Chapter 13

Visual Gesture–Based Character Recognition Systems for Design of Assistive Technologies for People With Special Necessities

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ABSTRACT

In the present scenario, around 15% of the world's population experience some form of disability. So, there has been an enormous increase in the demand for assistive techniques for overcoming the restraints faced by people with physical impairments. More recently, gesture-based character recognition (GBCR) has emerged as an assistive tool of immense importance, especially for facilitating the needs of persons with special necessities. Such GBCR systems serve as a powerful mediator for communication among people having hearing and speech impairments. They can also serve as a rehabilitative aid for people with motor disabilities who cannot write with pen on paper, or face difficulty in using common human-machine interactive (HMI) devices. This chapter provides a glimpse of disability prevalence around the globe and particularly in India, emphasizes the importance of learning-based GBCR systems in practical education of differently-abled children, and highlights the novel research contributions made in this field.

INTRODUCTION

Gestures play an important role in our day to day communication. A gesture may be defined as a physical movement of body parts such as hands, arms, head, face etc. to express some information or feelings (Murthy & Jadon, 2009). Among the various types of gestures, hand gestures are the most common form of communication and interaction. They can additionally have concrete linguistic content in it. Due to the celerity and expressiveness in interaction, hand gestures are widely utilized in sign languages and

human-computer interaction (HCI) systems (Pisharady & Saerbeck, 2015). The ability of a computer or any processing system to understand the meaning of these hand gestures is referred to as hand gesture recognition (HGR). Presently, HGR has become a highly developing research field for the purpose of human computer interaction (HCI). Such recognition systems are deployed to serve as a replacement for the commonly used human-machine interactive (HMI) devices such as keyboard, mouse, joystick etc. in real world situations (Karray et al., 2008). There are several applications of HGR systems such as gesture based character recognition (GBCR), sign language recognition (SLR), human-robot interaction (HRI), controller less video gaming, smart TV, video surveillance, video conferencing etc. (Hasan & Kareem, 2012). Among these, GBCR is an active topic of research as it aids in assisting people with special necessities as well as improving the quality of life of elderly and general individuals by increasing their comfort through smart interfaces for human-machine interaction.

Overview of Disability and Its Prevalence From Global and Local Perspective

As defined by the World Health Organization (WHO), Disability is an umbrella term covering impairments, activity limitations and participation restrictions. Impairment is a problem in body function or structure; an activity limitation is a difficulty encountered by an individual in executing a task or action; while participation restriction is a problem experienced by an individual in involvement in life situations (Ministry of Statistics and Programme Implementation, 2011). Thus disability is an intricate phenomenon reflecting an interaction between elements of a person's body and components of the society in which he or she lives. Individuals with disabilities are often subject to different hardships with constrained access to essential services; including education, employment, work, rehabilitation facilities and so on.

Disabilities can be categorized mainly into the following broad categories: motor, vision, hearing, cognitive and communication disabilities. These are described as follows (Scholz, 2015):

- **Motor Disabilities:** Mobility impairments, affect the upper as well as lower appendages. They include, for example, cerebral paralysis, spinal cord injuries (traumatic and non-traumatic), Parkinson's disease, multiple sclerosis, amyotrophic lateral sclerosis, shifting degrees of paralysis including locked-in syndrome and so forth.
- **Vision Disabilities:** Vision impairments range from low-vision to blindness. Visual weakness can be the consequence of damage to the eye or various eye-related conditions, for example, age-related macular degeneration, glaucoma, diabetic retinopathy etc.
- **Hearing Disabilities:** Hearing weakness, or deafness, can be innate. It can likewise come about because of ailment (for e.g. ear infections and meningitis), trauma, the side-effects of certain medicines, long-term exposure to loud noise, and ageing.
- **Cognitive or Learning Disabilities:** Cognitive disabilities envelop different conditions influencing scholarly or intellectual capacity, such as Down syndrome, traumatic brain injury, autism and dementia. Cases may likewise incorporate less extreme conditions such as dyslexia, attention deficit disorder and other learning disabilities that include problem-solving, numerical cognizance, reading, linguistic and verbal comprehension.
- **Communication Disabilities:** Speech impairments may extend from mild to extreme and refer to an impaired capacity to create speech sounds. They include articulation disorders (exclusions or contortions of sounds), fluency issue (atypical flow or rhythm) and voice disorders (anomalous pitch, volume, vocal quality or duration).

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