Detecting Brain Activity in ADHD Children and Healthy Controls using Machine Learning Techniques

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This study investigates the brain activity of children diagnosed with Attention Deficit Hyperactivity Disorder (ADHD) compared to healthy children by analysing brain wave patterns through advanced Machine Learning (ML) techniques. ADHD is a neurobehavioral disorder that affects numerous children worldwide, leading to difficulties with attention, impulse control, and excess activity (Flisher & Hawkridge, 2013). Precise diagnosis is crucial for effective treatment, highlighting the importance of using technology alongside neuroscience insights (Sayal et al., 2018). The methodology of my study involved collecting brain wave data, known as Electroencephalogram (EEG) from 60 children, divided equally between those diagnosed with ADHD and healthy controls. I employed a machine learning model known as a Multi-Layer Perceptron (MLP), validated using techniques called Leave-One-Out Cross-Validation and K-fold, to ensure the reliability of the findings (Gramouseni et al., 2023). The model achieved an overall accuracy of 80% in distinguishing between ADHD and control groups, indicating significant potential for ML techniques in supporting the diagnostic processes of ADHD through EEG data. This study not only provides an objective way to analyse brain function but also emphasizes the need to combine this with observations of behaviour to fully understand ADHD. This research highlights the important role of the brain's frontal areas (front part of brain) in ADHD, consistent with previous studies that show unusual brain activity in affected individuals. However, the small number of participants and the need for comparison with other brain imaging techniques are limitations of this study. Future research should include more data and different imaging methods to improve the accuracy of ADHD diagnosis.

References

Flisher, A. J., & Hawkridge, S. (2013). Attention deficit hyperactivity disorder in children and adolescents. *South African Journal of Psychiatry*, *19*(3), 136–140. https://doi.org/10.4102/sajpsychiatry.v19i3.943

Gramouseni, F., Prapas, G., Bellos, C., Angelidis, P., Giannakeas, N., & Tsipouras, M. G. (2023). Exploring Ensemble Machine Learning Models for Attention and Memory Assesment. *2023 46th International Conference on Telecommunications and Signal Processing (TSP)*, 280–283. https://doi.org/10.1109/TSP59544.2023.10197698

Sayal, K., Prasad, V., Daley, D., Ford, T., & Coghill, D. (2018). ADHD in children and young people: prevalence, care pathways, and service provision. *The Lancet Psychiatry*, *5*(2), 175–186. https://doi.org/10.1016/S2215-0366(17)30167-0