

DIAGNOSTIC AND CLASSIFICATION SYSTEM FOR KIDS WITH LEARNING DISABILITIES

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Abstract

Most experts are using manual techniques to diagnose dyslexia. Machine learning algorithms are capable enough to learn the knowledge of experts and thus, automation of the diagnosis process is possible. In this research, we propose an automated diagnostic and classification system. The system is trained by pre-classified data of 857 school children scores in spelling and reading. The twenty-fifth percentile was applied on the scores to label the data. The scores of the twenty-fifth percentile and below were marked as indicators of children who were likely to have dyslexia while the scores above the twenty-fifth percentile were considered to be indicators of children who were non-dyslexic. The system has three components: the diagnostic module is a pre-screening application that can be used by experts, trained users and parents for detecting the symptoms of dyslexia. The second module is classification, which classifies the kids into two groups, non-dyslexics and suspicious for dyslexia in spelling and reading. A third module is an analysis tool for researchers. The results show that 23% of children were at risk for dyslexia in the training data and 20.7% in the testing data with 98% of accuracy.

KEY WORDS: Diagnosis; Classification; Machine Learning; Algorithm; Dyslexia.

1. INTRODUCTION

“Dyslexia is a specific learning disability that is neurobiological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede the growth of vocabulary and background knowledge.” (International Dyslexia Association, 2017).

Malaysia is a relatively young nation, having a population of 31.66 million (Department of statistics, 2016). Five percent of the Malaysian population are primary school going children (Department of Statistics, 2000). Education is one of the vehicles for achieving the country's vision. In Malaysia, 4-10 % of students have been found to have the signs and symptoms of dyslexia (Dyslexia Association of Sarawak, 2017). Becoming literate is an important milestone in a child's scholarly life and a pathway to academic success into (Grajo, 2012; Snow et al., 2007). However, around the world and in Malaysia, there are children who continue to fall between the “cracks” and are left behind (Fletcher et al., 2004; Gomez, 2004). Drawing from studies overseas, we know that approximately 12% of the United States school population exhibit characteristics of reading disabilities that are heterogeneous (Cattset et al., 2003). Dyslexia affects about 10-15% of the school-age population (Vellutino et al., 2004). Studies in Malaysia on dyslexia have reported similar findings (Vellutino et al., 2004). Studies in Malaysia on dyslexia have reported similar findings (Gomez, 2004). The other two reading disabilities namely, hyperlexia (adequate decoding but inadequate comprehension skills) and language learning disabilities (difficulties in both decoding and comprehension), affect 15% and 36% of poor readers, respectively. Given these risks that children face, it is important that parents and teachers are given the proper tools to diagnose the symptoms of dyslexia in young children (Griffin et al., 1998).

Despite the heterogeneity in reading disabilities, dyslexia has been the predominant focus in Malaysia (Ong et al., 2009). Additionally, norm-referenced assessment for the