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Computer-Vision-Based Clinical Assessment of Upper Extremity Function

Clinical assessment of upper extremity function typically relies on subjective evaluation of movement quality and/or time spent to complete a given task. This is neither objective nor sensitive enough for subtle changes related to patient progression. Some systems use motion analysis with skeletal tracking software. However, these systems do not perform well if there are any objects between the camera and the patient and don't provide information about fingers. These systems only assess gross movement, which prevents assessment of functional tasks involving hand-object interactions, such as object grasping and manipulation.

Researchers at Arizona State University have developed novel computer vision algorithms to provide an objective and reliable assessment of upper extremity function of patients during standard/routine clinical evaluation. Because low-cost cameras are used and wearable sensors or motion markers are not required, this system is easy to set up and implement with minimum time, effort and cost. This system provides kinematic tracking of all upper extremity body segments, including fingers, to generate reliable, empirically-validated and objective evaluations on specific components of patients' sensorimotor function. Further, this system has the ability to track objects in addition to upper extremity body segments, allowing estimation of hand-object interactions in functional tasks.

This system provides an objective tool, to be used as part of a complete assessment of patients' sensorimotor function, to help clinicians make better decisions about patient-specific interventions.

Potential Applications

• Upper extremity evaluation

o Helps clinicians design optimal, patient-specific interventions (different types of physical therapies) based on level and source of impairment

o Helps in evaluating efficacy of interventions

o Provides historical data to show patient recovery progress

Benefits and Advantages

• Able to track hand-object interactions

• Objective and reliable

• Does not require complex/expensive wearable sensors or motion trackers

• Kinematic tracking of all upper extremity body segments, including fingers

• Provides historical data to show progress of a patient's recovery

• Movement is recorded continuously and in real time

• Data is output and summarized in graphical and tabular formats for easy interpretation

• Uses low-cost cameras

For more information about the inventor(s) and their research, please see Dr. Santello's laboratory webpage