ABSTRAK

Teknologi pengenalan wajah secara waktu nyata (*real-time*) saat ini masih menghadapi tantangan *trade-off* antara tingkat akurasi tinggi dan efisiensi komputasi, khususnya pada perangkat berspesifikasi terbatas. Penelitian ini bertujuan mengatasi masalah tersebut dengan merancang sistem pengenalan wajah yang mengintegrasikan arsitektur YOLOv5Face-s sebagai detektor wajah dan GhostFaceNetV1 sebagai model pengenalan identitas.

Model dilatih menggunakan dataset primer dengan mengimplementasikan strategi *transfer learning*, augmentasi data dinamis (*RandAugment*), serta fungsi kerugian *ArcFace Loss*. Selain itu, pengujian komparatif dilakukan menggunakan dataset publik untuk membandingkan efisiensi komputasi model usulan terhadap arsitektur konvensional MobileFaceNet. Sistem kemudian diintegrasikan ke dalam antarmuka *streaming* video berbasis *web* menggunakan *framework Flask*.

Hasil penelitian menunjukkan bahwa model GhostFaceNetV1 sangat andal dengan capaian akurasi sebesar 98,33% pada pengujian data primer. Pada pengujian komparatif, GhostFaceNetV1 terbukti lebih ringan secara komputasi dengan kebutuhan 435,14 MFLOPs dibandingkan MobileFaceNet (477,31 MFLOPs), dengan akurasi identik sebesar 99,76%. Dari segi implementasi sistem, pengujian *black-box* memvalidasi tingkat keberhasilan fungsionalitas 100% dalam mengklasifikasi identitas terdaftar dan menyaring wajah asing (*Unknown*). Sistem yang dibangun berhasil memproses aliran video secara stabil dan *real-time* dengan perolehan kecepatan 9 hingga 13 *Frames Per Second* (FPS). Berdasarkan hasil tersebut, arsitektur usulan terbukti memberikan solusi yang akurat sekaligus efisien secara komputasi.

Kata Kunci: Pengenalan Wajah, YOLOv5Face, GhostFaceNetV1, Real-Time, Deep Learning

ABSTRACT

Real-time face recognition technology currently faces a trade-off between high accuracy and computational efficiency, particularly on resource-constrained devices. This research aims to overcome this issue by designing a face recognition system that integrates the YOLOv5Face-s architecture as a face detector and GhostFaceNetV1 as an identity recognition model.

The model was trained using a primary dataset by implementing a transfer learning strategy, dynamic data augmentation (RandAugment), and the ArcFace Loss function. Additionally, comparative testing was conducted using a public dataset to compare the computational efficiency of the proposed model against the conventional MobileFaceNet architecture. The system was then integrated into a web-based video streaming interface using the Flask framework.

The results show that the GhostFaceNetV1 model is highly reliable, achieving an accuracy of 98.33% on the primary test data. In the comparative evaluation, GhostFaceNetV1 proved to be computationally lighter, requiring only 435.14 MFLOPs compared to MobileFaceNet's 477.31 MFLOPs, while maintaining an identical accuracy of 99.76%. Regarding system implementation, black-box testing validated a 100% functional success rate in classifying registered identities and filtering out unregistered faces (Unknown). The developed system successfully processed video streams stably in real-time, achieving a processing speed of 9 to 13 Frames Per Second (FPS). Based on these results, the proposed architecture is proven to provide an accurate and computationally efficient face recognition solution.

Keywords: *Face Recognition, YOLOv5Face, GhostFaceNetV1, Real-Time, Deep Learning*