

# EXAMINATION ON EARLY DETECTION OF AUTISM SYNDROME IN CHILD DEVELOPMENT DISORDER

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*Abstract - Children's mental health should be given utmost importance to prevent psychological issues in future. Recent study reveals children with sleeping disorder at young age will likely to get affected by mental disorders during adolescent. Further shocking reports prevails in medical field, creating a kind of panic among parents. One such serious developmental disorder among children is Autism Spectrum Disorder, which impairs the child's communication and interaction. Autism is a neurological disorder, which has lifelong effect on child's development. The aim of this paper is to provide a complete overview of autism disorder and its underlying facts. This paper also explores and intervene the diverse research topics like neural networks, image processing, data mining and other advancements applied to early intervention of ASD in children.*

*Keywords - Child development disorder, Autism disorder, autism prediction techniques*

## I. INTRODUCTION

Children disorder can be classified into mental disorder, developmental disorder, learning disorder, behavior disorder, conduct disorder and even eating disorder is included in the extending list. Recently World Health Organization (WHO) appends Gaming disorder to its international classification of diseases. Along with the growing list, a number of remedy measures and therapy techniques were also emerging with proper assistance of medical practitioners. In this paper we primarily focus on Autism Spectrum Disorder (ASD), a developmental disorder which is commonly found in children at young age. WHO estimates that worldwide one in 160 children are affected by Autism and the number of cases has increased in recent years [18]. Recently the percentage of affected children is increasing in spite of ethnicity and economic background [17].

Autism is considered as neurological disorder that affects children behaviorally, socially, and cognitively [9]. The children with ASD are likely to get affected by various issues such as lack of eye contact, attention deficit, social interaction/communication and stereotyped patterns of behavior. It is referred as spectrum disorder because the symptom might range from mild to severe. Researches also affirmed that autism disorder prevails more in boys than in girls.

## II. CAUSES AND RISK

The major cause and etiology of the autism disorder is still unknown [8] [16]. It is generally accepted that genetics or environmental factors are the reasons of Autism Spectrum Disorder [11]. But all the results given are inconclusive and there is no scientific evidence to prove it. Landrigan PJ et al. [1] describe the environmental factors such as toxic chemicals cause injury in the development of human brain that results in Autism and other neurodevelopment disabilities. Arthur L. [2] provides suggestive evidence that brain deficiency of carnitine and other micro nutrients may cause ASD. The author also state valuable information that child which looks normal at birth may show symptoms at the time of 6 month to 3 years of age. This risk is mainly due to change in the dietary pattern of the kid during 6 to 18 months.

Uta Frith et al. [3] defines that autism appears to be a genetic inheritance and even the siblings of those who have autism has 50% higher risk of ASD. Autism risk of reappearance in siblings is 2 – 10% [16].

### III. RIGHT TIME TO DIAGNOSE ASD

When the child has not attained the developmental milestone at a particular age or period then we classify it as a disorder. Disorders are initially noted by parent or caretaker when the child displays an uneven behavior. But early detection of autism disorder will prevent the severity therefore proper therapy techniques can be initiated at the right time that helps the child to have a normal independent life like others. Right time to diagnosis ASD is at the age of 23 – 210 months [7] [12] [17]. Therefore age of diagnosing is an important factor in ASD, where in few cases it is not detected until older ages.

Early diagnosis of autism spectrum disorder will provide opportunity to reduce the progression of disease [14] [15]. Autism Spectrum Disorder can be diagnosed only by a trained physician. Laboratory reports like blood test and urine test will not be helpful in any way to diagnose the disorder [16]. The physician needs to examine the behavioral attributes of the child like attention deficit, eye contact, response etc., which is a time-consuming process. This is one of the main reasons why ASD diagnosis is not performed in pediatric primary care [21]. Due to insufficient time and unfamiliar with the screening methods, ASD is not suggested in pediatric care. Another conventional strategy applied is answering a list of questionnaire by parents/guardian/care-takers that results in scoring functions to determine the developmental disorder in children.

### IV. ASD DIAGNOSIS METHODS

As the autism spectrum condition is steadily increasing, the researchers focus on improving the results by developing new tools and techniques in diagnosing the results. Few of them are enlisted in Table I.

ASD is a heterogeneous disorder, where it is still inconclusive to determine the exact cause [11]. But it is found that it certainly affects the brain functions therefore resulting in very complex diagnosis [10]. There is a difficulty in determining real time dataset for diagnosing autism disorder and only limited data available for public access. Due to scarcity of autism datasets, researchers focus on different set of parameters such as behavioral attributes, voice processing, Magnetic Resonance Image (MRI) of brain and video analysis are taken as input.

