

ABSTRAK

Attention Deficit Hyperactivity Disorder (ADHD) merupakan gangguan perkembangan saraf yang ditandai dengan inatensi, hiperaktivitas, dan impulsivitas. Diagnosis klinis ADHD masih bergantung pada observasi perilaku, sehingga diperlukan pendekatan objektif berbasis *neuroimaging*. Penelitian ini memanfaatkan citra *Structural Magnetic Resonance Imaging* (sMRI) untuk klasifikasi ADHD menggunakan dataset ADHD-200 dari *International Neuroimaging Data-sharing Initiative* (INDI) dengan dua kelas, yaitu *Typically Developing Children* (TDC) dan ADHD. Untuk mengatasi keterbatasan model *baseline 3D Convolutional Neural Network* (CNN) dalam menangkap informasi spasial yang luas, penelitian ini mengusulkan penambahan *Dilated Convolution* dan *Convolutional Block Attention Module* (CBAM). Evaluasi dilakukan menggunakan *k-fold cross-validation* dengan metrik *accuracy*, *precision*, *recall*, dan *F1-score*. Hasil pengujian menunjukkan bahwa performa terbaik diperoleh pada *learning rate* 0.00001. Model *baseline 3D CNN* mencapai nilai rata-rata *accuracy* dan *recall* sebesar 71%, serta *precision* dan *F1-score* sebesar 70%. Penambahan *Dilated Convolution* meningkatkan performa menjadi 72% pada *accuracy* dan *recall*, serta 71% pada *precision* dan *F1-score*. Selanjutnya, integrasi CBAM memberikan peningkatan lebih lanjut dengan nilai rata-rata *accuracy* dan *recall* sebesar 73%, serta *precision* dan *F1-score* sebesar 72%. Hasil ini menunjukkan bahwa kombinasi 3D CNN, *Dilated Convolution*, dan CBAM efektif dan stabil dalam meningkatkan performa klasifikasi citra sMRI untuk membedakan kelas ADHD dan TDC.

Kata Kunci: ADHD, 3D *Convolutional Neural Network* (CNN), *Dilated Convolution*, *Convolutional Block Attention Module* (CBAM), *deep learning*.

ABSTRACT

Attention Deficit Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder characterized by inattention, hyperactivity, and impulsivity. Clinical diagnosis of ADHD still relies primarily on behavioral observation, creating a need for objective neuroimaging-based approaches. This study employs Structural Magnetic Resonance Imaging (sMRI) to classify ADHD using the ADHD-200 dataset from the International Neuroimaging Data-sharing Initiative (INDI), consisting of Typically Developing Children (TDC) and ADHD classes. To overcome the limited spatial representation of a baseline 3D Convolutional Neural Network (CNN), Dilated Convolution and the Convolutional Block Attention Module (CBAM) are incorporated into the model architecture. Model evaluation is performed using k-fold cross-validation with accuracy, precision, recall, and F1-score as performance metrics. Experimental results show that the optimal performance is achieved at a learning rate of 0.00001. The baseline 3D CNN achieves an average accuracy and recall of 71%, with precision and F1-score of 70%. The integration of Dilated Convolution improves performance to 72% in accuracy and recall and 71% in precision and F1-score. Further performance gains are obtained by incorporating CBAM, resulting in an average accuracy and recall of 73% and precision and F1-score of 72%. These findings demonstrate that the proposed model effectively enhances sMRI-based ADHD classification.

Keywords: ADHD, 3D Convolutional Neural Network (CNN), Dilated Convolution, Convolutional Block Attention Module (CBAM), deep learning.