PostureCheck: Posture Modeling for Exercise Assessment Using the Microsoft Kinect

Elham Saraee, Saurabh Singh, Ajjen Joshi, Margrit Betke

Goal — Evaluate posture during physio-therapy to ensure exercises are performed correctly.

The Proficio Robotic Arm

- Robotic arm with 3 degrees of freedom.
- Trajectory planning that enables therapists to plan and personalize exercises.
- Programmable haptic feedback that can be leveraged to modify exercise difficulty.
- 3D positioning of the arm joints that allows exercise visualization and analysis.

Methodology
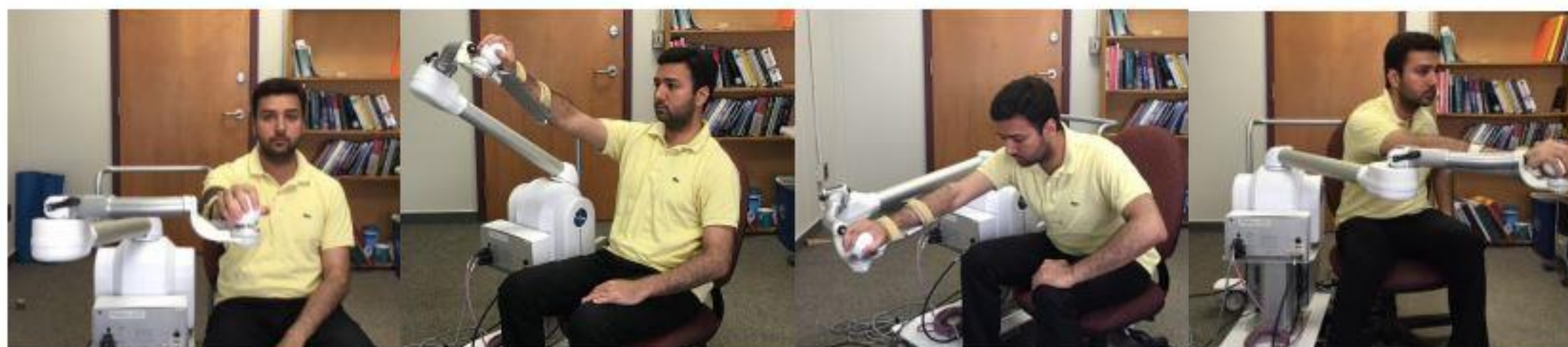
A: Correct posture

B: Incorrect 1: Leaning backward

C: Incorrect 2: Leaning forward

D: Incorrect 3: Moving Shoulder

Feature Extraction

Compute elevation, azimuth and humeral rotation angles of upper arm, elbow flexion angle, normal vector perpendicular to the coronal body plane, angle between shoulders and the spine using the Microsoft Kinect.

Classification

Train a Naïve Bayes classifier based on these features

Post-processing

Classifier outputs posture labels every frame. A sequence label is obtained after applying majority voting on the exercise sequence.

Experimental Results

- Recorded a dataset of 8 subjects performing several repetitions of an exercise using the Microsoft Kinect.
- Each participants performed the exercise with 4 variations: one with the correct posture and three with common incorrect postures.
- We trained our classification model on data from 4 subjects, validated on 2 subjects and tested on 2 subjects.

H \ T	A	B	C	D
A	191	5	7	0
B	14	158	3	0
C	5	0	136	0
D	0	0	0	75

Average Accuracy: 94.87%