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Identification of Autism Disorder Spectrum Based on Facial Expressions

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Abstract

The study of emotions has always been a matter for philosophers and psychologists. The purpose of this research is to identify and categorize children with autism disorder using diagnosis of the faces emotion in eight states (neutral, anger, ridicule, hate, fear, happiness, sadness and wonder). The method of this research is descriptive-analytic. To collect samples from 80 children with autism disorder, we take images in each of the 8 cases. MATLAB software has been used to analyse photos accurately. The results show that children who are in first group according to DSM-5, they have at least six mode of the listed eight modes. Children who are in the second category of DSM-5, they experience between three to five feelings. It is also observed that children who are in the third category according to DSM-5, can experience only one to two feelings.

Keywords:

Autism;
Facial Expressions;
Emotions;
MATLAB.

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1- Introduction

Based this issue, this goal can be used to identify face mode of children with autism. Disorders of autism spectrum is a range of neurodegenerative disorders that characterized by disorders of social interactions, communication, interests and frequent and limited interactions and behaviours (American Psychiatric Association, 2000) [1]. Despite the evaluation difficulty, the diagnosis of autistic children's emotions in their face is comparable to the face emotions of growing normal children [2], the analysis of the children behaviours has a great importance for the early detection of developmental disorders, such as disorder of autism spectrum. Early detection of autism spectrum disorders in children is important and allows for the necessary interventions to improve the growth and diagnosis accurately [3]. Existing research on autism spectrum disorder shows that behavioural symptoms can be observed at the end of the first year of childhood life. Many of these studies include studying of frame-to-frame video and analysing the child's natural behaviour [4]. Children with autism spectrum disorder encounter difficulty to understand the revealed mental and emotional state in the people who they have relations. Disability to understand the feelings in others prevents the interpersonal communication among these individuals [2].

Therefore, according to the above, it is clear that there is a difference between facial expressions in children with autism disorder and normal children. Therefore, the present study aimed to investigate the difference among revealed emotions in the face and its relationship with the severity level of autism disorder, in order to obtain more information about the classification of children with autistic disorders.

2- Literature

In order to identify and diagnose autistic disorder, many efforts have been made. In the following, several methods are briefly described:

J. C. McPartland et al. [4] used eye tracing to evaluate visual accuracy of faces and objects in adults with autism

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spectrum disorders and normal peers. In this study, systematic review of the effect of visual characteristics of static drives on visual accuracy is considered. To this aim, four sets of homogeneous control stimulus are used that differ in perceptions of the similarity of the human face. Two groups include normal people and ASD1 subjects were compared in terms of visual accuracy. Both groups tend to have higher accuracy on the upper region of visual stimulus and have lower accuracy to the lower regions.

The only difference between the two groups is that when comparing faces, 3D objects, geometric patterns; individuals with ASD focused on more accurately resources on the upper parts of visual stimulus.

J. Hashemi et al. [1] argued that early detection of growth disorders has great importance in relation to children and allows for the necessary interventions to improve growth and appropriate diagnosis. Available research on autism spectrum disorder shows that behavioural symptoms can be seen in the late first year of children life. Many of these studies include examining frame-to-frame video and analysing the child's natural behaviour. Although these methods are not disturbing for children, but their timing requires a high level of education, so they are not suitable for large-scale research purposes and large populations. This research is the first step in a long-term project to the early study on children by a non-disturbance method to help diagnose the risk and neuro -developmental disorders. In this study, we focused on the presentation of visual computer tools for measuring and identifying ASD behavioural symptoms based on the scale components of the autism observation for AOSI infants.

Particularly, they consider the development of reaction-response algorithms to evaluate the risk overall and activities associated with AOSI, which children's visual attention can be evaluated by following the reaction of facial members. The results of this study, including comparisons of professional and non-professional physicians indicate that the computer visual tools provided, can record behavioural observations, and enhance the behavioural observations obtained through physician's actual clinical assessments.

K. G. Smitha et al. [2] argued that Children with autism spectrum disorder encounter difficulty to understand the revealed mental and emotional state in the people who they have relations. Disability to understand the feelings in others prevents the interpersonal communication among these individuals [2]. Though several algorithms are introduced to identify emotions, but these algorithms are generally presented for processing by a personal computer, which lack of portability limits to use them. The portability of the system makes it easy to use and instantly detects emotions that help the children get quick response when communicating with others. This study examine exactly the continued and parallel usage of PCA to identify the most practical method of implementation to a portable system of emotions identification for children with otitism. The results of the performed tests on this system are 82.3% accuracy in emotion detection for words with a length of 8 bits. Despite extensive studies on the recognition of facial expressions in children with autism disorder, or most studies have used alternative stimuli [5, 6] and participants have been exposed to unlimited stimuli [7,8,9] Or limited their research to a limited set of basic emotions [10, 11]. Other people who have worked in this field are Clander et al, Joylee et al. [13], and Vallacher et al. [14].

