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Analisis Komparasi Performa Model YOLO dan SSDLite MobileNet dalam Deteksi Bahasa Isyarat Pengenalan Huruf Hijaiyah
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INTISARI

ANALISIS KOMPARASI PERFORMA MODEL YOLO DAN SSDLITE MOBILENET DALAM DETEKSI BAHASA ISYARAT PENGENALAN HURUF HIJAIYAH

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Pengenalan huruf hijaiyah sejak usia dini penting dalam membaca Al-Qur'an, namun anak tunarungu terkendala karena metode konvensional dominan menggunakan aspek auditori. Penelitian ini bertujuan mengembangkan platform web bernama IsyarahQ menggunakan metode *object detection* untuk menyediakan aksesibilitas media latihan mandiri bagi anak-anak tunarungu di TPQ Mulia. Model YOLOv8n dan SSDLite MobileNet v3 Large dilatih mengenali 29 kelas isyarat sesuai standar Mushaf Al-Qur'an Isyarat Kementerian Agama Republik Indonesia (RI) melalui skenario *baseline*, augmentasi rotasi ±10°, dan *hyperparameter tuning* (AdamW). Hasil eksperimen menunjukkan skenario *hyperparameter tuning* memberikan performa paling optimal. YOLOv8n meraih akurasi tertinggi (mAP@50 0,9931; 153,43 FPS) pada GPU, sedangkan pada CPU terjadi *trade-off* di mana SSDLite MobileNet V3 Large lebih efisien mencapai 40,82 FPS meskipun mAP@50 sedikit lebih rendah (0,9743). Kontribusi ilmiah penelitian ini terletak pada integrasi sistem deteksi *real-time*, fitur *switching model*, dan analisis komparasi performa model pada lingkungan CPU dan GPU. Kedua model diintegrasikan ke dalam website berbasis FastAPI dan Vue.js dengan mekanisme *sliding window* 30 *frame* dan dinyatakan lulus pengujian *black box testing*. Penelitian ini diharapkan menjadi acuan sistem visi komputer yang adaptif sekaligus media latihan interaktif bagi anak-anak tunarungu.

Kata Kunci: Deteksi Objek, Huruf Hijaiyah, YOLOv8n, SSDLite MobileNet v3 Large, Switching Model

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ABSTRACT

COMPARATIVE ANALYSIS OF YOLO AND SSDLITE MOBILENET MODEL PERFORMANCE IN SIGN LANGUAGE DETECTION FOR HIJAIYAH LETTER RECOGNITION

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Early introduction to Hijaiyah letters is crucial for reading the Al-Qur'an; however, deaf children face constraints due to conventional methods that predominantly rely on auditory aspects. This study aims to develop a web-based platform named IsyarahQ using object detection methods to provide accessible independent practice media for deaf children at the TPQ Mulia. The YOLOv8n and SSDLite MobileNet v3 Large models were trained to recognize 29 sign classes in accordance with the official Indonesian Ministry of Religious Affairs (RI) Sign Al-Qur'an Mushaf standards through baseline, $\pm 10^{\circ}$ rotation augmentation, and hyperparameter tuning (AdamW) scenarios Results show that the hyperparameter tuning scenario yields the most optimal performance. YOLOv8n achieves the highest accuracy (mAP@50: 0.9931; 153.43 FPS) on the GPU, while a trade-off occurs on the CPU where SSDLite MobileNet v3 Large is more efficient at 40.82 FPS despite a slightly lower mAP@50 (0.9743). The scientific contribution of this research lies in the integration of a real-time detection system, a model switching feature, and comparative analysis of performance models in GPU and CPU environments. Both models were integrated into a FastAPI and Vue.js-based website using a 30-frame sliding window mechanism and successfully passed black-box testing. This research is expected to serve as a reference for adaptive computer vision systems as well as an interactive practice medium for deaf children.

Keyword: Object Detection, Hijaiyah Letters, YOLOv8n, SSDLite MobileNet v3 Large, Switching Model