Researchers at the Advanced Digital Sciences Center (ADSC) have demonstrated a low-cost automated assistant to help patients perform rehabilitative physical therapy (PT) at home, reducing the need for expensive one-on-one sessions with physical therapists and limiting the need for frequent travel to and from therapy sessions—a boon for the many patients with limited mobility due to strokes and major muscular and skeletal problems. The PT assistant sends a summary of the completed exercise session to the attending physical therapist, allowing the therapist to support a larger case load while still providing traditional one-on-one physical therapy sessions in the clinic whenever needed.

ADSC’s PT assistant runs on any PC with a conventional + depth camera, such as Microsoft’s Kinect. The patient chooses an exercise from the assistant’s menu of assigned exercises, such as the shoulder exercises shown in Fig. 1, and performs the exercise in front of the camera. The assistant provides instructions on how to do the exercise, analyzes the video feed, and gives continual feedback on the patient’s performance. For example, in Fig. 1a, ADSC engineer Pei Yong is performing shoulder rotations, while the screen reports each arm’s current degree of rotation from the vertical plane. The camera is on a small tripod on the desk. In Fig. 1b, the assistant reminds Pei how to perform pendular exercises, while preparing to count his repetitions for each arm. If Pei does not perform the exercise properly, the assistant alerts him to the problem. In Fig. 1c, the assistant reports the degree of flexion for each elbow. The assistant can be bundled with video chat facilities to allow the therapist to observe the session remotely. If desired, portions of the session can be recorded and sent to the therapist after the session.

ADSC is working with four Singapore hospitals to test the PT assistant in clinical and home settings. The depth camera uses infrared structured lighting techniques to determine the distance between the camera and each point in the scene. Compared to traditional images, depth camera images make it easier to detect people and track their movement.

The PT assistant is an application of ADSC’s basic research on recognizing actions and activities in video, a key feature for virtual reality. More information is available at http://adsc.illinois.edu.

About Us
ADSC is a wholly-owned subsidiary of the University of Illinois at Urbana-Champaign. ADSC’s research program in interactive digital media is funded by the Agency for Science, Technology, and Research (A*STAR).