In the following, we study the automatic methods of faces detection. A. Ayesh et al. [15] state that emotions are always the subject of research and debate in philosophy and psychology, but in artificial intelligence, the emergence of emotions as a research subject are considered only over two decades.

In 2000, we observe the evolution in how people perceived feelings and their relation to human logic and human-computer interactions. This change continued over the next years, but it was slowly but continuously; and Computer Emotion is now one of the most popular research topics in the artificial intelligence and cognitive systems.

In this paper, the researchers help to the expansion of this field by interpreting psychological theories related to emotions in the form of computing and turning them into applied machine models. These models are general and apply independent of the application, something that is not common in current models. Researchers have chosen two psychological theories (sense psychology theory: Milenson and Sherer's visionary theories) that have the ability to interpret computations. They exactly examine the computational interpretation of these psychological models and provide a complete theoretical definition in the form of fuzzy logic - type 1, and present the partial application and analysis of these general computational models.

In this chapter, M. K. Mandal et al. [16] introduce the most common ways to detect face in images. Face detection in an Image is the first step to recognize emotions from face in a computational and computerized process. Then, a number of presented methods in recent researches for automatic recognition of emotions from facial expressions were investigated. In the next section, the mechanisms of emotion detection from face in psychological and neurological researches. Then algorithmic and mathematical details of automatic algorithms structure to receive emotions from facial images were presented.

These technologies are deeply rooted in techniques such as neural networks, learning machine, genetic algorithms, and core component analysis. Then they presented a specific algorithm that describes a mechanism for identifying emotions from the images in the videos. Then they presented a specific algorithm that describes the mechanism for detecting emotions from the existed images in the videos.

For G. Palestra et al., Automatic detection of facial expressions is one of the most interesting issues, because it has

a great effect on many important applications of the field of human interaction with computers [17].

Many applications in this area require immediate functionality, but most of the existing methods are not suitable to meet this requirement. Geometric features are usually the lightest in terms of computational load, but sometimes they use a large number of features and do not include all possible geometric features.

To solve this problem, in this study, the researchers presented an automatic system to detect facial expressions, of which 32 geometric facial features are used on one side of the face and include a wide range of geometric features. The results of the research show that the presented method in the 6-level set of face modes, diagnostic accuracy was equal to 95.46% and in the 7-level set was 94.24%.

T. D. Ngo et al. [18] argued that: The conversational actors were recently highly regarded by researchers in the field of human computer interactions. The ability to express feelings is one of the features that will be considered in the direction of making the software more reliable and friendlier.

In this study, the researchers analysed how facial emotional activity occurred from timing point of view. Their goal was to find out the time patterns of the face in the six basic senses to improve the simulation of facial expressions on the face of a three-dimensional software.

I the researchers, first, analysed videos from a database using facial diagnostic techniques, to determine that what relation have facial activities with a six-dimensional sense in terms of time. Subsequently, the researchers determined the general time patterns for facial expressions in six basic senses. Then, based on temporal patterns, they presented a plan for displaying a continuous emotional state on a three-dimensional face of a spokesman software.

U. Bakshi et al. introduced facial recognition as critical role especially in business, banking, social field and law enforcement fields. This is an interesting application of pattern recognition and is therefore very much appreciated. The complete process of face detection covers three stages of face recognition, feature extraction, and cognition.

For these three steps, different methods are required. Also, these methods are different in terms of other different factors such as face orientation, mode, lighting and background. In this study, various facial recognition techniques and facial extraction features were discussed to detect face. Both of them are an integral and important part of face recognition because the facial classification is completely dependent on these two parts. Template-based approaches are implemented easily, but they do not provide the overall structure of the face. While color-based methods use a color model with morphology operation to detect the features to diagnose the skin. According to different color models and light variations, these factors can influence on performance.

Appear-based methods show that the points of features are desirable, which can show the overall structure of the face. The geometric-based methods, such as Gaboor Walt's face feature extraction, fixed and stable features [19].

3- Implementation Process

According to the methods discussed in Section 2, we have chosen an intuitive method for data collection. The process of work consists of nine steps, as shown in Figure 1.

