Chapter 16
A Review of Supportive Computational Approaches for Neurological Disorder Identification

Dulani Meedeniya
https://orcid.org/0000-0002-4520-3819
University of Moratuwa, Sri Lanka

Iresha Rubasinghe
University of Moratuwa, Sri Lanka

ABSTRACT

At present there is a growth of physical symptoms with psychological overlays, resulting in neurodevelopment disorders, where both psychiatrist and medical specialties work in collaboration to provide optimal care for the patients. Disorders such as autism spectrum disorder, attention-deficit hyperactivity disorder, Down syndrome, cerebral palsy, sickle cell disease, and Alzheimer disease are more prevalent. These may have a genetic influence and give certain behavioural disturbances due to associated medical issues. The symptoms are observable in early childhood, and they may consist of comorbid medical disorders. This chapter addresses recent studies together with the applied techniques in this context. Further, this chapter shows the limitations, challenges in current practices, and possible future research directions.

INTRODUCTION

Overview of Neurological Disorders

Healthy lifestyles and behaviours are important for the betterment of society. Health informatics is a rapidly evolving area that acquires, analyse and manage biomedical and healthcare data in conjunction with computer engineering to provide a better healthcare service. At present there is a growth of physical

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symptoms with psychological overlays, resulting in neurodevelopment disorders, where both psychiatrist and medical specialities work in collaboration to provide optimal care for the patients. Disorders such as Autism Spectrum Disorder (ASD), Alzheimer Disease, down syndrome, Attention-Deficit Hyperactivity Disorder (ADHD), cerebral palsy, Sickle Cell Disease (SCD), depression, dyslexia and anxiety are more prevalent (Wilhelm, Schneider, & Friedman, 2006). Neurological disorders directly affect the brain and nerve system and causing development disabilities, which have become one of the major health issues worldwide (WHO, 2016). Some of these disorders are mostly encountered in children and continuing to adulthood that can be a lifelong health problem.

At present, here is an increasing growth in psychophysiological disorders. World statistics have shown that 9.4% of children have diagnosed with ADHD in 2016. The rate of ADHD affected children has increased by more than 50% from 2008 to 2012 (CDC, 2018). According to USA statistics, there is an ASD patient in every 68 children. In a recent study in Sri Lanka, being a developing country, it is found that 10% of the children involved in the study are suffering from ASD. Another study shows that 1 in every 93 children are affected by ASD in Sri Lanka (Rohanachandra, Dahanayake, Rohanachandra, & Wijetunge, 2017). Thus, it requires special attention, awareness and treatments of neurological disorders.

The neurological disorders may have a genetic influence and give certain behavioural disturbances due to associated medical issues. The symptoms such as hyperactivity, impulsivity and inattention are observable in early childhood and they may consist of comorbid medical disorders (Henry et al, 2016). These disorders show a high rate of patterns of such symptoms compared to normal-healthy people (WHO, 2016).

However, the early identification of most chronic disorders is restricted due to the unawareness and expenses in the check-up procedures used for diagnosis. For example, in general, patients visit a medical practitioner only when experiencing significant symptoms. Further, in practice the chronic diseases diagnosis procedure is performed manually by the medical experts by examining the test reports. Thus, although different types of testing criteria exist based on advanced technologies, the manual contribution can be error-prone, expensive or complex, and required expert knowledge.

Most of the neurological disorders are under-diagnosed due to the lack of accurate diagnosis methods. Consequently, there is a high risk of child patients with these disorders, to continue the symptoms to adulthood (WHO, 2016). Therefore, the early detection and identification of neurological disorders are important to prevent severe symptoms and difficulties in executive comorbidity, where a person can have many disorders at the same time. For instance, some of the disorders with a high risk of comorbidity are depression, anxiety, learning disability, repetitive movements and attention issues. Hence, early diagnosis of the neurological disorders will be helpful to minimize the severe impact on patients and to develop good mental health (Henry et al, 2016).

The psychophysiological data and clinical diagnosis measurements involved in the diagnosis of the disorders include computerized tomography scans, Electroencephalography (EEG), eye movement data, functional Magnetic Resonance Imaging (fMRI), child behaviour analysis and anatomical scales such as Quantitative Electroencephalography (Gemmell & Staff, 2005)(Bailey, 2014)(Abreu, Leal, & Figueiredo, 2018). However, manual diagnosis is still challenging due to complex layers with the encapsulated data.

Chronic disorders are the conditions that last more than three months. It may limit daily activities and requires medical attention continuously (Oliver et al, 2016). Generally, these disorders neither can be prevented by vaccines nor cured by medication. At present there is an increase in patients with chronic disorders. The neurological chronic disorders caused due to differences in brain regions than a healthy