Post-stroke patients' rehabilitation exercise assessment from Vicon-based skeletal angle displacement using Convolutional Neural Network

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Abstract: Stroke is one of the leading causes of neurological disorders, and around 1 million people suffer from stroke in the United States. Two-thirds of these individuals survive and requires rehabilitation exercise in their daily life to improve their quality of life. Automatically assessing these performed rehabilitation movements is inherent to improving post-stroke patients' overall physical condition. With the recent growth in computer vision research, people are using motion capture systems to perform physical exercises, workouts, and training at their preferred place, as these systems occupy less space but provide flexibility to the users. This work assesses post-stroke patient rehabilitation movement from full-body skeletal joint displacement data sensed through vision-based Vicon sensors for ten exercises. We take advantage of transfer learning to strike the right balance between computation and performance. We propose a convolutional neural network (CNN) and train it using 117-dimensional skeletal angle displacement data from Vicon. This pre-trained convolutional neural network is fine-tuned for each post-stroke exercise movement. We use the publicly available rehabilitation exercise dataset to showcase the effectiveness and efficacy of our proposed simple CNN model. Our pretrained CNN model outperforms existing state-of-the-art complex Spatio Temporal Convolutional NN and achieves an **average of 0.005795 MAD and 0.00786944 RMS error**.