

Chapter 111

Recognizing Physical Activities using Wearable Devices

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ABSTRACT

Physical activity is a major part of the user's context for wearable computing applications. The System should be able to acquire the user's physical activities using body worn sensors. The authors propose developing a personal activity recognition system that is practical, reliable, and can be used for health-care related applications. They propose to use the wearable device which is a readymade, light weight, small and easy to use device for identifying physical activities (i.e. lying, sitting, walking, standing, cycling, running, ascending stairs and descending stairs), fitness studio activities (i.e. using elliptical trainer, butterfly, bench-press and pull down) and swimming techniques (i.e., dolphin, back-stroke, breast-stroke and free-style) using machine learning algorithms. In this chapter, the authors present an approach to build a system that exhibits this property and provides evidence based on user studies. Their results indicate that the system has a good accuracy rate.

INTRODUCTION

Human activity recognition by using body worn sensors has received attention in recent years. It is an important and challenging field which can support many novel ubiquitous applications. Activity recognition is a multidisciplinary research area which covers artificial intelligence, ubiquitous computing and human computer interaction. The aim of an activity recognition system is to recognize the actions or activities of its users by unobtrusively observing the behavior of people and take necessary actions in response. Activity recognition systems in health care support especially in elder care, long-term health/fitness monitoring, and assisting those with cognitive disorders (Axivity, 2012; xsens, 2014) (Lester et al., 2006) has been demanded. Therefore, recognizing human physical activities with body worn sensors

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is not a new research field; much research has already been done in this area. We can identify users' physical movements using a body movement suit (xsens, 2014). We also have other research projects where researchers identify the users' physical activities using some sensors like (Lester et al., 2006; Laerhoven and Aronsen, 2007; T. Choudhury et al, 2008; Kern et al., 2003; Maurer et al., 2006; Bao and Intille, 2004).

In some diseases like diabetes, heart problems, mentally disabled persons, elder patients are required to perform some physical activities in order to make them physically fit. Similarly, in some cases patients need to be monitored by nurses which is very time consuming and expensive.

Modern day lifestyle has led to various physical and mental diseases such as diabetes, depression and heart diseases as well. According to the World Health Organization, there are at least 1.9 million people dying as a result of physical inactivity annually (move for health, 2014; Manson et al., 2004).

Although, people are aware of the importance of exercise there is a lack of motivation due to their busy schedules. People need to be forced and reminded about physical activities. Probably automatic and personal reminders can be very helpful if it can monitor one's physical activities and persuade people to perform them regularly.

Activity recognition technology can tackle this problem as it is able to monitor an individual's physical activities and their duration in order to estimate how much calories are being consumed on a daily basis. Those systems can also provide recommendations when they fail to complete enough exercise and it also encourages people to conduct more activities (Consolvo et al., 2008; Lin et al., 2006; Anderson et al., 2007).

In some cases, especially in heart diseases, physical activities are also required along with the physiological information for doctors in order to examine their patient's conditions when he is away from the doctor's clinic (Khan, 2011b).

We want to develop a physical activity recognition system using a minimum amount of sensors which should be able to identify the basic activities like lying, walking, running, sitting, standing, cycling, ascending and descending stairs.

In our research we want to prove that it is possible to identify the aforementioned activities for a specific user by using a 3D accelerometer. In next chapter, "related work" will be discussed, "hypothesis and research question" will be discussed in the 3rd chapter, "experimental methodology" will be discussed in the 4th chapter, "evaluation" will be discussed in the 5th chapter and "conclusion and future work" will be in the last.

RELATED WORK

There are several ways to recognize a person's daily activities. One way is using cameras to visually detect people's motion (Pavan et al., 2008; Hu et al., 2004). The drawback of this solution is that a large number of cameras would be required in order to monitor a moving person. This system would also need to be designed to compute information from each camera and deal with other factors such as light, distance and angle, which make the system impractical. Researchers have identified various physical activities using wearable sensors like sitting (Lester et al., 2006; Kern et al., 2003; Manson et al., 2004; Bao and Intille, 2004), standing (Lester et al., 2006; Kern et al., 2003; Manson et al., 2004; Bao and Intille, 2004), lying (Kern et al., 2003), walking (Lester et al., 2006; Laerhoven and Aronsen, 2007; Kern et al., 2003; T. Choudhury et al, 2008; Kern et al., 2003; Bao and Intille, 2004), climbing stairs (Lester et

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