Demonstration Abstract: Detecting Deterioration of Nearsightness

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ABSTRACT

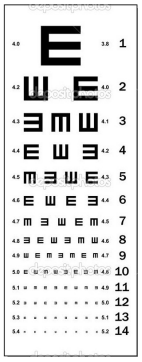
Myopia becomes a more and more serious worldwide problem as the number of myopic people (especially young people) grows rapidly. Efficient methods are required to monitoring the deterioration of nearsightness so as to take further treatment. This demo realizes a noval nearsightness monitoring system, called iSee, which utilizes the widely used smartphones to detect the deterioration of nearsightness by monitoring and analysing the the distance between the eyes and the smartphone screen. A prototype of iSee has been developed to evaluated the effectiveness under different environmental conditions.

1. INTRODUCTION

The number of myopic people grows rapidly in the last three decades. For example, over 25 percent of all adult Americans or 70 million people have myopic problem, and the number is still growing [1]. In India, the number of myopic people is near 300 million [2]. China has the largest population, and the myopia problem is also the most serious in the world. More than 33 percent or 400 million Chinese people are myopic [3]. And near 90 percent of students in the Chinese universities are nearsighted. Therefore, the myopic problem is very serious in the world.

Efficient mechanism is required for people with myopia to chech whether their nearsightness is becoming worse, so as to remind them to keep eye health, change eyeglasses or other further treatments. Accurate vision examination is typically performed by a specialized doctor, the ophthalmologist, or by an optometrist or orthoptist with autorefractor[4]. The myopics are usually advised to have vision examinations regularly. The vision examination process is a time-consuming work. Most of the myopias regard it as a fussy work and are probably unwilling to do the vision examination as the doctor advised. The eye chart examination is an inaccurate way to test ones' vision as shown in Figure 1b. People can test their vision every day using an eye chart. However, most people leave the eye charts unused except the first few days they take them home. More over, such examination can not record the vision degradation process, nor it can remind the myopias to perform an accurate vision examination.

(a) autorefractor



(b) eye chart

Figure 1: Vision examination

This demo presents an novel system called iSee to monitor the status of nearsightness by utilizing the smartphone that every one use every day. iSee will automatically detect whether one is watching a phone or a mobile device, and etimate the distance between one's eyes and the screen. The distance is recorded by iSee and through a long time monitoring, iSee is able to tell whether one's nearsightness is becoming more and more worse.

2. SYSTEM OVERVIEW

Figure 2 presents a global view of iSee system. iSee first perform an activity recognition process. A sudden moving of one's head or body has a strong impact of the monitoring result. iSee employs the 3-axis acceleration sensor to determine whether a user is watching a phone calmly. Once a calmly watching activity is recognized, iSee takes a photograph and send it to the cloud center. The cloud center detects the face and localizes the two eyes with Face++ [5]. The distance between eyes and the screen is estimated by the ratio of the photograph width and the two-eye distance. The photograph and the position of the two eyes are stored in the cloud center. An analysis process is performed periodically. iSee provides people the changing curve of their eyes'

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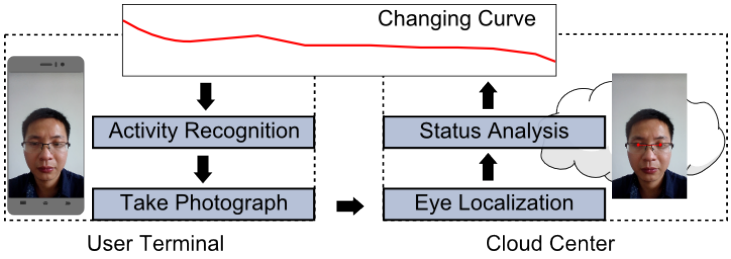

Figure 2: System architecture

status, iSee can also warn people from long time near reading, alert people to take a treatment when a deterioration of their nearsightness occurs, and detect whether pseudomyopia happens.

2.1 Activity Recognition

The activity recognition process is used to determine whether one is watching the screen carmly. A temporary or sudden moving of one's head or body needs to be avoided. Therefore, the activity recognition is very important. In the entire monitoring processes, a high quality of activity recognition can greatly reduce the transmission data amount and improve the monitoring accuracy.

2.2 Eye-Screen Distance Estimation

The eye-screen distance is estimated by the ratio of the photo width and the two-eye distance. The estimated distance is proportional to the real eye-screen distance. This is easy to understand. When one's face is far way from the screen, then the two eyes are closer to each other in the photo (as shown in Figure 3a). In contrast, when one's face is closer to the screen, then the two-eye distance is larger (as shown in Figure 3c).

(a) (b) (c)

Figure 3: Looking at phone at different distances

3. DEMO INTERFACE

Figure 4 is the user interface of iSee. iSee automatically determines whether a user is watching a phone calmly, and take a photograph under the condition of less communication and storage cost. The photograph is send to the cloud center to detect the face and locate the two eyes. The positions of two eyes is stored at the cloud center, and is also send back to the user. The cloud center will filter those photographs that are taken at wrong time, e.g. one moves his hand or body suddenly. After a long term analysis, iSee can find wheter the nearsightness is becoming worse, and can

Figure 4: User interface

also detect pseudomyopia. iSee does not realize the identification authentication. A different person using the same phone will cause noise. Identification authentication can be realized by some techniques, such as fingerprints recognition, face recognition, use habit recognition, and so on. This will be completed in the future work.

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