

# Autism Identification and Learning through Gesture Patterns



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## **Dedication**

We dedicate this effort to our beloved Parents and respected Teachers. Without their prayers and guidance this work wasn't possible. We would also like to dedicate this to Sir Abdul Sattar Edhi for his countless efforts to make this world a better place.

# Final Approval

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## ABSTRACT

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Autism Spectrum Disorder (ASD) is a *mental development disorder* which affects the processing of information in brain causing delays in the language and reasoning development. A person's behavior can make it distinguishable if he/she has the disorder or not through three main traits i.e. social interaction, restricted/repetitive behavior or communication skills. ASD is usually diagnosed clinically on the basis of some core symptoms and tests which are expensive and can be stressful for a child. Research has shown that Autistic people can be differentiated through the difference of force in their Motor Gestures which is related to restricted/repetitive behavior of Autistic individuals. Motor disturbance is observed in autistic patients which is a key factor for us to make its identification possible through a technical early stage approach which can be very effective. A preschool level Android touch application has been developed in which the motor patterns are observed through touch sensors and inertial sensors. Ten features were obtained as kids touched the screen for the gameplay. This touch and inertial data was then analyzed by processing them through Machine Learning (ML) algorithms to classify between Autistic and Non-Autistic group on the basis of the ten features and the motor disruption was identified. This data supports the motion disruption of movements which is identified to be as a core feature of ASD (restricted/repetitive behavior) and this demonstrates that Autism is possible to be computationally assessed through an interactive and fun gameplay on a smart device. In this way we will be able to diagnose Autism through an easy to access, learning smart phone application instead of a typical, expensive clinical diagnosis.

## REVISION CHART

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## DEFINITIONS AND ACRONYMS

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<b>Acronym</b>	<b>Definition</b>
UMT	University of Management and Technology
ASD	Autism Spectrum Disorder
ML	Machine Learning
SVM	Support Vector Machine (Machine Learning Algorithm)
CDC	Centre of Disease Control
ROC	Receiver Operator curves
JSON	JavaScript Object Notation

**Table 1: Table of acronyms and definitions**

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# 1 INTRODUCTION

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Autism Spectrum Disorder, a mental development disorder which is difficult and quite expensive to identify and is estimated to be in at least 1 out of 160 kids [1]. It is a “Spectrum Disorder” and not a disease [2] as it is based on issues with structure (disorder) of brain instead of internal or external factors (disease). It affects the processing of information in brain causing delays in the language and cognitive development. It is observed that the behavior of a person affected by the disorder can be distinguished mainly through 3 characteristics i.e. Social interaction, restricted/ repetitive behavior or communication skills [3]. One of the symptoms Notion Disruption, is observed in autistic kids [4] i.e. their motor patterns are different as compared to non-autistic kids [5], which can help to identify ASD by analysis through machine learning algorithms of the motor patterns traced by the children, making it equivalent to a professional diagnostic test. Kids are really attracted to gadgets with gaming applications, so a faster, low cost, enjoyable way of testing for diagnosis of ASD is needed which engages them in playing a game rather than a professional diagnostic test. The project will help in diagnosis of Autism Spectrum Disorder in children through a gaming application using motor gestures on a touch screen. The performance observed through touch data will be used to obtain the probability if the child has the disorder or not. So the main objective of the research project is to diagnose the Autism Spectrum Disorder through a gaming application which can afterwards aid in understanding their needs more precisely.