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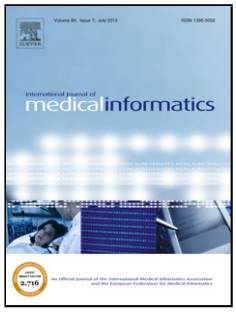

Title: A New Computational Intelligence Approach to Detect Autistic Features for Autism Screening

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PII: S1386-5056(18)30054-6
DOI: https://doi.org/10.1016/j.ijmedinf.2018.06.009
Reference: IJB 3717

To appear in: *International Journal of Medical Informatics*

Received date: 8-2-2018
Revised date: 28-5-2018
Accepted date: 12-6-2018

Please cite this article as: Thabtah F, Kamalov F, Rajab K, A New Computational Intelligence Approach to Detect Autistic Features for Autism Screening, *International Journal of Medical Informatics* (2018), https://doi.org/10.1016/j.ijmedinf.2018.06.009

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ACCEPTED MANUSCRIPT

A New Computational Intelligence Approach to Detect Autistic Features for Autism Screening

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Highlights

- New feature selection ranking method (VA) based on simplified likelihoods of observed and predicted values of variables is proposed
- Derive small yet effective autistic traits without hindering ASD screening performance
- VA maintained performance according to predictive accuracy, sensitivity and specificity rates
- In depth experimentations using 3 autism datasets and five known feature selection methods

Abstract

Autism Spectrum Disorder (ASD) is one of the fastest growing developmental disability diagnosis. General practitioners (GPs) and family physicians are typically the first point of contact for patients or family members concerned with ASD traits observed in themselves or their family member. Unfortunately, some families and adult patients are unaware of ASD traits that may be exhibited and as a result do not seek out necessary diagnostic services or contact their GP. Therefore, providing a quick, accessible, and simple tool utilizing items related to ASD to these families may increase the likelihood they will seek professional assessment and is vital to the early detection and treatment of ASD. This study aims at identifying fewer, albeit influential, features in common ASD screening methods in order to achieve efficient screening as demands on evaluating the items' influences on ASD within existing tools is urgent. To achieve this aim, a computational intelligence method called Variable Analysis (Va) is proposed that considers feature-to-class correlations and reduces feature-to-feature correlations. The results of the Va have been verified using two machine learning algorithms by deriving automated classification systems with respect to specificity, sensitivity, positive predictive values (PPVs), negative predictive values (NPVs), and predictive accuracy. Experimental results using cases and controls related to items in three common screening methods, along with features related to individuals, have been analysed and compared with results obtained from other common filtering methods. The results exhibited that Va was able to derive fewer numbers of features from adult, adolescent, and child screening methods yet maintained competitive predictive accuracy, sensitivity, and specificity rates.

Keywords: Accuracy, Autism Spectrum Disorder, Behaviour Science, Classifiers, Computational Intelligence, Data Mining, Feature Analysis, Machine Learning, Sensitivity, Specificity

1. Introduction

Autism Spectrum Disorder (ASD) refers to a neurodevelopmental disorder associated with limitations in social interactions, communication, and behaviour that is becoming increasingly common in many parts of the world (Ruzich, et al., 2015). The causes of ASD have been linked to genetic and neurological components, but are primarily diagnosed using non genetic variables related to behaviour such as social interaction, play and imagination, repetitive behaviours, and communication among others (Chakrabarti, et al., 2009; Geschwind, et al., 2001). Existing estimates reveal that about 1.5% of the world's population is on the spectrum, and it is believed that a huge number of individuals on the spectrum remain undetected (Brugha, et al., 2011; Fitzgerald, 2017). Therefore, high demands exist for faster diagnosis services corresponding with the growing awareness of ASD (Russell, et al., 2016).

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