ABSTRAK

PERBANDINGAN *MULTI-MODEL* DAN *SINGLE-MODEL* ALGORITMA *CONVOLUTIONAL NEURAL NETWORK* DALAM KLASIFIKASI ALFABET BAHASA ISYARAT INDONESIA

(2025:xvi + 100 halaman + 31 gambar + 14 tabel + 10 lampiran)

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Perkembangan teknologi komputer dan pengolahan citra berbasis deep learning telah mendorong pengembangan sistem pengenalan isyarat tangan, termasuk klasifikasi alfabet Bahasa Isyarat Indonesia (BISINDO). Penelitian ini membandingkan performa pendekatan *Multi-model* dan *Single-model* pada algoritma *Convolutional Neural Network* (CNN) untuk klasifikasi alfabet BISINDO. Pada pendekatan *Multi-model*, digunakan kombinasi arsitektur ResNet50 dan MobileNetV2 sebagai *feature extractors* yang digabungkan menggunakan teknik *feature fusion*. Sedangkan pada pendekatan *Single-model*, ResNet50 dan MobileNetV2 digunakan secara terpisah sebagai *pre-trained model* melalui *transfer learning*. Dataset terdiri dari 11.471 gambar gesture tangan huruf A–Z, dengan pembagian 80% data pelatihan dan 20% data validasi. Evaluasi dilakukan menggunakan metrik akurasi, *precision, recall,* dan F1-*score* pada data pelatihan, validasi, serta pengujian data baru. Hasil menunjukkan bahwa model *Multi-model* mencapai akurasi pelatihan 99.92%, validasi 99.91%, *precision* 99.91%, *recall* 99.91%, dan F1-*score* 99.91% dan pengujian data baru mencatat akurasi 79.23%, *precision* 82.91%, *recall* 79.23%, dan F1-*score* 80.04%. Model ResNet50 memperoleh akurasi pelatihan 86.29%, validasi 98,64%, *precision* 98.71%, *recall* 98.65%, F1-*score* 98.61% dan pengujian data baru dengan akurasi 50.76%, *precision* 53.07%, *recall* 50.76%, dan F1-*score* 47.90%. Sementara itu, Model MobileNetV2 mencatat akurasi pelatihan 99.99%, validasi 99.64%, *precision* 99.67%, *recall* 99.65%, F1-*score* 99.64% serta pengujian data baru dengan akurasi 70.00%, *precision* 78.39%, *recall* 70.00%, dan F1-*score* 69.96%.
Dari hasil tersebut, pendekatan *Multi-model* lebih unggul dalam hal akurasi, kestabilan, dan kemampuan generalisasi terhadap gesture baru dibandingkan *Single-model.*

Kata Kunci : BISINDO, *Multi-model, Deep Learning*, CNN, ResNet50, MobileNetV2

ABSTRACT

COMPARISON OF MULTI-MODEL AND SINGLE-MODEL CONVOLUTIONAL NEURAL NETWORK ALGHORITHMS FOR THE CLASSIFICATION OF THE SIGN LANGUAGE ALPHABET

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The advancement of computer technology and image processing based on deep learning has driven the development of hand gesture recognition systems, including the classification of the Indonesian Sign Language (BISINDO) alphabet. This study compares the performance of multi-model and single-model approaches using Convolutional Neural Network (CNN) algorithms for BISINDO alphabet classification. In the multi-model approach, a combination of ResNet50 and MobileNetV2 architectures was used as feature extractors, which were then merged using a feature fusion technique. In contrast, the single-model approach applied ResNet50 and MobileNetV2 separately as pre-trained models through transfer learning. The dataset consisted of 11,471 hand gesture images representing the letters A to Z, split into 80% training data and 20% validation data. Evaluation was conducted using accuracy, precision, recall, and F1-score metrics on the training data, validation data, and a separate unseen test dataset. The multi-model achieved 99.92% training accuracy, 99.91% validation accuracy, and 99.91% for precision, recall, and F1-score. On new testing data, it reached 79.23% accuracy, 82.91% precision, 79.23% recall, and 80.04% F1-score. The ResNet50 model obtained 86.29% training accuracy, 98.64% validation accuracy, 98.71% precision, 98.65% recall, and 98.61% F1-score, while its performance dropped on the new test data with 50.76% accuracy, 53.07% precision, 50.76% recall, and 47.90% F1-score. Meanwhile, MobileNetV2 achieved 99.99% training accuracy, 99.64% validation accuracy, 99.67% precision, 99.65% recall, and 99.64% F1-score, with 70.00% accuracy, 78.39% precision, 70.00% recall, and 69.96% F1-score on the new test data. These results indicate that the multi-model approach outperforms the single-model approaches in terms of accuracy, stability, and generalization capability when classifying new BISINDO gesture variations.

Keywords *: BISINDO, Multi-model, Deep Learning, Convolutional Neural Network (CNN), ResNet50, MobileNetV2.*