Analisis Perbandingan YOLOv12 dan RT-DETR Berbasis Edge-Cloud Computing Untuk Deteksi Kendaraan
Berbasis Video Closed Circuit Television
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INTISARI

ANALISIS PERBANDINGAN YOLOV12 DAN RT-DETR BERBASIS *EDGE-CLOUD COMPUTING* UNTUK DETEKSI KENDARAAN PADA VIDEO *CLOSED CIRCUIT TELEVISION*

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Pertumbuhan volume kendaraan di persimpangan jalan perkotaan membutuhkan sistem pemantauan lalu lintas yang akurat dan efisien. Penelitian ini bertujuan membandingkan performa model YOLOv12 dan RT-DETR dalam mendeteksi dan menghitung kendaraan pada rekaman CCTV persimpangan jalan di Kota Yogyakarta menggunakan algoritma pelacakan Byte*Track*, sekaligus mengevaluasi kinerja sistem berbasis arsitektur *edge-cloud computing*. Dataset dikumpulkan dari empat skenario kondisi rekaman CCTV, dianotasi menggunakan Roboflow, dan dilatih menggunakan *Google Colaboratory*. Sistem diimplementasikan dengan proses inferensi berjalan di lapisan *edge* (GPU lokal) melalui *web dashboard* berbasis *Flask*, sementara penyimpanan hasil dan aksesibilitas *dashboard* menggunakan layanan *cloud* (*Supabase*, Telegram Bot). Hasil penelitian menunjukkan RT-DETR unggul dalam akurasi dengan mAP@0.5 sebesar 0,7426 dan *precision* 0,8072 dibandingkan YOLOv12 dengan mAP@0.5 sebesar 0,7367 dan *precision* 0,69, namun YOLOv12 lebih efisien dalam penggunaan sumber daya dengan utilisasi CPU rata-rata 37,1–44,2% dibandingkan RT-DETR sebesar 46,5–48,2%. Pengujian multi-akses menggunakan Locust menunjukkan sistem mampu melayani hingga 50 pengguna simultan tanpa kegagalan *request* dengan *throughput* 17,3 *requests per second,* namun mulai mengalami kegagalan *request* sebesar 3,3% dan 13% pada beban 400 dan 500 pengguna, sehingga arsitektur *edge-cloud* yang diterapkan terbukti andal pada beban operasional yang wajar.

Kata kunci : YOLOv12, RT-DETR, *Edge-Cloud Architecture,* Deteksi Kendaraan, *ByteTrack*, Video CCTV.

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ABSTRACT

COMPARATIVE ANALYSIS OF YOLOV12 AND RT-DETR BASED ON EDGE-CLOUD COMPUTING FOR VEHICLE DETECTION IN VIDEO CLOSED CIRCUIT TELEVISION

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The growth of vehicle volume at urban intersections requires an accurate and efficient traffic monitoring system. This study aims to compare the performance of the YOLOv12 and RT-DETR models in detecting and counting vehicles in CCTV footage at intersections in Yogyakarta City using the ByteTrack tracking algorithm, while evaluating the performance of the system based on an edge-cloud computing architecture. The dataset was collected from four CCTV footage condition scenarios, annotated using Roboflow, and trained using Google Colaboratory. The system was implemented with the inference process running at the edge layer (local GPU) through a Flask-based web dashboard, while the results were stored and dashboard accessibility used cloud services (Supabase, Telegram Bot). The results showed that RT-DETR was superior in accuracy with mAP@0.5 of 0.7426 and precision of 0.8072 compared to YOLOv12 with mAP@0.5 of 0.7367 and precision of 0.69, but YOLOv12 was more efficient in resource usage with an average CPU utilization of 37.1–44.2% compared to RT-DETR of 46.5–48.2%. Multi-access testing using Locust showed the system was capable of serving up to 50 simultaneous users without request failure with a throughput of 17.3 requests per second, but began to experience request failures of 3.3% and 13% at loads of 400 and 500 users, respectively, thus proving reliable at reasonable operational loads.

Keywords **:** YOLOv12, RT-DETR, *Edge-Cloud Architecture, Vehicle Detection*, Byte*Track*, Video CCTV.