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OBJECT DETECTION AND NEAR-MISS ANALYSIS IN TRAFFIC VIDEOS OF HIGH AND LOW QUALITY BASED ON THE YOLO MODEL

(*Pengesanan Objek dan Analisis Hampir Terlepas dalam Video Trafik Berkualiti Tinggi dan Rendah Berdasarkan Model YOLO*)

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ABSTRACT

The development of intelligent transportation systems has made traffic detection technology crucial for preventing near-miss events and enhancing road safety. You Only Look Once (YOLO), a popular target detection model, is widely used in traffic target detection. However, the performance of different YOLO models varies significantly on the same quality video data. Furthermore, different video qualities affect near-miss event detection differently. This paper conducts experiments on different YOLO models using high-quality and low-quality video data to assess their detection performance. Considering the expressway scenario in this study, we use manual reporting (based on human detection), the bird's-eye view method (based on image processing), and the distance neighbor method (based on data analysis) for near-miss detection. Results show that YOLOv5m has the highest precision, recall, and mAP@0.5 (0.990, 0.977, and 0.994) for high-quality video detection. YOLOv8m has the highest mAP@0.5 - 0.95 (0.908) for low-quality video detection. In high-quality video near-miss detection, manual reporting, the bird's-eye view method, and the distance neighbor method show high consistency, indicating that the latter two can replace manual calculation in specific scenarios. In low-quality video near-miss detection, all three methods yield identical results, highlighting the significant impact of clarity and fluency on near-miss detection.

Keywords: traffic object detection; YOLO model performance comparison; video data quality; near-miss detection; distance detection

ABSTRAK

Pembangunan sistem pengangkutan pintar telah menjadikan teknologi pengesanan trafik sangat penting untuk mencegah kejadian nyaris kemalangan dan meningkatkan keselamatan jalan raya. You Only Look Once (YOLO), sebuah model pengesanan lanjutan yang popular, digunakan secara meluas dalam pengesanan sasaran trafik. Namun, prestasi model YOLO yang berbeza menunjukkan variasi yang ketara pada data video dengan kualiti yang sama. Selain itu, kualiti video yang berbeza turut mempengaruhi pengesanan kejadian nyaris kemalangan secara berbeza. Kajian ini menjalankan eksperimen ke atas pelbagai model YOLO menggunakan data video berkualiti tinggi dan rendah untuk menilai prestasi pengesanan mereka. Dengan mengambil kira senario lebuh raya dalam kajian ini, kami menggunakan pelaporan manual (berdasarkan pengesanan manusia), kaedah pandangan mata burung (berdasarkan pemprosesan imej), dan kaedah jarak jiran (berdasarkan analisis data) untuk pengesanan kejadian nyaris kemalangan. Eksperimen ini menunjukkan bahawa YOLOv5m mempunyai ketepatan, kadar panggilan semula (recall), dan mAP@0.5 tertinggi (masing-masing 0.990, 0.977, dan 0.994) dalam pengesanan video berkualiti tinggi. YOLOv8m pula mencatatkan mAP@0.5 - 0.95 tertinggi (0.908) untuk pengesanan video berkualiti rendah. Dalam pengesanan kejadian nyaris kemalangan menggunakan video berkualiti tinggi, kaedah pelaporan manual, pandangan mata burung, dan jarak jiran menunjukkan tahap keserasian yang tinggi, menunjukkan bahawa dua kaedah terakhir boleh menggantikan pengiraan manual dalam situasi tertentu. Bagi pengesanan kejadian nyaris kemalangan menggunakan video berkualiti rendah, ketiga-tiga kaedah

memberikan keputusan yang sama, menekankan kesan ketara kejelasan dan kelancaran video terhadap pengesanan kejadian nyaris kemalangan.

Kata kunci: pengesanan objek lalu lintas; perbandingan prestasi model YOLO; kualiti data video; pengesanan nyaris; pengesanan jarak

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