerging technology that is now being used to provide novel solutions in several industries, including healthcare. Deep learning (DL) algorithms have grown in popularity in medical image processing research. AD is diagnosed by magnetic resonance imaging (MRI) images. This study investigates the integration of blockchain technology with a DL model for Alzheimer's disease prediction (AD). This proposed model was used to classify 3182 images from the ADNI collection. The edge-based segmentation algorithm has overcome the segmentation problem. During the investigation's test stage, the DL-EfficientNetB0 model with blockchain earned the highest accuracy rate of 99.14%. The highest accuracy, sensitivity, and specificity scores were obtained utilizing the confusion matrix during the comparative assessment stage. According to the study's results, EfficientNetB0 with blockchain model surpassed all other trained models in classification rate. This study will aid clinical research into the early detection and prevention of AD by identifying the sickness before it occurs.

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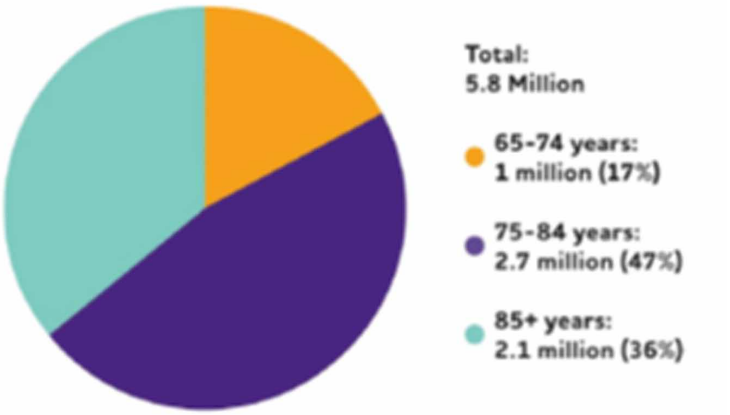
INTRODUCTION

AD is a kind of dementia that often affects the elderly and is characterized by gradual cognitive impairment and a deterioration in the brain's functioning skills. According to the 2016 World Alzheimer Report, around 46.8 million individuals have AD and dementias which is illustrated as Figure 1. It is anticipated that the incidence of Alzheimer's will double every 20 years and that by 2050, the global prevalence of Alzheimer's will reach around 131.5 million (Ding et al.,2019). Approximately 60% of the brain's total volume is contained within this area. Grey matter, situated deep inside the brain, performs this crucial processing. This structure consists of the dendrites and nuclei of neurons. It accounts for around 40% of the volume of the brain. The white and grey matter of the central nervous system and spinal cord are protected from mechanical shocks by cerebrospinal fluid. Different hormones released by the hypothalamus facilitate communication between white and grey matter in the central nervous system (Zhang et al.,2019). Artificial Intelligence (AI) encompasses a vast array of algorithms and methodologies, including genetic algorithms (Wang et al.,2019; Alberdi & Weakley, 2018; Li et al.,2019), neural networks (Pavisic et al.,2021), and evolutionary algorithms (López-De-Ipiña et al., 2020; Sapey-Triomphe et al., 2015; Tzimourta, n.d.; Afrantou et al., 2019).

Figure 1. People affected by AD according to age



The most obvious symptoms include ineffective communication, increased susceptibility to infection, poor judgment, poor sense of direction, short-term memory loss, and visual difficulties. Recent research indicates that approximately 50 million people worldwide have Alzheimer's (Krishna et al., 2019; Chandra et al., 2019; Ke et al., 2019; Zheng et al., 2019).

However, most existing DL methods train a deep convolutional neural network (CNN) model from scratch and suffer from limitations (Lian et al., 2020). First, it requires a substantial quantity of labeled training data, which may be difficult to acquire in the medical domain. Second, it requires enormous computational and memory resources; training a model would take longer without them. Thirdly, it requires careful optimization of network parameters via regularisation; failure to do so leads to overfitting