

ABSTRAK

Deteksi dini terhadap depresi merupakan tantangan penting dalam bidang kesehatan mental, terutama karena banyak kasus tidak teridentifikasi secara akurat melalui metode tradisional seperti wawancara atau kuesioner. Penelitian ini mengembangkan sistem deteksi depresi berbasis pengolahan citra (*image processing*) dengan memanfaatkan ekspresi wajah dan pergerakan kepala sebagai fitur utama. Model yang digunakan adalah *Hybrid Stacking Ensemble*, yang menggabungkan *XGBoost* dan *Extra Trees Classifier* sebagai *base learners*, serta *Logistic Regression* sebagai *meta-classifier*. *Dataset* yang digunakan berasal dari kompetisi ABC Challenge tahun 2024, dengan lebih dari 130.000 entri data ekspresi wajah dan dinamika kepala. Proses pra-pemrosesan melibatkan rekayasa fitur seperti *Facial Structure*, *Eye Open Avg*, *AU Smile*, *AU Sad*, dan *Head Movement*. Model diuji menggunakan evaluasi berbasis *Leave One Participant Day Out (LOPDO)*, menghasilkan akurasi rata-rata sebesar 96,39%, *precision* 93,92%, *recall* 96,56%, *F1-score* 95,12%, dan *AUC* 99,61%. Hasil penelitian menunjukkan bahwa pendekatan hybrid stacking mampu meningkatkan akurasi dan generalisasi model secara signifikan dibandingkan model individu. Sistem ini berpotensi digunakan dalam proses skrining awal depresi secara objektif, non-invasif, dan berbasis teknologi kecerdasan buatan.

Kata kunci: Depresi, *Image Processing*, *Stacking Ensemble*, *Machine Learning*, Ekspresi Wajah, *Head Movement*.

ABSTRACT

Early detection of depression remains a major challenge in the mental health domain, particularly due to the limitations of traditional methods such as interviews and self-report questionnaires. This study proposes a depression detection system based on image processing, leveraging facial expressions and Head Movement as primary features. The model applies a Hybrid Stacking Ensemble, combining XGBoost and Extra Trees Classifier as base learners and Logistic Regression as the meta-classifier. The dataset was obtained from the 2024 ABC Challenge, containing over 130,000 entries of facial and head dynamics. Pre-processing involved feature engineering such as Facial Structure, Eye Open Avg, AU Smile, AU Sad, and Head Movement. Evaluation was conducted using the Leave One Participant Day Out (LOPDO) approach, yielding an average accuracy of 96.39%, precision 93.92%, recall 96.56%, F1-score 95.12%, and AUC 99.61%. The results indicate that the hybrid stacking approach significantly enhances model accuracy and generalization compared to individual classifiers. This system has strong potential for objective, non-invasive, and AI-driven early depression screening.

Keywords: *Depression, Image Processing, Stacking Ensemble, Machine Learning, Facial Expression, Head Movement.*