Real-Time Finger Tracking: Evaluating YOLOv8 and MediaPipe for Enhanced HCI

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Abstract : In the field of human-computer interaction (HCI), hand gestures play a crucial role in facilitating communication by expressing emotions and intentions. The precise tracking of the index finger and the estimation of joint positions are essential for developing effective gesture recognition systems. However, various challenges, such as anatomical variations, occlusions, and environmental influences, hinder optimal functionality. This study investigates the performance of the YOLOv8m model for hand detection using the EgoHands dataset, which comprises diverse hand gesture images captured in various environments. Over three training processes, the model demonstrated significant improvements in precision (from 88.8% to 96.1%) and recall (from 83.5% to 93.5%), achieving a mean average precision (mAP) of 97.3% at an IoU threshold of 0.7. We also compared YOLOv8m with MediaPipe and an integrated YOLOv8 + MediaPipe approach. The combined method outperformed the individual models, achieving an accuracy of 99% and a recall of 99%. These findings underscore the benefits of model integration in enhancing gesture recognition accuracy and localization for real-time applications. The results suggest promising avenues for future research in HCI, particularly in augmented reality and assistive technologies, where improved gesture recognition can significantly enhance user experience.

Keywords : YOLOv8, mediapipe, finger tracking, joint estimation, human-computer interaction (HCI)

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