A Comparison of Machine Learning Models (CNN and SVM) in the Novel Supervised Image Classification Approach for the Accessible Diagnosis of Alzheimer's Disease via Clock Drawing Tests on Mobile Phone Applications

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Elderly populations are at an increasing risk of dementia, and accessibility to status-quo diagnosis tools is a significant issue, as proposed by the substantial rates of undiagnosed cases. This study aimed to compare the performance of two supervised machine learning models, Convolutional Neural Networks (CNN) and Support Vector Machine (SVM) algorithms, in the supervised image classification of Clock Drawing Tests (CDTs) for the diagnosis of dementia. The study used a 40,000-image dataset containing labelled CDTs, ranked by qualified clinicians from 0-5, where 0 reflects severe cognitive decline and high likelihood of dementia, and 5 reflects a healthy brain. Rigorous image preprocessing was performed to clean and extract key features of images before designing and training a CNN and SVM model of classification. The performance and suitability of these models for implementation into a widely-accessible mobile application were assessed on three factors: accuracy of classification, sample complexity, and computational complexity. These performance indicators were evaluated by inputting rounds of unseen data into the two models. Results showed that the constructed CNN (89.7% Accuracy) outperformed the constructed SVM (82.1% Accuracy) in accuracy of classification and sample complexity, whilst SVMs outperformed CNNs in computational complexity. Considering the importance of accuracy in detecting dementia, the study concluded that CNNs are a more suitable and high-performance model for this application. Finally, the results of this study showed how the combination of machine learning and CDTs can be effectively used to develop a widely-accessible dementia diagnosis mobile-application fit for clinical pre-screening, aged-care homes and self-testing.

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