ABSTRAK

Perkembangan teknologi kecerdasan buatan dan *computer vision* telah memberikan peluang besar dalam pengembangan sistem robotik yang dapat membantu aktivitas manusia, termasuk bagi individu dengan keterbatasan fisik. Penelitian ini bertujuan untuk mengembangkan sistem deteksi gerakan mata dan mulut menggunakan algoritma YOLOv8 *small* pada *self-feeding assistive robot arm*, yang berfungsi membantu proses makan secara mandiri. Model YOLOv8 *small* dipilih karena ringan, efisien, dan mampu melakukan deteksi objek secara *real-time* dengan akurasi tinggi. Penelitian ini menggunakan *webcam* sebagai sensor *input* yang menangkap citra wajah pengguna, kemudian diproses untuk mengidentifikasi kondisi mata terbuka, mata tertutup, mulut terbuka dan mulut tertutup. Deteksi kondisi mata tertutup selama satu detik digunakan sebagai sinyal pengguna meminta makanan dan mulut terbuka digunakan sebagai sinyal kesiapan pengguna untuk menerima suapan makanan. Metodologi penelitian mencakup pelatihan model menggunakan dataset berlabel, implementasi sistem, serta evaluasi performa menggunakan metrik *precision*, *recall*, dan mAP. Berdasarkan hasil evaluasi, kinerja model menunjukkan performa sangat baik. Pada *epoch* 100 Akurasi keseluruhan mencapai 90,1%, dengan *precision*, *recall*, *F1-score* tertinggi mencapai 99% pada kondisi mulut terbuka. Nilai mAP@0.5 sebesar 97,3% menunjukkan bahwa model mampu mengenali dan mengklasifikasikan objek secara konsisten dalam berbagai kondisi. *Confusion matrix* menunjukkan dominasi prediksi benar dengan kesalahan klasifikasi yang minimal. Hasil ini membuktikan bahwa model YOLOv8 *small* dapat secara efektif mengidentifikasi kesiapan pengguna dan mengendalikan sistem robot secara responsif tanpa interaksi fisik langsung.

Kata Kunci: *computer vision*, YOLOv8 *small*, gerakan mata dan mulut, *self-feeding assistive robot arm*.

ABSTRACT

The advancement of artificial intelligence and computer vision technologies has opened significant opportunities in the development of robotic systems to assist human activities, especially for individuals with physical disabilities. This study aims to develop a system for detecting eye and mouth movements using the YOLOv8 small algorithm on a self-feeding assistive robot arm, which functions to help users eat independently. YOLOv8 small was chosen for its lightweight architecture, high efficiency, and real-time object detection capabilities with high accuracy. A webcam is used as an input sensor to capture the user's facial image, which is then processed to identify the conditions of open eyes, closed eyes, open mouth, and closed mouth. A closed-eye condition sustained for one second is used as a signal that the user is requesting food, while an open mouth indicates readiness to receive food. The research methodology includes training the model using a labeled dataset, system implementation, and performance evaluation using metrics such as precision, recall, and mAP. Based on the evaluation results, the model demonstrated excellent performance. At epoch 100, the model achieved an overall accuracy of 90.1%, with the highest precision, recall, and F1-score reaching 99% in the open mouth condition. The mAP@0.5 value of 97.3% indicates the model's ability to detect and classify objects consistently under various conditions. The confusion matrix also shows a dominance of correct predictions with minimal misclassifications. These results prove that YOLOv8 small can effectively identify user readiness and control the robot system responsively without physical interaction.

***Keywords**: computer vision, YOLOv8 small, eye and mouth movement, self-feeding assistive robot arm.*