

# Autism Spectrum Disorder Analysis and Classification

Abdelhakim Ridouh\*, Fayçal Imedjdouben, Sarra Mahi, Mustapha Yahiaoui

Scientific and Technical Research Center for the Development of Arabic Language CRSTDLA, Algeria

\*Corresponding author's e-mail: a.ridouh@crstdla.dz

## ABSTRACT

Autism Spectrum Disorder (ASD) is a condition related to brain development that affects how a person perceives and interacts with others on a social level, causing problems with social interaction and communication. ASD begins in early childhood and eventually causes problems with social functioning. There is no direct cure for ASD, but early and intensive diagnosis can make a huge difference in the lives of many people. In our work, we will study and analyze a database containing 1875 cases of autism distributed among three categories: children, adolescents, and adults, recorded all over the world using the Autism Quotient AQ-10 test. We use a Support Vector Machine (SVM) classifier to classify the datasets into two classes; autistic and non-autistic. The method has given good results with a success rate equal to 100%.

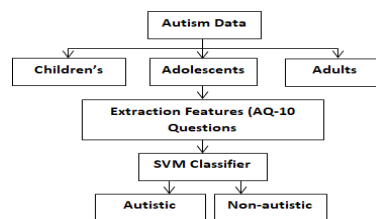
**Keywords:** Autism spectrum disorder, Autism quotient, Support vector machine

## 1 Introduction

Several tests have been developed by researchers for the diagnosis of autism in all age groups such as Checklist for Autism in Toddlers (10-Q-CHAT), AQ-10- Children, AQ-10-adolescents, and AQ-10- Adult, with 10 questions each proposed by Allison [1]. In our work, we propose a method to investigate autism's existence in several people using SVM classification on an autism database (See the method diagram in Figure 1).

## 2 Methodology

Firstly, we extract the score results from the dataset for three categories: children, adolescents, and adults. The vector containing the scoring values is considered the input of an SVM classifier used in purpose to classify all data into two classes: healthy and autistic.



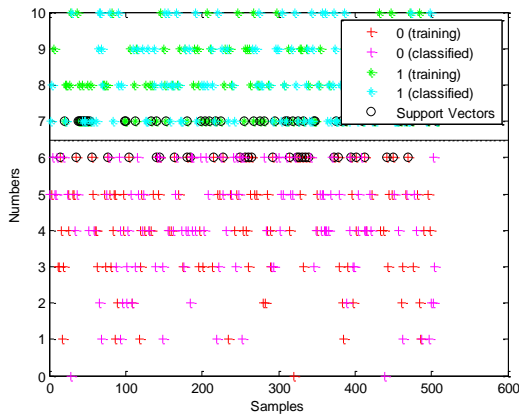
**Figure 1:** Diagram of our method

SVM is a supervised learning technique based on Vapnik–Chervonenkis machine learning theory, aimed at solving discrimination and regression problems. To distinguish between different data class, the SVM establish a separating hyper-plane. In our work, we use an SVM classifier with a linear kernel for two classes of problems; healthy and autistic cases. The database studied in our work was used for the first time in [2], the author invented a mobile application called ASDTests, and he used it as an ASD screening tool. The application has been used in many countries around the world and allowed to collect more than 1400 in that time. In our work, we use recent data from the database. These data include 1875 cases divided as follows: children (509 cases), adolescents (248 cases), and adults (1118 cases).

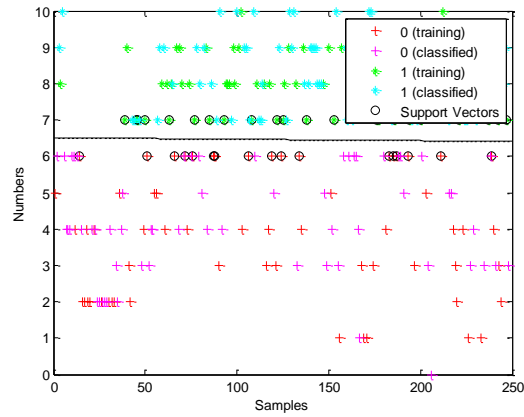


### 3 Results and Discussion

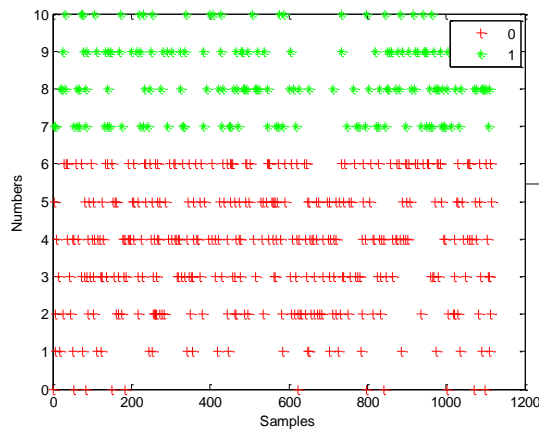
Figures 2, 3, and 4 show respectively the classification results using SVM on children's data, adolescents' data, and adults' data.



**Figure 2:** Classification of child data



**Figure 3:** Classification of adolescents' data.



**Figure 4:** Classification of adults' data.

The performances of the method are evaluated using the following statistical parameters (Table 1): the Sensitivity (Sen), the specificity (Spe), and the Accuracy (Acc):

$$Sen = \frac{TP}{TP + FN} \quad (1)$$

$$Spe = \frac{TN}{TN + FP} \quad (2)$$

$$ACC = \frac{TP + TN}{TP + TN + FP + FN} \quad (3)$$

**Table 1:** Performance results

Performance	Children	Adolescents	Adults
Spe	100	100	100
Sen	100	100	100
Acc	100	100	100

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## 4 Conclusion

The contribution deals with the classification of some healthy and autistic persons. The paper presents a comparative study to detect the existence of autism in children, adolescents, and adults. These experiments are realized to improve ASD detection based on an SVM classifier by extracting a score using a questionnaire (AQ-10 Test). The studies have permitted the distinction between autistic sets and healthy sets in two classes with an accuracy of 100%. Future work may be achieved to make a comparison and classification using an artificial neural network on our database.

### How to Cite

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### References

- [1] Allison, B. *et al.*, (2012). Toward brief 'Red Flags' for autism screening. *J. Am. Acad. Child Adolesc. Psychiatry*, 51(2), 202– 212. 10.1016/j.jaac.2011.11.003.
- [2] Thabtah, F. and Peebles D. (2019). A new machine learning model based on induction of rules for autism detection. *Health Inform. J*, 26(1), 1-17, 10.1177/1460458218824711.