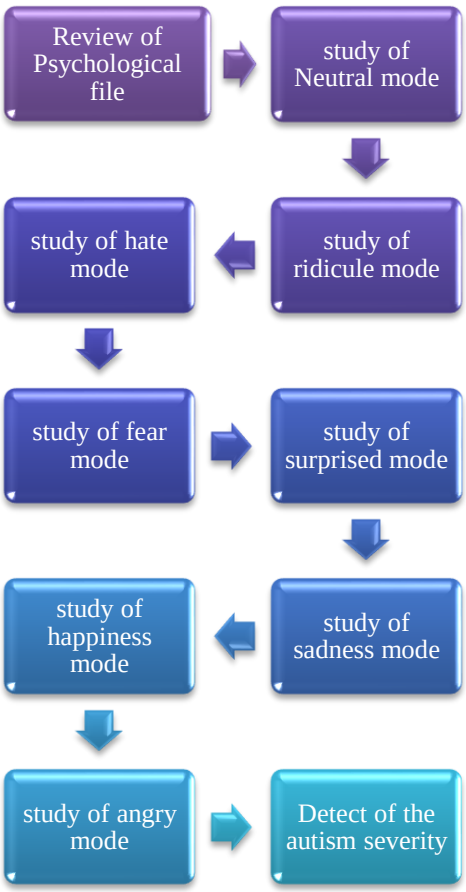

Figure 1. Implementation Model

Initially, to collect dataset, we refer to the Autistic Children's Charity Center and the parents allowed check their children's feelings. The all study of facial expressions was recorded by the camera.

First stage: The parents were asked about the severity of the disorder and, if the family did not know, the file of psychology was studied.

Second stage: The child's face was checked in neutral mode. As shown in Figure 2, all three groups showed a neutral mode in their faces.

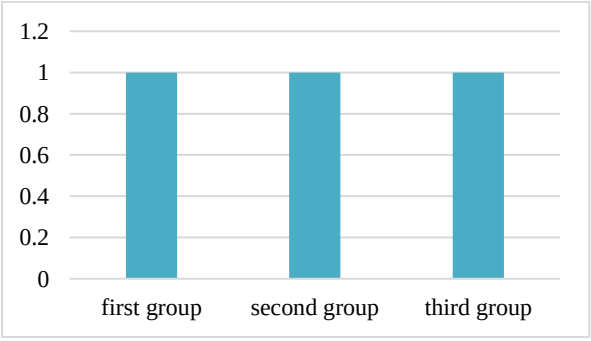

Figure 2. Neutral mode in autistic children

Stage Three: It was attempted to teach ridicule mode and how it cause to children with a stereotyped way. Then the feeling of ridicule was analysed in the face of children. Figure 3 show that 80% of the children in the first group and 8% in the second group showed this mode.

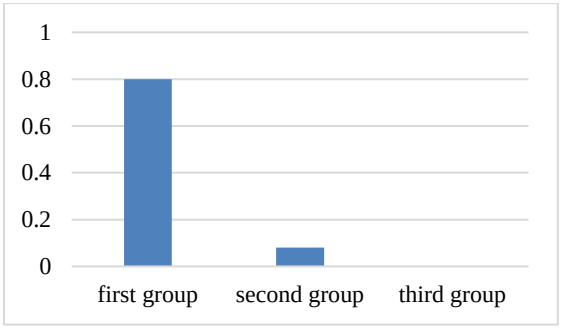

Figure 3. Ridicule mode in autistic children

Stage four: As in the second phase, children were taught how to feel fear using stereotyped learning, and their facial expressions were recorded. In Figure 4, the fear levels of the three groups were plotted (86% of the first group and 6% of the second group had this mode)

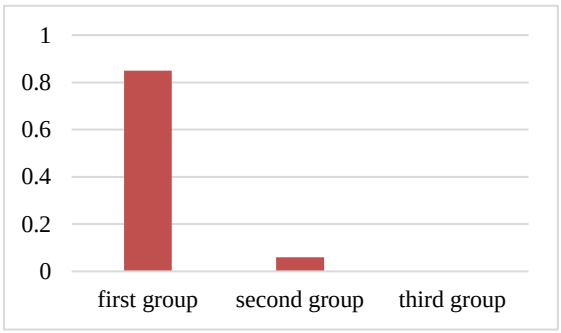

Figure 4. The fear mode in autistic children

Step Five: As two previous stages, the hatred mode was taught to children, then the hate mode was examined in the children's face. Figure 5 shows how much is hate feeling in the three groups. (92% in the first group and 9% in the second group had this sense).

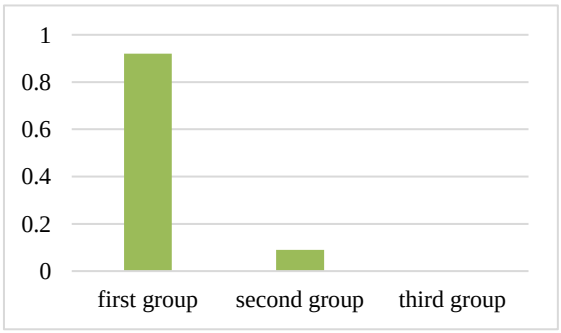

Figure 5. The hate mode in autistic children

Step 6: Surprised mode are photographed in autistic children with a stereotyped learning method by showing the surprising photos. In Figure 6, the sensation of surprise has been studied in three groups in autistic children. (100% of the first group and 82% of the second group had this sense)

