3 COPDTrainer: A smartphone-based motion rehabilitation training system with real-time acoustic feedback

Patient motion training requires adaptive, personalized exercise models and systems that are easy to handle. In this work, we evaluate a training system based on a smartphone that integrates in clinical routines and serves as a tool for therapist and patient. Only the smartphone's build-in inertial sensors were used to monitor exercise execution and providing acoustic feedback on exercise performance and exercise errors. We used a sinusoidal motion model to exploit the typical repetitive structure of motion exercises. A Teach-mode was used to personalize the system by training under the guidance of a therapist and deriving exercise model parameters. Subsequently, in a Train-mode, the system provides exercise feedback. We validate our approach in a validation with healthy volunteers and in an intervention study with COPD patients. System performance, trainee performance, and feedback efficacy were analysed. We further compare the therapist and training system performances and demonstrate that our approach is viable.

Spina, Gabriele, et al. "COPDTrainer: a smartphone-based motion rehabilitation training system with real-time acoustic feedback." Proceedings of the 2013 ACM international joint conference on Pervasive and ubiquitous computing. ACM, 2013.