

KLASIFIKASI OTAK MANUSIA DALAM KEADAAN RELAX MENGUNAKAN METODE SUPERVISED LEARNING

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ABSTRAK

Aktivitas otak manusia mengalami perubahan seiring bertambahnya usia, terutama pada lansia perempuan yang berisiko lebih tinggi mengalami penurunan fungsi kognitif. Penelitian ini bertujuan untuk mengklasifikasikan aktivitas otak lansia perempuan saat istirahat atau dalam keadaan rileks berdasarkan kondisi mata (terbuka dan tertutup) menggunakan algoritma *Support Vector Machine* (SVM) dan *Naive Bayes*. Data yang digunakan berupa sinyal *EEG* dari subjek perempuan berusia 60–80 tahun yang diperoleh dari *OpenNeuro*, dengan 20 kanal *EEG* yang direkam pada laju 500 Hz. Tahapan penelitian mencakup proses *preprocessing* menggunakan *band pass filtering*, ekstraksi fitur domain waktu (mean, standar deviasi, skewness, kurtosis) dan domain frekuensi (menggunakan *Short-Time Fourier Transform*), serta pembagian *dataset* menjadi data latih dan data uji. Model klasifikasi yang digunakan adalah SVM dengan *kernel* linier dan polinomial serta *Naive Bayes*, dengan evaluasi kinerja model menggunakan *Confusion Matrix* yang mencakup akurasi, *precision*, *recall*, dan *F1-score*. Hasil penelitian menunjukkan bahwa SVM dengan *kernel* linier dan parameter $C = 0.01$ menghasilkan performa terbaik dengan akurasi 85,71%, *precision* 0,89, *recall* 0,86, dan *F1-score* 0,85. Sementara itu, *Naive Bayes* memperoleh akurasi sebesar 71,43%, *precision* 0,73, *recall* 0,71, dan *F1-score* 0,71, dan SVM *kernel* polinomial menunjukkan hasil yang lebih rendah dengan akurasi 57,14%, *precision* 0,77, *recall* 0,57, dan *F1-score* 0,47. Berdasarkan hasil tersebut, SVM linier dinilai paling efektif dalam mengklasifikasikan kondisi mata terbuka dan tertutup berdasarkan sinyal *EEG* pada lansia perempuan.

Kata Kunci: EEG, Lansia perempuan, klasifikasi, Support Vector Machine (SVM), Naïve Bayes, Kondisi mata terbuka dan tertutup.

ABSTRACT

Human brain activity changes with age, especially in elderly women who are at higher risk of cognitive decline. This study aims to classify the brain activity of elderly women at rest or in a relaxed state based on their eye conditions (open and closed) using the Support Vector Machine (SVM) and Naive Bayes algorithms. The data used were EEG signals from female subjects aged 60–80 years old obtained from OpenNeuro, with 20 EEG channels recorded at a rate of 500 Hz. The research stages included preprocessing using band-pass filtering, feature extraction in the time domain (mean, standard deviation, skewness, kurtosis) and frequency domain (using the Short-Time Fourier Transform), and dividing the dataset into training and test data. The classification models used were SVM with linear and polynomial kernels and Naive Bayes. Model performance was evaluated using a Confusion Matrix, which measures accuracy, precision, recall, and F1-score. The results of the study showed that the SVM with a linear kernel and parameter $C = 0.01$ produced the best performance with an accuracy of 85.71%, a precision of 0.89, a recall of 0.86, and an F1-score of 0.85. Meanwhile, the Naive Bayes achieved an accuracy of 71.43%, a precision of 0.73, a recall of 0.71, and an F1-score of 0.71, while the polynomial kernel SVM performed lower with an accuracy of 57.14%, a precision of 0.77, a recall of 0.57, and an F1-score of 0.47. Based on these results, the linear SVM was deemed the most effective in classifying eye-open and eye-closed conditions based on EEG signals in elderly women.

Keywords: EEG, Elderly women, classification, Support Vector Machine (SVM), Naïve Bayes, Open and closed eye conditions.