

## Chapter 9

# Research Investigation and Analysis on Behavioral Analytics, Neuro Imaging, and Pervasive Sensory Algorithms and Techniques for Autism Diagnosis

**Sasikala R.**  
VIT University, India

**Sureshkumar N.**  
VIT University, India

### ABSTRACT

*Interdisciplinary research on autism diagnosis and training for the autistic children are current requirements. Behavioral analytics are the techniques followed by pediatricians for identifying ASD in children. However, the techniques successfully accepted by the pediatricians worldwide would be useful for the parents and pediatricians only for the elementary school-aged children, and the system is not helping for early diagnose among children of age 2. Machine learning, image processing, and pervasive techniques are trending for early diagnosis of ASD. Hence, the chapter has done a research-based survey and detailed analysis on behavioral analytics algorithms, neuro imaging, and eye tracking techniques for early diagnosis. The behavioral analytics survey mainly focuses on social and meta-cognitive skills, and the input dataset has been taken from parents, trainers, teachers, and peer groups. The chapter also identifies that computing technologies with neuro-imaging and pervasive techniques are better than the behavioral skill analysis for early diagnosis.*

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## **INTRODUCTION**

Scientific report says early diagnosis and identifying level of autism in early stage helps the therapist to start treatment in initial stage which improves learning, communication and social skills of young children with autism. Dr. Arora, a paediatrician who has worked in AIIMS says “The autistic children numbers are alarming and calls for policy-making and interventions to bring these children into mainstream society,” and he also says “Autism warrants immediate attention,”. Most of the time, children are diagnosed much later but when proper techniques used, it can be diagnosed at the age of 24 months. The paediatricians,, Geneticists, molecular biologists and biochemists are working together to understand and treat how brain cells talk and how it is to be treated(Kulage KM 2014).

A specialized paediatric care must be required globally which makes the system for children from receiving care that could improve their wellbeing. The cloud based medical assistance technologies greatly expand the reach of paediatric specialists, increase collaboration among clinicians and researchers, and make quality healthcare available to more children worldwide. The physical or occasional system based behaviour analytics (Bauer O et al 2017) are the mechanisms which usually doctors follow for identifying Autism(Zheng Z et al 2016, 2017). In addition to IOT based and pervasive devices(Tentori M 2017) (Cabiellles-Hernández et al 2017), an eye-tracking device based research study found that differences in gaze preference can be detected in infants as young as two months. The research work showed that the infants watching videos, mostly look at mouths more than eyes and also infants look at objects more than people are diagnosed as autism. The infants with autism usually experienced a decline in attention to other people’s eyes. The eye tracking devices are easy to handle and portable and it can be fixed away from infants. The other research study on autism diagnosis is based on electroencephalography(EEG) signals(Auzias et al). The feature extraction and classification techniques assist the diagnosis process of Autism. Hence, the research study on EEG and eye tracking devices(Liu W et al 2016) supports the paediatricians to start treatment before mature brain circuitry is established (i.e., between ages 1 and 3 years). It helps the paediatricians to start treatment early and efforts provide best chance of promoting effective and positive connections between brain cells. Hence stimulation and treatment will be easily happening while brain connections are actively being created. In contrast, Identifying autism among kids in elementary school aged can start treatment later in brain development (i.e., at age 4 or later), which leads to more challenging job of trying to change brain cell connections in the later stage. Screening process for autism among 1 year old children using a broad band screen allows scientists with the opportunity to study the disorder during the first year or two of life(Wedyan 2016, Cheung SC 2015).

. A strong preference for moving geometric images over social images was highly specific to this ASD subtype compared with toddlers with typical development, language delay, and global developmental delay as well as unaffected siblings of toddlers with ASD. In conclusion, although it is unclear what the future will hold, it is possible that diagnosis may move away from a purely clinical judgment approach to a more objective research domain approach that instead focuses on the combined techniques such as cloud based pervasive Image processing and analytics to help the biomarkers. From various study, we identified that still more computing techniques of research analysis required in Autism diagnosis. The objective of the paper is to analyse the possibilities of autism diagnosis in various levels, Video Analytics, sensor based pervasive eye tracking device and behaviour analytics. Hence, an integrated early diagnosis and treatment system can be developed for the global attention and the centralized database would be useful for making further research on this area(Fischer S 2017, Chandler DL 2016, Camada MY 2017).

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