

## ABSTRAK

Deteksi depresi yang akurat dan objektif menjadi tantangan penting dalam bidang kesehatan mental, mengingat diagnosis konvensional sering kali bersifat subjektif dan bergantung pada pelaporan pasien. Penelitian ini mengusulkan pendekatan berbasis ekspresi wajah dan gerakan kepala sebagai *biomarker* perilaku untuk mendeteksi gejala depresi, dengan menggunakan algoritma *Decision Tree* yang dioptimasi melalui teknik *pre-pruning*. Dataset yang digunakan berasal dari ABC Challenge 2025, terdiri dari 286.074 entri data ekspresi wajah dan pose kepala dari 25 partisipan. Data menjalani proses pra-pemrosesan komprehensif seperti interpolasi nilai hilang, sinkronisasi waktu, normalisasi *Min-Max Scaling*, serta pengujian korelasi dan *ANOVA* untuk seleksi fitur. *Feature engineering* menghasilkan fitur-fitur seperti *AU\_sedih*, *AU\_senyum*, gerakan kepala, dan rata-rata keterbukaan mata. Model *Decision Tree* dilatih menggunakan skema validasi silang *Leave-One-Participant-Out (LOPO)* dan dikendalikan dengan parameter *pre-pruning* seperti *max\_depth = 7* dan *ccp\_alpha = 0.01* untuk mencegah *overfitting*. Hasil evaluasi menunjukkan rata-rata akurasi sebesar 83,96% dan *AUC* sebesar 89,41%, dengan performa terbaik pada partisipan tertentu. Teknik *pre-pruning* terbukti menjaga interpretabilitas dan efisiensi model tanpa mengorbankan akurasi, sehingga sangat potensial untuk diterapkan pada sistem deteksi depresi real-time yang ringan dan dapat diakses secara luas.

Kata kunci: *Decision Tree*, *Pre-pruning*, Ekspresi Wajah, Gerakan Kepala, Depresi, *Machine Learning*

## **ABSTRACT**

*Accurate and objective detection of depression remains a critical challenge in mental health, as conventional diagnoses are often subjective and dependent on patient self-reporting. This study proposes a behavior-based approach using facial expressions and head movements as biomarkers to detect depressive symptoms, applying a Decision Tree algorithm optimized through pre-pruning techniques. The dataset used is derived from the ABC Challenge 2025, comprising 286,074 entries of facial and head pose data collected from 25 participants. A comprehensive preprocessing pipeline was applied, including missing value interpolation, timestamp synchronization, Min-Max normalization, as well as correlation and ANOVA tests for feature selection. Feature engineering produced significant features such as AU\_sad, AU\_smile, head movement, and eye openness average. The Decision Tree model was trained using Leave-One-Participant-Out (LOPO) cross-validation, with pre-pruning parameters such as  $max\_depth = 7$  and  $ccp\_alpha = 0.01$  to reduce overfitting. Evaluation results demonstrated an average accuracy of 83.96% and an AUC score of 89.41%, with the best performance observed in several participants. The use of pre-pruning effectively maintained model interpretability and efficiency without sacrificing accuracy, making it highly suitable for lightweight and accessible real-time depression detection systems.*

**Keywords:** *Decision Tree, Pre-pruning, Facial Expression, Head Movement, Depression, Machine Learning*