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Deep learning-based correctness assessment for the Tadasana (Mountain Pose) Yoga Asana

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Yoga has become increasingly popular worldwide, but practicing without proper guidance can lead to incorrect posture alignment, reducing effectiveness, and increasing injury risk. This research aimed to address this issue by developing a deep learning-based system that relies on the MediaPipe framework to assess the correctness of the Tadasana yoga asana and provide real-time feedback for improvement. A deep learning-based system was selected for the proposed study to implement the MediaPipe framework, for its outstanding real-time performance (75.9% mean average precision on the COCO dataset) and cross-platform efficiency. Using MediaPipe, a custom-developed web app analyzed more than 50 professional yoga instruction videos to extract crucial body angles for each Tadasana step, generating the dataset for the yoga pose angle calculation algorithm. This approach accounts for MediaPipe's inherent variability in landmark detection, ensuring robust angle calculations. The primary goals of this study were to develop an accurate pose estimation and angle calculation algorithm specifically optimized for Tadasana, as well as a comprehensive, real-time feedback mechanism for pose correction. The proposed system integrated MediaPipe's pose estimation capabilities with a custom angle calculation algorithm and a rule-based feedback system. An extensive evaluation was conducted using more than 100 images of correct and incorrect poses for each of the three Tadasana steps. The system demonstrated promising results, achieving accuracy scores of 78, 75, and 72% for steps 1, 2, and 3, respectively. It was observed that the system's performance varied based on factors such as image quality and environmental conditions. This study demonstrates the feasibility and potential of using deep learning and computer vision techniques for precise yoga pose correction. Future work will focus on enhancing the system's robustness across diverse conditions, expanding its capabilities to encompass a wider range of yoga poses, and implementing real-time video analysis for feedback generation. These advancements could significantly enhance the accessibility and effectiveness of remote yoga instruction, making proper technique more attainable for practitioners.

Keywords: Deep learning; mediapipe framework; computer vision; yoga pose correctness assessment

Underlined is the presenting author.