Detection neurocognitive problems in fetal alcohol spectrum disorder using deep learning approach

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Objective

Ideally, screening instruments identify those who are in need of further testing and exclude those who do not need these resources. However, these diagnosis methods are time-consuming and can be misleading sometimes. Among these tools, Machine Learning (ML) can become one of the prime tools to improve FASD detection. Deep learning has become popular for its model estimation transparency and have been used to help diagnose diseases such as cancer and even FASD. DL is widely used in computational neuroscience, neuroimaging, data integration, medical imaging, diagnosis of neurological disorders for diseases such as Alzheimer's, Attention Deficit Hyperactivity Disorder (ADHD) and autism spectrum disorder (ASD), depression, tumor prediction. This study focuses on reviewing the use of deep learning to detect neurocognitive problems in fetal alcohol spectrum disorder.

Methods

This study is a systematic review study. In this study search was performed of the following databases: Google Scholar, PubMed, Cochrane Register of Controlled Trials, EMBASE, and MEDLINE. Relevant articles were reviewed. Key components were elicited: FASD, PEA, alcohol, deep learning, artificial intelligence, neurocognitive problems, Artificial Neural Networks (ANNs).

Results

There is currently an underestimation of people with FASD. This syndrome affects a significant percentage of the world population. However, it could be undiagnosed due to the clinical similarities with other neuro-development diseases. This issue is a critical factor for developing a new technique for FASD diagnosis. In recent decades, one of the most used techniques is artificial neural networks (ANN), since their learning is based on a set of connections, it is transparent to the user and the result has managed to solve complex problems in the medical field. ANN algorithms are used to determine FASD likelihood in children using numerical psychometric, DTI, and saccadic eye movement data on children/young people algorithms of ANN by using input data from a battery of psychometric tests assesses multiple domains of attention and executive functioning, memory and learning, sensorimotor functioning, social perception, language, and visual-spatial processing. researchers attempt to explore how accuracy is the use of ANN for the prediction of children with Fetal Alcohol Spectrum Disorder (FASD). Using machine learning approach, studies have reported the ANN model to predict children/adolescents with FASD with accuracy ranging from 75.5% in testing data. Principle of deep learning is mainly to use the deep neural network models to analyze and study the data and to improve the efficiency through feature extraction and feature classification so that more important application value can be reflected in the processing of medical images. DL algorithms successfully with more than 90% accuracy and sensitivity to help diagnose FASD. Also Reduce the number of false-positive findings on nervous system defects and neurodevelopmental disorder.

Conclusion

The deep learning approach is a competitive and efficient methodology to detect and differentiate the cognitive neurodevelopmental consequences of prenatal alcohol exposure.