

Chapter 23

A Survey of Using Microsoft Kinect in Healthcare

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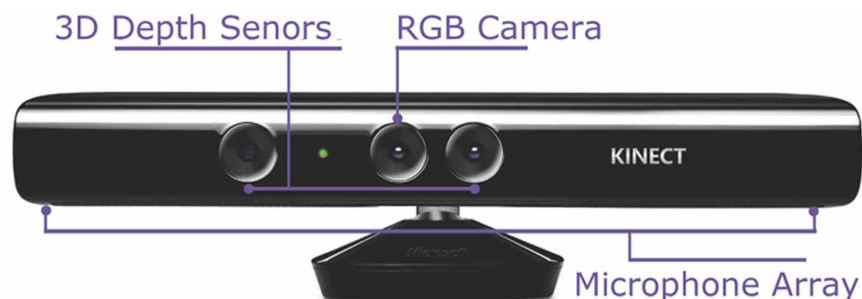
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INTRODUCTION

Launched in 2010, the Microsoft Kinect device is one of the most popular game controllers in recent years. Kinect allows users to naturally interact with a computer or game console by human body movement or voice command. At a very affordable price ranging from \$99 to \$200, Kinect is built with a color camera, infrared depth sensor, and a multi-array microphone, as shown in Figure 1. In late 2011, Microsoft released the Software Development Kit (SDK) for Kinect, which enables users to develop sophisticated computer-based human body tracking applications on both C# and C++ programming platforms (Jana 2012). Through the SDK, Kinect provides skeleton tracking of the positions of 20 articulated joints of the human body (Shotton et al., 2013), shown in Figure 2.

Figure 1. The Kinect sensor



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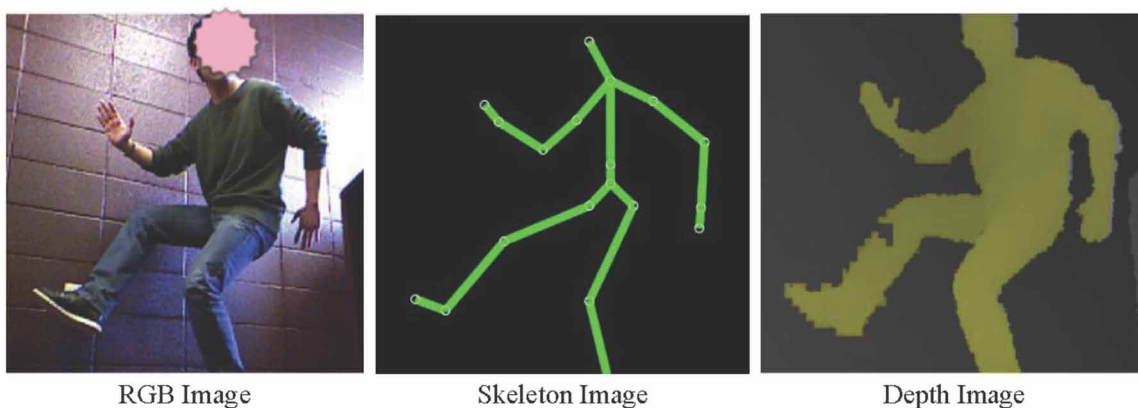
The low-cost, and the availability of SDK for the Kinect sensor has attracted many researchers to investigate its applications beyond the video gaming industry, particular in the healthcare realm (for example, Brian et al., 2012). As the aging population rapidly grows in the United States, demands of healthcare services, especially physical therapy and rehabilitation services, have grown enormously in recent years. To meet the increasing demands and reduce the cost of services, providers are often looking for computers and other equipment that can assist them in providing services to patients in an affordable, convenient, and user-friendly environment. As a low-cost, portable, accurate, nonintrusive, and easily set up motion detecting sensor, Kinect enables researchers to develop computer-based vision control without using traditional input devices, e.g. mouse, keyboard, or joystick. This revolutionary technology makes it possible for Kinect to meet the challenge of providing high quality evaluations and interventions at an affordable price for healthcare services, as seen from the works surveyed in this article.

BACKGROUND

Computer-vision based human body motion capturing and analysis technologies have become increasingly popular in healthcare, especially in the applications that require tracking human activities. However, such motion analysis systems are generally used in specific laboratories rather than in more convenient locations, e.g. physician's office, or even the patient's home, due to their size, high cost, and difficulty of setup. Most importantly the use of wearable sensors is intrusive to patients and it is very difficult for patient with hand impairment to set up wearable sensors.

With the launch of the Kinect sensor, researchers have paid great attention to applying the Kinect technology to healthcare related services, such as physical therapy exercises, sports rehabilitation games, motor skill training, monitoring patient activities, medical operating room assistance, and other clinical areas, which will be surveyed in the next section.

Figure 2. Kinect color, skeleton, and depth images



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