**TABLE I: ASD DIAGNOSIS METHODS**

S. No.	Author	Methodology	Input Parameter	Outcome
1.	Deng et al., 2017 [6]	Speech based analysis for autism detection by applying Generative adversarial networks (GANs) from the field of Deep Learning	Acoustic features	Provides promising results to continue further study
2.	Dekhil et al., 2017 [7]	Integrates both anatomical and functional information of brain images. Anatomical features from 47 subjects are extracted and supplied to multi-level deep network for further diagnosis.	sMRI and fMRI	94.7% of classification accuracy
3.	Feng et al., 2018 [10]	Suggested multi level high-order functional connectivity and interaction between multiple brain images. 54 ASD patients under the age of 15 were analyzed	rs-fMRI	Provides distinctive information for diagnosis and the performance is quite better.
4.	Jinting et al. 2016 [11]	A novel method called aberrant gene expression analysis. The method applied is to search a unique combination of genes using greedy algorithm.	104 brain tissue samples	> 70% accuracy

5.	Chongruo et al., 2019 [15]	Proposed machine learning methods to predict Autism in children. Experimented an image based approach, were 300 different images are displayed to the children for three seconds each. The eye tracker captures the scanpath data for analysis. This analysis is performed because ASD and non ASD children will have different behaviors when they view the same image.	300 natural images	65.41% of accuracy
6.	Ngo et al., 2018 [17]	Combined approach between artificial neural network and fuzzy logic. The study is carried out with a temporary dataset generated from Childhood Autism Rating Scale (CARS).	Questionnaire	The proposed approach confirms accuracy and suggested to apply the model for diagnosis of similar disabilities.
7.	Seyed et al., 2020 [19]	Applies Convolutional Neural Network (CNN) classification method trained with historical autism cases. Here the author predicts the outcome by learning the cases via AI, instead of focusing on scoring results of questionnaire.	Questionnaire – Mobile Application	Delivers high predictive accuracy
8.	Anurag S et al., 2018 [20]	Designed a new tool by applying hierarchical fuzzy system for fast and accurate diagnosis. One change compared to conventional method is, the prediction is measured under severity level such as normal, mild, moderate and severe and also highlights the highly impaired area to concentrate further.	25 input variables – GUI	99% accuracy.

## V. EARLY INTERVENTION

Autism is generally diagnosed at the age of 2 – 3 years, when the child initiates social communication. Robert et al. [12] and his team develop an early intervention approach to predict ASD at 24 months of age for 6-month old infants. The results were astounding i.e., 9 of 11 infants correctly predicted as ASD at 24 months and 48 infants were non ASD with the prediction value of 96%. 59 Kids with high heredity risk are used in this study. Philip et al. [13] suggests even much earlier detection of ASD at the age of 4- 6 months or sometimes even in a new born. The authors proposed that movements of infants can be used to diagnose ASD even in the first few months of birth. Lying position, turning direction, sideways-upward pattern, rotation of head and pelvis, falling position, baby crawling pose and many other parameters were carefully studied and analyzed from the videos of infants to predict ASD.

## VI. SCREENING TOOLS FOR ASD

Many tools available in research to screen developmental disorders but ASD diagnosis is recommended to carried out by an experienced and trained professional to obtain reliable result. Few tools available in online however to obtain conclusive evidence, clinical assessment is recommended. Commonly used screening and diagnosis tools are shown in Table II.

**TABLE II: SCREENING TOOLS**

S.No.	Tool	Developed by	Age Range	Criteria Focused
1.	The Social Communication Questionnaire (SCQ) [22]	Michael Rutter, Anthony Bailey and Catherine Lord	More than 4 years	Social interaction, language and communication
2.	Autism Diagnostic Interview, Revised (ADIR) [23]	Michael Rutter, Ann Le Couteur, and Catherine Lord	> 2 years	Language, social interaction, Stereotyped behaviors
3.	The Modified Checklist for Autism in Toddlers, Revised (M-CHAT-R) [24]	Diana Robins	16 – 30 months	Behavioral attributes
4.	Communication and Symbolic Behavior Scales (CSBS) [25]	Wetherby and Prizant 2001	6 – 24 months	Communication, eye contact, use of objects
5.	The Childhood Autism Rating Scale (CARS) [17]	Eric Schopler, Robert Reichler and Barbara Rothen Renner	> 2 years	Relationship with people, body use, listening, visual and

#### VII. REASONS OF ASD: PARENTS PERSPECTIVE

Apart from clinical examination Leanne Mercer et al. [4] the authors did a survey on ASD from parent perspectives. Parents were instructed to reply a questionnaire through which the following responses are considered to be the most significant factors for the prevalence of ASD: genetic influence more than 90%, diet nearly 51%, prenatal factors close to 44% and vaccines 40%. Virginia Chaidez et al. [5] also tried to analyze the beliefs and attitudes of parents for the underlying cause of their child's autism. [4] [5] Perspective of family members is not a valuable information and even it is not clinically proven. But the study helps to understand the awareness and perceptions of them for the better family communication and counseling. Even though the above strategies haven't produced any clinical evidence for the cause of ASD, however the results guide the researchers to travel in a pointed direction.

#### VIII. CONCLUSION

There is no cure for autism. But early diagnosis and continuous therapies will assist children to lead an independent life. Recent technologies and advancements in science will enhance to predict early intervention of ASD in near future. This paper is highly focused to interpret the diagnosis methods and research essentials for Autism disorder. Parents view and screening aids are added as an inclusion. These fundamentals understanding is considered to be the initial step in our research work. We aim to work on prediction algorithms, machine learning concepts and barriers in implementation, which will be included in further study.

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