Non-Contact versus Contact-based Sensing Methodologies for In-Home Upper Arm Robotic Rehabilitation

A. Howard, D. Brooks: Georgia Institute of Technology, USA
E. Brown, A. Gebregiorgis: Rochester Institute of Technology, USA
Y.P. Chen: Georgia State University, USA

- Two sensing methods have been developed for extracting upper-arm movement characteristics through robot interaction
- The physical contact method utilizes EMG sensors coupled with a Hidden Markov Model (HMM) algorithm
- The non-contact method uses off-body camera data coupled with image-processing techniques
- Preliminary results compare the advantages and limitations of each approach as applied to an in-home rehabilitation scenario
Arm support in sub-acute stroke rehabilitation

• ROBAR implementation study:
  – Application of arm support in 7 stroke rehabilitation centers

• RCT of arm support training ↔ conventional therapy:
  – Arm function ↑ in both groups
  – Gains after equal intensity training:
    arm support = conventional therapy
  – User acceptance positive by both therapists and patients
Assessment of upper limb motor function in patients with Multiple Sclerosis using the Virtual Peg Insertion Test: a pilot study

O Lambercy, M-C Fluet, R Gassert: ETH Zurich, Switzerland
I Lamers, P Feys: Hasselt University, Belgium
L. Kerkhofs: Rehabilitation & MS Center Overpelt, Belgium

• 10 multiple sclerosis patients were evaluated on the Virtual Peg Insertion Test, a haptic/VR assessment tool, and compared to performance of 8 healthy subjects
• Nine out of ten patients could perform the test, illustrating feasibility
• Execution time correlated well with clinical measures, and intention tremor was quantified using a frequency analysis
The Manumeter: A non-obtrusive wearable device for monitoring spontaneous use of the wrist and fingers

J Rowe, N Friedman, M Bachman, D Reinkensmeyer: University of California Irvine (UCI)

- Design and pilot testing of a novel device for unobtrusive monitoring of wrist and hand movement called the manumeter.
- Magnetometers in a watch-like unit sense the field produced by a magnetic ring to estimate wrist and finger joint angles.
- Joint angle estimates were found to be within roughly 6° of their actual values.
Effort, performance, and motivation: Insights from robot-assisted training of human golf putting and rat grip strength

JE Duarte, B Gebrekristos, S Perez, JB Rowe, K Sharp, DJ Reinkensmeyer: University of California, Irvine, US

- Robotic devices were used to modulate the success rates and required effort levels in training humans in a virtual game of golf putting and rats in a grip strength task.
- Robotic assistance in golf putting increased participants feelings of competence and sense of effort but had mixed effects on learning.
- Reducing required effort led rats with SCI to practice the grip strength task more frequently but not exceed gains achieved by rats who exercised less frequently but at higher forces.