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Robot Assisted Therapy for Children with Autism Spectrum Disorder - A Survey

Sara Baber Sial* and Yasar Ayaz

School of Mechanical and Manufacturing Engineering, National University of Science and Technology (NUST), Islamabad, Pakistan

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***Corresponding author:** Sara Baber Sial, Robotics and Intellegient System Engineering Lab, School of Mechanical and Manufacturing Engineering, National University of Science and Technology (NUST), Islamabad, Pakistan, Tel: +92-320-555-9500; Email: sara.baber@ymail.com

Abstract

This paper discusses various approaches and equipment/robots used for behavioral assessment and improvement of an autism spectrum disorder (ASD) child. These studies are usually conducted for 4-6 weeks period of time. All of these therapies involve a considerable improvement in various features evaluated for an ASD child. The improvement is observed in various parameters evaluated such as joint attention, occlusion, distance from the robot, eye contact, social interaction, communication and many more depending upon the time taken and features chosen for each therapy. Children with autism spectrum disorders have shown a remarkable improvement when brought in interaction with robots by involving in various collaborative plays.

Keywords: ASD, interaction, Autism, Assistive robots, Therapies, Typically developed (TD)

Introduction

A child in the journey of development matures its social interaction and cognitive skills through nonverbal communications, gestures, actions, sound and various other features that are important in a child's development. However with the recent advancement in technology this non-verbal communication and cognitive skills are important not only for humans but also for robots [1]. However for a child diagnosed with Autism spectrum disorder, lacks these abilities. Therefore research is now focusing on building various collaborative plays for the social interaction of an autism spectrum disorder child. It usually aims at certain pattern of interaction [2]. These kinds of therapies usually involve directive commands for the timings of interaction, actions and how the strategies are built for certain goals [3]. However early implementation of these therapies on detection of autism in a child is a must for improved cognitive skills [4]. From past few years the robotics community has been using robots for therapy of the ASD children frequently [5]. From the past research carried out, these different structured scenarios based on activity or a physical play between a socially assistive robot and an ASD child has significantly improved the communication and social behavior of an autistic child. Therefore these robotic therapies are contributing a lot towards the ASD child development and social interaction. All these research based on activities adapts a novel approach towards a technique for robot assisted therapy and can be used for interdisciplinary clinical intervention later.

Discussion

There are variety of equipment/gadgets used for improvement of cognitive skills and social interaction of ASD children other than socially assistive robots such as tablets for intervention of different games, computer used with joystick and mouse and mobiles etc. All of these interventions aim to force the ASD child to concentrate and improve the selected features. Most widely features selected are eye contact, eye blink rate, response time, concentration time, gadget association, task repetition, proximity in terms of distance, joint attention, turn taking and communication etc. The interventions adapted for the improvement of communication skills of ASD children include various humanoid robots playing xylophone, teaching emotion by showing GUI, videos and later testing the ASD child, imitating robot's behavior. Various comparisons are also done for a typically developed (TD) and ASD child that uses MRI signals, comparison of the gate/walk pattern of both, comparing eye blinking rate by using EEG signals, difference in the facial expression of a TD and ASD child, comparing the functional brain connectivity during perception of certain emotion, difference in the sleep mode, Apha band signal analysis, comparison of motor movement skills and many more.

Conclusion

Socially assistive robots along with the therapist are contributing a lot towards building of new learning activities for

cognitive skill development and communication improvement of a child with autism spectrum disorder. Results of all of the interventions show remarkable improvement in an ASD child using various gadgets or robots for interaction. While all of these interventions are showing remarkable results, there are certain limitations that also exist in this kind of research. Sample size limitation and duration for implementing the intervention are major factors. Despite these limitations, the studies show massive improvements in evaluated features.

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