

Chapter 10

The Use of AI and Structural Magnetic Resonance Imaging in the Diagnosis of Major Depressive Disorder

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ABSTRACT

Major depressive disorder (MDD) is one of the most frequent diseases in the mental and behavioral disorders group. Despite the fact that many diseases have been cured or eliminated as a consequence of technology and medical advances, the prevalence of major depressive disorder is quickly rising over the world. The structural brain abnormalities associated with severe depressive disorder have been widely studied using voxel-based morphometry. The MRICloud software has been used to process each subject's structural T1-weighted MRI scan. The classification model has been developed utilizing artificial intelligence (AI) algorithms to distinguish healthy and MDD patients. The study included 18 major depressive disorder patients and 19 healthy controls. Magnetic resonance imaging has been performed using 1.5 Tesla MR unit. As a result, MR images have been classified using AI algorithms to distinguish healthy and diagnosed with MDD patients.

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INTRODUCTION

One of the most common diseases in the field of mental and behavioral disorders is major depressive disorder (MDD). Despite the fact that many diseases have been cured or eradicated as a result of technology and medical advances, the prevalence of major depressive disorder is increasing globally. In 2004, unipolar depressive disorders were rated third in terms of illness burden by the World Health Organization (WHO). On the other hand, MDD is expected to become the most frequent mental illness by 2030. MDD affects roughly 350 million people worldwide and approximately 2 million people in Turkey.

MDD has a worldwide lifetime prevalence of 4-10 percent. In Turkey, the prevalence of MDD increased from 1.6 percent in 1998 to 1.9 percent in 2012 and 2.8 percent in 2014. Furthermore, it has been found that antidepressant use increased by approximately 162 percent in Turkey in 2013 (Aydın et al., 2013; Erol et al., 1998; WFMH, 2012; Moussavi et al., 2007; Savrun, 1999; Kessler et al., 2009; Iwata et al., 2002; Başara et al., 2013; Gutierrez-Rojas et al., 2020).

MDD is a mental disorder that can be diagnosed and treated in primary care. When left untreated, it can lead to suicide by causing recurrent and increasing disability, which continues with serious reductions in the individual's quality of life. Every year, an estimated 1 million people die by suicide as a result of MDD. Between 2015 and 2019, 16,355 people in Turkey died as a result of a suicide attempt, with MDD being the leading cause.

For these reasons, etiology, definitive diagnosis, treatment, and stopping MDD, which threatens public health, are among the most important issues. Many studies are being conducted to elucidate the pathophysiology of MDD. Although there are many different views on the etiology of MDD, its cause has not yet been fully elucidated. The biological formation mechanism of MDD has various opinions, such as the monoamine hypothesis, neuroplasticity hypothesis, glucocorticoid and neurotrophs hypothesis (Doğan, 1995; Balcıoğlu, 1999; Levine and Black, 2000; Bains and Abdijadid, 2022).

Pathological changes in certain structures in neuropsychiatric diseases such as Alzheimer's, schizophrenia, MDD and Parkinson's have become possible thanks to the use of modern brain imaging techniques such as magnetic resonance imaging (MRI) and computerized tomography (CT) in the non-invasive examination of brain structures. Even though MRI does not pose a radiation risk, it can be used safely in all age groups and during pregnancy, and because its contrast and imaging properties in soft tissues are better compared to other radiological imaging techniques, anatomical structures can be displayed in detail. Furthermore, it is used to explain the pathophysiology of neurodegenerative diseases, as well as to evaluate pre-diagnosis,

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