Health Tech Asmnt Act. 7(4).

Letter

Investigation of Artificial Intelligence in Alzheimer's Disease

Rashin Iman[1]*, Mohammadreza Mobinizadeh[2]

[1]Children's Medical Center, Tehran University of Medical Sciences, Tehran, Iran
[2]National Institute for Health Research, Tehran University of Medical Sciences, Tehran, Iran

*Corresponding Author: Children's Medical Center, Tehran University of Medical Sciences, Tehran, Iran. Email: rashineiman@yahoo.com

Received 2023 August 16; Accepted 2023 September 12.

While artificial intelligence in medical sciences is highly popular, its utilization in mental illnesses remains limited, focused on establishing connections, controlling patient behaviors, and managing emotions. As it's known, mental health varies widely from individual to individual, and artificial intelligence can offer diverse applications in this field. AI has the potential to redefine diagnostics and enhance our knowledge of diseases. The mental health is dependent on the psycho-biological and social background of the person. Understanding the interaction of these characteristics and identifying biomarkers in these patients can provide us a better comprehension of the diseases. This can also serve as a screening tool for their prognosis. It seems that more effort is required to explore and incorporate AI into the diagnosis and treatment processes for these patients.

The following are examples of the benefits of using artificial intelligence in the diagnosis of Alzheimer's disease:

In a systematic review conducted by Sarica et al., the random forest algorithm was employed to predict the risk of Alzheimer's disease in patients with mild cognitive impairment. In this study, the random forest algorithm, using multidimensional data, provided reliable predictions for the conversion of mild cognitive impairment to Alzheimer's disease in this group. Furthermore, it was successful in managing nonlinear data, processing multi-modal neuroimaging data, and controlling overfitting (1).

In a study by Sarhady and Shaygan, the diagnosis of Alzheimer's disease in patients with mild cognitive impairment was investigated using brain scans such as MRI. In this research, convolutional neural networks and active contours were employed to segment the hippocampus from other brain regions. The average accuracy, sensitivity, and specificity in diagnosing Alzheimer's patients compared to healthy individuals were 98.77%, 98.74%, and 97.96%, respectively. In the classification of mild cognitive impairment against healthy controls, the mean accuracy, sensitivity, and specificity were 96.14%, 96.23%, and 88.21%, respectively. Compared to the nearest rival method, the proposed approach demonstrated enhancements in both the accuracy (1.64%) and sensitivity (2.81%) for the classification of Alzheimer's Disease from normal controls. Moreover, in the classification of mild cognitive impairment from normal individuals, it exhibited an 8.9% increase in accuracy and a 2.16% increase in sensitivity. These improvements were attributed to several factors, including the utilization of a modified ACM segmentation algorithm, the use of a combination of features extracted from hippocampal images and features already created by the ImageNet network, the elimination of inappropriate features from the feature vector, and the use of the deep Inception v3 network (2).

Petti et al. conducted a systematic review focusing on diagnosing Alzheimer's disease based on verbal and language symptom. In this study, spontaneous speech data, including linguistic features, as well as word retrieval and semantic, syntactic, and acoustic impairments, were collected. These data were analyzed by using neural networks, support vector machines, and decision trees. This demonstrated the effectiveness of this approach in diagnosing Alzheimer's disease. The method achieved a good performance with an 89% accuracy in Alzheimer's disease diagnosis and an 82% accuracy in diagnosing mild cognitive impairment. This study highlighted the effectiveness of language and speech features in disease diagnosis (3).

A systematic review conducted by Lucia Billeci focused on investigating the use of Diffusion Tensor Imaging (DTI) technology for the diagnosis of Alzheimer's disease. The combination of a machine learning approach and using data obtained from DTI was found to be efficient in the early diagnosis of Alzheimer's disease and mild cognitive impairment and in distinguishing healthy

individuals. Its greatest advantage is the ability to diagnose Alzheimer's patients even before clinical symptoms appear, potentially making it a valuable tool in clinical settings. The capacity to provide early diagnosis for this disease is highly valuable and contributes to improving treatment effectiveness. This study acknowledged the efficacy of this technology (4).

In a systematic review by Pellegrini et al., the accuracy of machine learning methods in the differential diagnosis of Alzheimer's disease was examined. The studies included in the review demonstrated high accuracy in distinguishing Alzheimer's patients from healthy individuals. However, accuracy was lower in the diagnosis of patients with mild cognitive impairment and in predicting Alzheimer's disease in people with mild impairment to Alzheimer's disease. These studies utilized the Alzheimer's Neuroimaging Initiative (ADNI) database and support vector machines,relying only T1-weighted sequences images. This study revealed that machine learning methods were successful in Alzheimer's diagnosis. However, their performance was less effective in predicting the conversion to Alzheimer's disease in patients with mild cognitive impairment, indicating the need for further efforts in this area (5).

In conclusion, it appears that the use of artificial intelligence in the early diagnosis of Alzheimer's disease holds the potential for positive outcomes in the treatment process and will have a beneficial impact on therapeutic planning. However, further in-depth studies in this area are necessary to gain a more comprehensive understanding of its full potential and effectiveness.

References

1. Sarica A, Cerasa A, Quattrone A. Random Forest Algorithm for the Classification of Neuroimaging Data in Alzheimer's Disease: A Systematic Review. Front Aging Neurosci. 2017;9:329. [PubMed ID:29056906]. [PubMed Central ID:5635046]. https://doi.org/10.3389/fnagi.2017.00329.
2. Sarhady M, Shaygan MA. [The study of hippocampal atrophy to diagnose of Alzheimer's disease by using brain MRI images]. Pyavard Salamat. 2023;15(1):39-54. Persian.
3. Petti U, Baker S, Korhonen A. A systematic literature review of automatic Alzheimer's disease detection from speech and language. J Am Med Inform Assoc. 2020;27(11):1784-97. [PubMed ID:32929494]. [PubMed Central ID:7671617]. https://doi.org/10.1093/jamia/ocaa174.
4. Billeci L, Badolato A, Bachi L, Tonacci A. Machine Learning for the Classification of Alzheimer's Disease and Its Prodromal Stage Using Brain Diffusion Tensor Imaging Data: A Systematic Review. Processes. 2020;8(9):1071. https://doi.org/10.3390/pr8091071.
5. Pellegrini E, Ballerini L, Hernandez M, Chappell FM, Gonzalez-Castro V, Anblagan D, et al. Machine learning of neuroimaging for assisted diagnosis of cognitive impairment and dementia: A systematic review. Alzheimers Dement (Amst). 2018;10:519-35. [PubMed ID:30364671]. [PubMed Central ID:6197752]. https://doi.org/10.1016/j.dadm.2018.07.004.