

Research on machine learning methods for action recognition and application in recognizing students' hand-raising gestures.

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Abstract: This study investigates machine learning methods for action recognition, with a specific application to detecting hand-raising gestures in classroom environments. The research addresses the challenge of accurately identifying student hand-raising behavior, a critical non-verbal cue for teacher-student interaction. We propose and evaluate a framework combining pose estimation with temporal sequence modeling. Initially, student body keypoints are extracted using a convolutional neural network-based pose estimator. Subsequently, these spatial-temporal features are classified using various machine learning models, including Long Short-Term Memory (LSTM) networks and Transformer-based architectures. A custom dataset of classroom video recordings was collected and annotated to train and validate the models. Experimental results demonstrate that the proposed approach achieves high accuracy and robustness in distinguishing genuine hand-raising actions from other arm movements and occlusions. The findings indicate that the Transformer model outperforms traditional LSTM in capturing long-range dependencies of the gesture sequence. This work provides a practical solution for automated classroom analytics, enabling real-time feedback on student participation and contributing to the development of intelligent educational support systems.

Keywords: machine learning, action recognition, hand-raising to speak, student