Chapter 3
Predicting ADHD Using Eye Gaze Metrics Indexing Working Memory Capacity

Anne M. P. Michalek
https://orcid.org/0000-0001-6850-3948
Old Dominion University, USA

Gavindya Jayawardena
Old Dominion University, USA

Sampath Jayarathna
Old Dominion University, USA

ABSTRACT

ADHD is being recognized as a diagnosis that persists into adulthood impacting educational and economic outcomes. There is an increased need to accurately diagnose this population through the development of reliable and valid outcome measures reflecting core diagnostic criteria. For example, adults with ADHD have reduced working memory capacity (WMC) when compared to their peers. A reduction in WMC indicates attention control deficits which align with many symptoms outlined on behavioral checklists used to diagnose ADHD. Using computational methods, such as machine learning, to generate a relationship between ADHD and measures of WMC would be useful to advancing our understanding and treatment of ADHD in adults. This chapter will outline a feasibility study in which eye tracking was used to measure eye gaze metrics during a WMC task for adults with and without ADHD and machine learning algorithms were applied to generate a feature set unique to the ADHD diagnosis. The chapter will summarize the purpose, methods, results, and impact of this study.

DOI: 10.4018/978-1-5225-7467-5.ch003

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

INTRODUCTION

Attention-Deficit/Hyperactivity Disorder is being recognized as a diagnosis which persists into adulthood impacting economic, occupational, and educational outcomes. Estimates indicate that 3-5% of adults have a diagnosis of ADHD (Willcutt 2012) with prevalence estimated to have increased from 6.1% of the United States population in 1997 to 10.2% of the population in 2016 (Xu et al. 2018). The disorder is behaviorally marked by difficulty with attention to important details, difficulty initiating and completing tasks, and difficulty modulating behaviors appropriately in relation to the situation (Fields et al. 2017; Fostick 2017). According to Barkley (1997), adult ADHD symptoms result from impairments of inhibition or the inability to regulate and modulate prepotent responses. While a diagnosis of adult ADHD presumes disinhibition, little is known about the physiological underpinnings of that cognitive skill in relation to an adult ADHD diagnosis. There is an increased need to accurately diagnose ADHD through the development and implementation of objective and reliable outcome measures which reflect core diagnostic criteria, like inhibition.

Researchers in cognitive psychology evidence attention control as the measurable psychological construct which facilitates inhibitory responses by allocating attention according to task demands, especially in the presence of distracting stimuli (Conway et al. 2005; Engle 2002; Kane et al. 2001). Attention control differentiates success during tasks requiring intentional and sustained constraints for effective inhibition, like dichotic listening (Colflesh and Conway 2007) or processing speech in noise (Rönnberg et al. 2013). Measurements of attention control are demonstrated through differences in working memory capacity (WMC) accounting for approximately 60% of the variance seen across people on measures of WMC, like complex span tasks (Engle et al. 1999). Adults with ADHD have reduced WMC when compared to their peers (Michalek et al. 2014) and, despite the understanding that disinhibition is central to an ADHD diagnosis and differences in WMC mathematically represent the resource which makes inhibition possible, there is a paucity of research investigating physiological responses during measures of WMC which could differentiate adults with and without ADHD.

The primary goal of this work is to determine the feasibility of identifying and integrating eye gaze metrics from a WMC task using machine learning to generate a valid and reliable feature set which indexes and predicts an ADHD

21 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/chapter/predicting-adhd-using-eye-gaze-metrics-indexing-working-memory-capacity/227272

Related Content

Analysis of Risk Factors for Breast Cancer Decision Support System in Egypt

Basma Emad Abd El-Fatah, Mohamed I. Owisand Manal Abdel Wahed (2017). *International Journal of Biomedical and Clinical Engineering (pp. 23-31).*
www.irma-international.org/article/analysis-of-risk-factors-for-breast-cancer-decision-support-system-in-egypt/185621

Data Provenance in Scientific Workflows

Khalid Belhajjame, Paolo Missierand Carole Goble (2009). *Handbook of Research on Computational Grid Technologies for Life Sciences, Biomedicine, and Healthcare (pp. 46-59).*
www.irma-international.org/chapter/data-provenance-scientific-workflows/35687

Development of Portable Medical Electronic Device for Infant Cry Recognition: A Primitive Experimental Study

Natarajan Sriraam, S. Tejaswiniand Ankita Arun Chavan (2016). *International Journal of Biomedical and Clinical Engineering (pp. 53-63).*
www.irma-international.org/article/development-of-portable-medical-electronic-device-for-infant-cry-recognition/170461

HIPAA: Privacy and Security in Health Care Networks

Pooja Deshmukhand David Croasdell (2009). *Medical Informatics: Concepts, Methodologies, Tools, and Applications (pp. 1897-1909).*
www.irma-international.org/chapter/hipaa-privacy-security-health-care/26344

Electrical Conductivity of Skin Compared to Skin Perfusion Recordings

Anders Jarløvand Tim Toftgaard Jensen (2017). *International Journal of Biomedical and Clinical Engineering (pp. 1-17).*
www.irma-international.org/article/electrical-conductivity-of-skin-compared-to-skin-perfusion-recordings/189117