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A Multi-Model Approach for Classifying Sleep Disorders Utilizing Machine Learning and Deep Learning Techniques

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Abstract: In this research, various models, including both ma- chine learning and deep learning techniques, have been used to find a more efficient method to diagnose sleeping disorders based on the different parameters of an individual. As machine learning models, Random Forest and Gaussian Na¨ıve Bayes and for Deep Learning model 1D CNN is utilized to extract intricate patterns from sleep data, to improve classification accuracy. In addition, we have developed a hybrid model combining 1D CNN with Bidirectional LSTM that leverages the strength of both models. The models classify sleep disorders into three distinct categories: No Disorder, Insomnia, and Sleep Apnea. This three- class classification allows for a more detailed understanding of an individual's sleep patterns and provides a premise for early detection and treatment. The machine learning models, Random Forest demonstrated an accuracy of 88% and Gaussian Naive Bayes showed an accuracy of 72%, whereas the deep learning models 1D CNN and our hybrid model shows an accuracy of 90.67% and 92%, respectively. The hybrid model shows more accuracy than individual models, indicating the effectiveness of collaborative techniques in diagnosing sleep disorders. Temporal relationships are difficult for Random Forest and Gaussian Naive Bayes to capture, while CNN models may miss significant spatial features in sequential sleep data. Our method combines the best features of 1D CNN and Bi-LSTM to create a complete framework resulting in improved diagnosis of sleep disorders. To improve health outcomes for those dealing with sleep-related issues, our research highlights the possibility of early identifica- tion and intervention utilizing these models.