

INTISARI

PERBANDINGAN PERFORMA MODEL DETEKSI OBJEK YOLOv11, YOLOv10, dan YOLOv5 PADA PLAT NOMOR DI INDONESIA

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Jumlah kendaraan bermotor di Indonesia terus mengalami peningkatan setiap tahunnya. Seiring dengan tren tersebut, kebutuhan akan sistem keamanan dan keselamatan yang andal pun semakin tinggi. Salah satu teknologi yang menjanjikan untuk mendukung sistem tersebut adalah deteksi plat nomor kendaraan secara otomatis. Model deteksi objek *You Only Look Once* (YOLO) dikenal sebagai solusi yang efisien dan akurat untuk kebutuhan deteksi *real time*. Penelitian ini membandingkan performa tiga model YOLO, YOLOv5n, YOLOv10n, dan YOLOv11n dalam tugas deteksi plat nomor kendaraan di Indonesia.

Ketiga model dilatih menggunakan dataset asli tanpa augmentasi manual, namun dengan aktivasi augmentasi otomatis yang disediakan oleh framework YOLO selama proses pelatihan. Evaluasi dilakukan berdasarkan metrik *precision*, *recall*, *mean average precision* ($mAP@50$ dan $mAP@50:95$), *F1-score*, *inference time*, dan *GFLOPs*. Hasil pengujian menunjukkan bahwa YOLOv5n memberikan performa terbaik secara keseluruhan, dengan *precision* 0.967, *recall* 0.971, $mAP@50$ sebesar 0.993, *F1-score* 0.969, serta *inference time* tercepat yaitu 4.8 ms per gambar. Hal ini menjadikannya model yang ideal untuk aplikasi *real time* berbasis perangkat terbatas.

Sementara itu, YOLOv11n menunjukkan kemampuan generalisasi terbaik dengan nilai $mAP@50:95$ tertinggi sebesar 0.702, serta performa yang seimbang pada metrik lain, meskipun dengan kompleksitas dan waktu inferensi yang lebih tinggi. Temuan ini menegaskan pentingnya pemilihan model deteksi objek yang mempertimbangkan keseimbangan antara akurasi, efisiensi, dan konteks penggunaan akhir.

Kata Kunci: YOLOv11, YOLOv10, YOLOv5, Deteksi Objek, *Deep Learning*, Plat Nomor

ABSTRACT

COMPARISON OF THE PERFORMANCE OF OBJECT DETECTION MODELS YOLOv11, YOLOv10, AND YOLOv5 ON LICENSE PLATES IN INDONESIA

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The number of motor vehicles in Indonesia continues to increase every year. Along with this trend, the need for reliable security and safety systems is also increasing. One promising technology to support these systems is automatic vehicle number plate detection. The You Only Look Once (YOLO) object detection model is known as an efficient and accurate solution for real-time detection needs. This study compares the performance of three YOLO models, YOLOv5n, YOLOv10n, and YOLOv11n, in the task of vehicle number plate detection in Indonesia.

All three models were trained using an original dataset without manual augmentation, but with automatic augmentation activation provided by the YOLO framework during the training process. Evaluation was conducted based on metrics including precision, recall, mean average precision (mAP@50 and mAP@50:95), F1-score, inference time, and GFLOPs. Test results show that YOLOv5n delivers the best overall performance, with precision of 0.967, recall of 0.971, mAP@50 of 0.993, F1-score of 0.969, and the fastest inference time of 4.8 ms per image. This makes it an ideal model for real-time applications on resource-constrained devices.

Meanwhile, YOLOv11n demonstrated the best generalisation ability with the highest mAP@50:95 value of 0.702, as well as balanced performance on other metrics, despite higher complexity and inference time. These findings emphasize the importance of selecting an object detection model that considers the balance between accuracy, efficiency, and end-use context.

Keywords: YOLOv11, YOLOv10, YOLOv5, Object Detection, Deep Learning, License Plate