Chapter 75
A Face Based Real Time Communication for Physically and Speech Disabled People

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ABSTRACT

The main purpose of this research is to enhance the communication of the disabled community. The authors of this chapter propose an enhanced interpersonal-human interaction for people with special needs, especially those with physical and communication disabilities. The proposed model comprises of automated real time behaviour monitoring, designed and implemented with the ubiquitous and affordable concept in mind to suit the underprivileged. In this chapter, the authors present the prototype which encapsulates an automated facial expression recognition system for monitoring the disabled, equipped with a feature to send Short Messaging System (SMS) for notification purposes. The authors adapted the Viola-Jones face detection algorithm at the face detection stage and implemented template matching technique for the expression classification and recognition stage. They tested their model with a few users and achieved satisfactory results. The enhanced real time behaviour monitoring system is an assistive tool to improve the quality of life for the disabled by assisting them anytime and anywhere when needed. They can do their own tasks more independently without constantly being monitored physically or accompanied by their care takers, teachers, or even parents. The rest of this chapter is organized as follows. The background of the facial expression recognition system is reviewed in Section 2. Section 3 is the description and explanations of the conceptual model of facial expression recognition. Evaluation of the proposed system is in Section 4. Results and findings on the testing are laid out in Section 5, and the final section concludes the chapter.

INTRODUCTION

Communication is a social process of exchanging information from one entity to another in verbal and non-verbal form. It defines our existence and it is an important instrument that connects people together. It comes naturally as a raw skill embedded in most people at birth and we acquired the ways of communication through cognitive learning. Communication is the basis, which drives the process of development in all the fields (Manohar, 2008) and it is the very core of our civilisation. The ability to communicate allows us to express emotion, feelings, convey our thoughts and ideas as well as to relate our experiences. It plays an important role in the dissemination of information and sharing of knowledge especially in the academic arena. Research has found that human started to learn how to communicate with each other since they are born not only through spoken and written languages but also body gesture, posture, facial expression and eye contacts (Busso, et al., 2004; Cohen, Grag & Huang, 2000).

Communication skill might come as a natural ability in majority of people. However, there are some people inflicted with some form of physical defects which affect their ability to communicate. One of the more severe disabilities is known as "cerebral palsy", a congenital disorder at birth which causes abnormality in their motor system. It affects their muscle movement and coordination, learning and speech abilities. Their malfunctioned motor system causes an uncontrollable and involuntary movement. They are unable to control their oral-facial muscles, thus affects their ability to perform facial expression appropriately.

Many assistive tools or formally termed as Alternative and Augmentative Communication (AAC) has been developed and employed to assist people with impaired communication skills. The term encompasses the whole combination of methods used for communication such as text to speech system, pointing gestures, facial expression and body language. Although these AACs have

been widely used to assist the disabled, but it is not potentially effective because most AACs are text to speech and touch screen based applications, which are unsuitable for those with severe physical abilities. There are many kinds of AACs tools available in the market which is shown in Figure 1.

From the limitation of the existing tools reviewed (Novita, 2006; Macsolvers, 2009; Standup, 2006; Universiteit van Amsterdam, 2008; Crestwood, 2009; ScienceDaily, 2008), there is still a pressing need for more effective and efficient tools to alleviate this problem. One the possible methods is to implement a facial expression recognition system to predict or determine the emotional state of a disabled person through his expression projected on his face. The implementation of such method can be made possible through biometrics information systems. According to Gregory and Simon (2008), biometrics information system can be employed as a means to detect and classify the physiological aspect of a person in real time. Franco and Treves (2001) further support the notion that facial expression can be used for human computer interaction and usability enhancement.

Based on the problem statements deliberated above, we propose an improved real time behaviour monitoring application for the disabled by employing real time biometric information i.e. the facial expression recognition system. The aim to create a model that is capable of detecting user's emotion without engaging any physical action from the users. To increase the usability and interactivity of the tool, the emotion detected by the system will be sent to the care-taker's mobile phone in the form of SMS.

FACIAL EXPRESSION

Facial expressions recognition is an ability to recognize people by their facial characteristic and differentiate it with one another. Human is born with the ability to recognize other people easily by identifying their facial features such as shape,

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