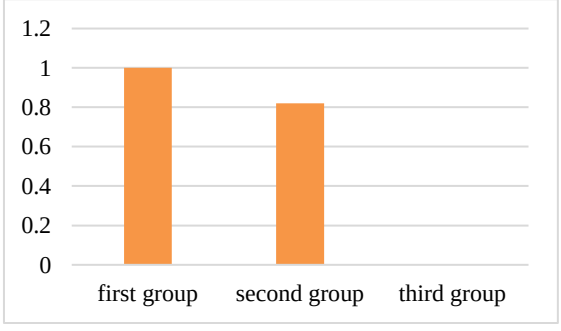

Figure 6. The surprise mode in autistic children

Step 7: In addition to the previous methods, we played a sad short animation, we observed and recorded sadness on the children's face. Figure 7 shows the degree of sadness in the three groups of autistic children. (100% in the first group and 91% in the second group had this mode)

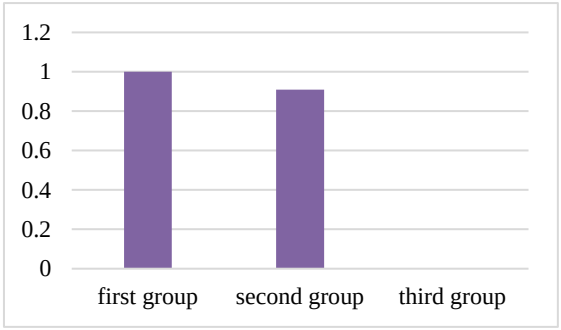

Figure 7. The sadness mode in autistic children

Step 8: Based on the stereotypical learning and getting their favorite objects, they cause chidren be angry and their angry faces were studied. Figure 8 shows anger mode in children. (100% in the first group, 100% in the second group and 98% in the third group had this mode)

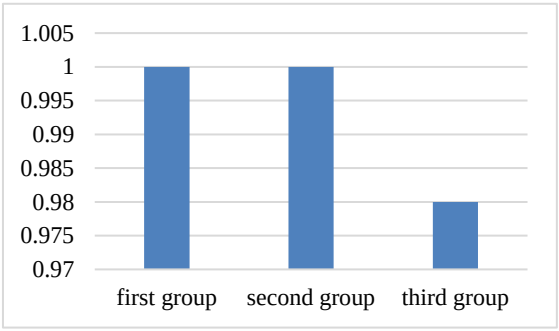

Figure 8. The angry mode in autistic children

Stage 9: At this stage, giving gifts to children and playing a happy short cartoon, the happiness mode was observed in autistic children. Figure 9 shows the appearing pleasure on the face in autistic children (100% in the first group, 100% in the second group and 2% in the third group had this sense)

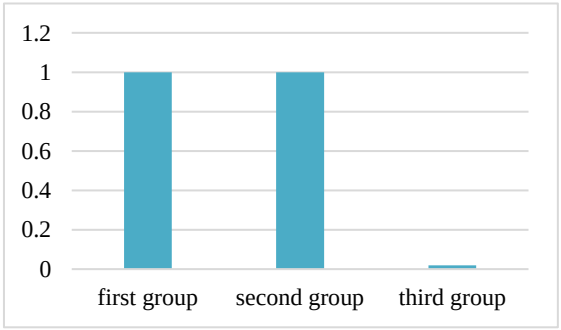

Figure 9. The happiness mode in autistic children

4- Conclusion

The classification of children with autism disorder and their early diagnosis is very important. According to that the severity of autism sometimes is mistakenly diagnosed or experts recognize this disorder in some children later, the study of facial sensation can be helpful in this regard. By examining nine steps expressed in the previous section, the result in Figure 2 was deduced. Children in the first group need to support and show at least six modes of the eight in the face. Children who experienced among three and five feelings, there are in the second group (require significant support). Children who appear only one to two feelings were in the third group (need much support and care).

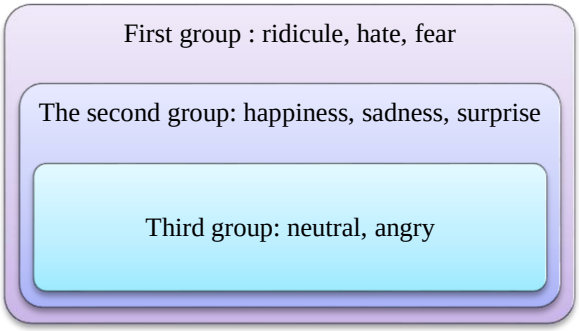

Figure 10. Results from the study of the faces mode in children with autism

With regard to the results obtained, and the study of automatic detection methods of face and appeared modes in the literature review, an automatic system for identifying the range of autistic children can be implemented. If an automatic system is designed, the human error is deleted in this section.

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