VIGOR-- A Virtual, Individualized and Generative Orchestrator for Rehabilitation

Physical inactivity is a major national concern, particularly among individuals with chronic conditions and/or disabilities. There is an urgent need to devise practical and innovative fitness methods, designed and grounded in physical, psychological and social considerations that will effectively promote physical fitness participation among individuals of all age groups with chronic health condition(s) and/or disabilities. The proposed project is dedicated to achieving Virtual, Individualized, and Generative Orchestrator for Rehabilitation (VIGOR). Tai-Chi is a traditional mind-body wellness and healing art, and its clinical benefits have been well documented. A Tai-Chi version called VIGOR will be developed. Through the use of Helping, Pushing and Coaching functions (HPC) by following Tai-Chi kinematics, the VIGOR system is designed to make engagement in physical activity an affordable, individually engaging, and enjoyable experience for individuals who live with disabilities due to disease or injury. VIGOR aims to enable users an intelligent, four-dimensional (namely X-Y-Z plus somatosensory), partial control (e.g., phantom limb), and virtual-reality-enabled generative modality. To incorporate simplicity, skimpiness, scalability, and speed (SSSS) into VIGOR, the project focuses the following challenging technique problems: (1) deep learning (e.g., recognition, classification, generation of phantom-limbs and individualized choreography) about the human musculoskeletal kinematics from small data; (2) seamless integration of neural network with physical therapy and human pathology; (3) real-time analysis of 4D kinetic data over relatively affordable hardware platform.

Keywords: deep learning, 4D experience, virtual reality, kinetics, rehabilitation, physical inactivity.

Figure 1: (a) Classification of Help-Push-Coach (HPC) schemes; (b) A snapshot of VIGOR’s virtual reality (VR) interface developed based on the Unit3D platform (online video: https://www.youtube.com/playlist?list=PL8kjZ32ptmjYM3vubpAX919Ea18MoOg1z)