

## INTISARI

### **Sistem Pengawasan *Physical Distancing* di Tempat Umum Menggunakan Kamera dengan Metode YOLOv4 dan DEEPSORT**

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Pembatasan jarak fisik merupakan salah satu cara yang diterapkan untuk mencegah penyebaran virus di tempat umum. Pelaksanaannya memerlukan pengawasan agar berhasil sesuai harapan. Pengawasan yang dilakukan secara manual terutama pada tempat dengan tingkat keramaian tinggi kurang efektif karena memerlukan banyak petugas di lokasi yang justru akan menambah keramaian. Penelitian ini akan mengembangkan purwarupa sistem pengawasan *physical distancing* otomatis dengan memanfaatkan kamera CCTV yang dilengkapi kemampuan deteksi pedestrian YOLOv4, pelacakan pedestrian DeepSORT dan estimasi jarak pedestrian.

Tahapan penelitian secara keseluruhan meliputi persiapan data, deteksi dan pelacakan pedestrian, estimasi jarak dan pendeteksian pelanggaran jarak, dan evaluasi performa sistem. Penelitian dilakukan menggunakan data video yang diperoleh dari CCTV area Malioboro. Video diproses menjadi frame dan didapatkan 473 data latih, 119 data validasi dan 2156 data uji. Data latih dan validasi digunakan untuk melatih YOLOv4 sebagai pendeteksi pedestrian dengan menggunakan metode *transfer learning*. Kemudian metode DeepSORT digunakan untuk melacak pergerakan pedestrian hasil pendeteksi. Estimasi jarak pedestrian dilakukan terhadap hasil pelacakan menggunakan teknik trigonometri berdasarkan perspektif kamera untuk menemukan pelanggaran pembatasan jarak fisik.

Pada penelitian ini didapatkan performa YOLOv4 terhadap data uji dengan nilai *recall* sebesar 0,86; *precision* sebesar 0,69 dan *mean average precision* (mAP) sebesar 0,83. Sistem berhasil melakukan pelacakan pedestrian dengan perubahan identitas sebanyak 6 kali terhadap data uji. Sistem mampu melakukan estimasi jarak dengan kesalahan kurang dari 2 meter. Secara keseluruhan sistem mencapai kecepatan rata-rata pemrosesan frame secara *real-time* yakni pada 24 sampai 26 FPS.

Kata kunci: Pendeteksian Objek, Pelacakan Objek, *Deep Learning*

## ABSTRACT

### **Physical Distancing Monitoring System at Public Place using Camera *with* *YOLOV4 and DEEPSORT***

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Physical distancing is one way to prevent the spread of the virus in public places. Its implementation requires supervision to be successful as expected. Supervision that is carried out manually, especially in places with high levels of crowds, is less effective because it requires many officers at the location which will increase the crowd. This study will develop a prototype of an automatic physical distancing surveillance system by utilizing CCTV cameras equipped with YOLOv4 pedestrian detection capabilities, DeepSORT pedestrian tracking and pedestrian distance estimation.

The overall research stages include data preparation, pedestrian detection and tracking, distance estimation and detection of distance violations, and system performance evaluation. The study was conducted using video data obtained from CCTV in the Malioboro area. Video is processed into frames and obtained 473 training data, 119 validation data and 2156 test data. Training and validation data are used to train YOLOv4 as a pedestrian detector using the transfer learning method. Then the DeepSORT method is used to track pedestrian movements. Pedestrian distance estimation is carried out on tracking results using trigonometric techniques based on camera perspective to find violations of physical distance restrictions.

In this study, the performance of YOLOv4 on test data was obtained with a recall value of 0.86; precision of 0.69 and mean average precision (mAP) of 0.83. The system has succeeded in tracking pedestrians by changing the identity 6 times to the test data. The system can estimate the distance with an error of less than 2 meters. Overall, the system achieves an average real-time frame processing speed of 24 to 26 FPS

Keyword: Object detection, Object tracking, Deep Learning