Chapter 51

A Review of Interventions with Assistive Technologies for Patients with Cognitive Impairment

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ABSTRACT

Advances in technology in the last decade have created a diverse field of applications for the care of persons with cognitive impairment. This chapter is an attempt to review these advances in a systematic way, and focuses on observations of current software engineering systems (computer based assistive interventions) that contribute to the diagnosis and treatment of patients with cognitive problems. Nevertheless a holistic approach has been attempted, in order to view the research themes and applications that currently exist around the "intelligent systems" healthcare given to the cognitively impaired persons, thus looking at research directions, systems, technological frameworks and trends.

INTRODUCTION

According to the World Health Organization (2009), the number will increase two-fold to 1.2 billion people by 2025. This is a statement that concerns a set of people closely related to potential cognitive impairment developed in their aging process. However, it is known that beyond this, cognition problems can affect all groups of people depending upon various causes. These can be age, intellectual or learning disabilities, autism, dementia, acquired brain injury or mental illness.

Cognitive brain capacities like attention, memory, problem solving, information and sensory processing, are the basic tools developed from the early stage of our biological lives. For some people these capacities strengthen over the course of their life, while for others they worsen due to ageing[1]. Emerging tools in algorithmic and computational methods that are used and implemented in software and hardware systems, try to improve the work of the medical services in favour of the cognitively impaired (CI) individuals.

Artificial, machine, and computational intelligence in dedicated hardware and software forms is being researched in order to find more effective and widely applied means for the diagnosis and assistance of individuals with CI. Neuropsychology tools translated in machine or computational intelligence can interfere by diagnosing brain capabilities and thus disclose unwanted events in the long run.

COGNITIVE IMPAIRMENTS

There is no definition for the state of individuals with cognitive impairment, as stated by LoPresti and colleagues (*LoPresti et al*, 2008). There is also no clear definition of the 'normal' cognitive behaviour and the 'abnormal' one. In psychological and medical terms this distinction is made, if there are primarily continuous and periodic dysfunctions of the basic cognitive functions like memory, orientation or for example, the inability of basic arithmetic calculations (talking about persons that have had basic education), including of course other biological-body parameters, like age and medical history. It has been evident, that cognitive problems may affect a person's life and his surrounding social environment. If one commutes and is in no position to return home, or drives a car and keeps being distracted causing a traffic accident, then the need is immediately defined.

Assistive technologies and methods can aid people to improve in combination with the expert environment, taking into account human brain capability and the 'neuro-adaptiveness' as recently reviewed by Kolb et al,(2011).

ASSISTIVE TECHNOLOGIES

A Scope View

The scope of the emerging assistive technologies developed in the last years, which aim at aiding people with cognitive impairments, is simple. They intervene in the best way on the individual's disability in a supportive manner. The support given may be diagnostic, short or long term therapeutic and in general contributing to the stimulation and reinforcement of the individual's inherent adaptive capabilities. Kirsch and colleagues make a proposition for the engineering systems with this purpose, stated with the following words (Kirsch et al, 2004, Morganti et al 2005):

In regard to device features, an ideal intervention will be one that is minimally intrusive, provides assistance without assuming unnecessary control, and does not demand of the user an uncharacteristic level of comfort with technological aids.

From this retrospective view, we may find that in the vast research fields, many assistive technologies and methods aim at creating systems under this condition. The potential impact of any of these systems

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