IEEE Access
Multidisciplinary ⋮ Rapid Review ⋮ Open Access Journal

Received February 3, 2020, accepted April 9, 2020, date of publication April 21, 2020, date of current version May 7, 2020.

Digital Object Identifier 10.1109/ACCESS.2020.2989396

Alzheimer's Diseases Detection by Using Deep Learning Algorithms: A Mini-Review

SUHAD AL-SHOUKRY[1,2], TAHA H. RASSEM[1], (Senior Member, IEEE), AND NASRIN M. MAKBOL[3]

[1]Faculty of Computing, College of Computing and Applied Sciences, Universiti Malaysia Pahang, Kuantan 26300, Malaysia
[2]Najaf Technical Institute, Al-Furat Al-Awsat Technical University, Najaf 54003, Iraq
[3]College of Computer Science and Engineering, Hodeidah University, Hodeidah, Yemen

Corresponding author: Taha H. Rassem (tahahussein@ump.edu.my)

This work was supported in part by the Ministry of Education under Grant FRGS/1/2018/ICT02/UMP/02/6 (RDU190173), and in part by the Universiti Malaysia Pahang under Grant RDU190333 and Grant RDU180365.

ABSTRACT The accurate diagnosis of Alzheimer's disease (AD) plays an important role in patient treatment, especially at the disease's early stages, because risk awareness allows the patients to undergo preventive measures even before the occurrence of irreversible brain damage. Although many recent studies have used computers to diagnose AD, most machine detection methods are limited by congenital observations. AD can be diagnosed-but not predicted-at its early stages, as prediction is only applicable before the disease manifests itself. Deep Learning (DL) has become a common technique for the early diagnosis of AD. Here, we briefly review some of the important literature on AD and explore how DL can help researchers diagnose the disease at its early stages.

INDEX TERMS Alzheimer's disease, deep learning, early stage detection and diagnosis.

I. INTRODUCTION

Translational applications of computational neuroscientific approaches have been proven exceptionally beneficial in comprehensive mental health trials [1]. This multidisciplinary field of study can help model the biological processes governing the healthy and diseased states of the human brain and map these processes into observable clinical presentations. In the past decade, the rapid increase in high-volume biomedical datasets (neuroimaging and related biological data), concurrent with the advances in machine learning (ML), has opened new avenues for the diagnosis and prognosis of neurodegenerative and neuropsychiatric disorders [2]. From a computational perspective, this recent advancement has spawned the development of tools that incorporate several patient-specific observations into predictions and improve the clinical outcomes of patients suffering from such disorders [3], [4]. The ultimate purpose of these neuroscientific approaches is to enhance the initial exposure and complete the treatment plan of individuals in high risk of Alzheimer's disease (AD) and AD-related cognitive decline [5], [6].

For the reasons mentioned above, recent studies have focused on establishing exceptionally capable approaches that use ML systems to enhance the examination of AD. The use of automatic systems capable of differentiating pathological cases from normal cases based on their magnetic resonance imaging (MRI) scans (i.e., no past hypotheses are needed) will contribute immensely to the initial diagnosis of AD [7].

In this study, we review relevant studies that examines AD and use MRI data, ML and Deep Learning (DL) techniques with various AD datasets.

The rest of the study is organised as follows. Section II presents a brief history of AD, such as the discovery of the disease and brain imaging techniques. Section III describes the movement from ML towards DL in the AD field. Sections IV and V present a review of AD modules and datasets, respectively. The conclusion is provided in section VI.

II. ALZHIEMER'S DISEASE STORY

The history of AD, as presented in this section, is consolidation of finding from AD publications searched in Google Scholar. Only the latest publications were considered, and only the papers published between 2008 and 2019 were

The associate editor coordinating the review of this manuscript and approving it for publication was Minho Jo.