

Chapter 14

Activity Recognition System Through Deep Learning Analysis as an Early Biomarker of ASD Characteristics

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ABSTRACT

Autism spectrum disorder (ASD) is a very high-flying area of research in the current era owing to its limited and on-going exploration. This chapter aims to bridge the gap of such late realization of autistic feature through machine intervention commonly known as computer vision. In this chapter, basic summarization of important characteristic features of autism and how those features could be measured and altered before a human could recognize are proposed. The chapter proposes a model for activity identification of the autistic child through video recordings. The approach is modelled in a way that consists of two phases: 1) Optical flow method detects the unusual frames based on motion pattern. 2) Each of these detected frames are fed to convolution neural network, which is trained to extract features and exactly classify if the particular frame under consideration belongs to usual or unusual class. This examines the various activities, time delay, and factors influencing the motion of the autistic child under constrained scenarios proving maximum accuracy and performance.

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INTRODUCTION

Autism spectrum disorder is found to be one of the major concerns of parents in the recent years owing to the wide exposure of its presence. The darkened part is that most of the people are unaware of the basic characteristics of autism to identify them. ASDs are neurodevelopmental disorders with high prioritized features like impaired social communication, atypical repetitive behaviors, restrictions in range of interests, anxiety disorders and even includes language impairment that emerge during the age of 6 months to 3 years on average. This target of proper guidance could be achieved at a higher rate only with the help of early identification and early diagnosis of autistic feature in the child. Many studies and survey suggests that the parents were able to map the characteristics of their child shown at their earlier stage of development with the autistic character only after a long period of identification. This is due to the lack of granular analysis of their children characteristics and insufficient knowledge about autism and its various observation characteristics.

The autism spectrum disorder is mainly due to the impairments made in their five sensory organs that either makes the children to under react or over react and in certain case leading to neutral and repetitive behaviours respectively which is found to be purely a neurodevelopmental disorder. These differences in the behaviour should be monitored, analysed and differentiated. To perform this series of task every parent should be aware of such neurodevelopmental disability and their impacts. Also, such developmental activities could be mapped against the autism symptom before approaching the clinical trials. This is made with the help of computer vision where the analysis could be turned out as an application through handheld devices.

Early identification and early diagnosis of such autism could help the parents to bring the child to their specific field of interest. The very early diagnosis of autism is at the age of 3 months, is the point where the child tends to recognize the mother. As there are varied reasons behind this activity such as lower vision, poor eye contact, etc., the abnormality could only be identified and not concluded. Hence the autistic feature could never be solely being authorized unless the symptoms are examined further. This model helps the parents to identify the difference in the behaviour pattern and can be made prior to clinical evaluation and analysis. This minimizes the effort of clinical traits supporting the clinical advisor and the parents.

Earlier diagnosis of autism spectrum disorder is limited by various factors. Some of the commonly well known and discussed pitfalls are as follows: i) knowledge on developmental stages of the infant and toddler with and without autistic characteristics. ii) use of traditional and convolution methods such as questionnaire formats of diagnosis, iii) improper classification of unusual behaviour along with the non typically developing communicational and social behaviours, iv) delay in the acceptance state of the parents to acknowledge their child to be autistic and v) lack of awareness and proper guidance in bring up the children at the right age which is to be specific in months. Understanding and eliminating the difficulties influenced by the society could comfort, improve and support the autism child, family and the autistic society.

The proposed activity recognition system is built so as to find if the action of the autistic child is relevant to the object and also to find the time delay in performing the action. At the initial stage the system is modelled to find the activity recognition using Optical Flow algorithm. The optical flow algorithm figures out the presence of subject and then analyzes the activity made by the subject with respect to the object. Along with activity analysis, this model focuses in analysing the time delay in action of the subject (autistic child) with respect to an object.

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