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Facial Recognition and Landmark Detection in Fitness Assessment and Performance Improvement

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Abstract : For physical therapy, exercise prescription, athlete training, and regular fitness training, it is crucial to perform health assessments or fitness assessments periodically. An accurate assessment is propitious for tracking recovery progress, preventing potential injury and making long-range training plans. Assessments include necessary measurements, height, weight, blood pressure, heart rate, body fat, etc. and advanced evaluation, muscle group strength, stability-mobility, and movement evaluation, etc. In the current standard assessment procedures, the accuracy of assessments, especially advanced evaluations, largely depends on the experience of physicians, coaches, and personal trainers. And it is challenging to track clients' progress in the current assessment. Unlike the tradition assessment, in this paper, we present a deep learning based face recognition algorithm for accurate, comprehensive and trackable assessment. Based on the result from our assessment, physicians, coaches, and personal trainers are able to adjust the training targets and methods. The system categorizes the difficulty levels of the current activity for the client or user, furthermore make more comprehensive assessments based on tracking muscle group over time using a designed landmark detection method. The system also includes the function of grading and correcting the form of the clients during exercise. Experienced coaches and personal trainer can tell the clients' limit based on their facial expression and muscle group movements, even during the first several sessions. Similar to this, using a convolution neural network, the system is trained with people's facial expression to differentiate challenge levels for clients. It uses landmark detection for subtle changes in muscle groups movements. It measures the proximal mobility of the hips and thoracic spine, the proximal stability of the scapulothoracic region and distal mobility of the glenohumeral joint, as well as distal mobility, and its effect on the kinetic chain. This system integrates data from other fitness assistant devices, including but not limited to Apple Watch, Fitbit, etc. for a improved training and testing performance. The system itself doesn't require history data for an individual client, but the history data of a client can be used to create a more effective exercise plan. In order to validate the performance of the proposed work, an experimental design is presented. The results show that the proposed work contributes towards improving the quality of exercise plan, execution, progress tracking, and performance.

Keywords : exercise prescription, facial recognition, landmark detection, fitness assessments
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