Autism spectrum disorders were compared using EEG data, the Novel Gaussian Kernel Smoothing Classifier, and the KNN Classifier.

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ABSTRACT

Aim: The purpose of this research is to determine the causes of Autism Spectrum Disorder (ASD), the using ofcontemporary-day algorithms, and evaluating the accuracy and sensitivity rate between Novel Gaussian Kernel Smoothing and KNN. **Materials and Methods:** The Datasets contain EEG signal value photographs from the hospital centers and are used in this research.The sample is interpreted as (N =40) for Novel Gaussian Kernel Smoothing and (N =40) for KNN, and the total sample is calculated using Clinical.com by maintaining the alpha error-threshold at 0.05, enrollment ratio as 0:1, 95%confidence interval, g-power at 80%. Accuracy and sensitivity was calculated by using standard dataset. **Results:** The level of accuracy and the level of sensitivity are compared using the independent IBM-SPSS sample testing software. There is a statistical indifference between the Novel Gaussian Kernel Smoothing algorithm and KNN. The accuracy of Novel Gaussian Kernel Smoothingalgorithm is 54.57% (p=0.001) is higher than KNN 50.4% and the sensitivity of Novel Gaussian Kernel Smoothing algorithm is 45.55% (P=0.001) is higher than KNN 43.8%. **Conclusion:** Gaussian kernel smoothing algorithms appear to provide better accuracy and sensitivity than KNN in predicting autism with an EEG signal.

Keywords: Autism Spectrum Disorder, Novel Gaussian Kernel Smoothing, KNN, Python, Artificial Intelligence.

INTRODUCTION

In this study, Autism Spectrum Disorder (ASD) is a brain-related ministry of social development like social interaction, communication skills, behavior problems. There are many disorders like this in India, totalling 7,000 people suffering from Autism Spectrum Disorder. . The simulation of intellect by computers, such as the capacity to solve problems, act reasonably, and act like people is known as artificial intelligence. . The proper early therapy can relieve pain and promote overall development by assisting youngsters in learning new abilities. This technique will enable children to be more self-sufficient throughout their lives.. The caretaker should listen to them and provide new guidelines every month . So, the people may cure fast and interact among the normal people and can communicate with them. If there is a defect in the patient's condition,into visually guided behavior,sleeping disorder; interaction among them. The caretaker (or) parents should look after them. Take a proper recording daily every one hours. So that

can cure them according to their conditions (Fosfuri, Arora, and Gambardella).

Total number of papers written on this topic in the last several years is 400 in Science Direct and in Google Scholar is 500. The above data are the total number of articles present related to the topic and their findings (Addy et al. 2015). The study of most referred articles have shown that to examine and provide a comprehensive diagnosis of ASD based on MRI function and hybrid imaging techniques are similar in the EEG signal. They have used 2 techniques, among which the EEG signal gives the proper value and clear graph . In other articles, EEG examined ASD detection in children and adults to find the brain image in 3D image, but the parameter values are higher in the alpha range. So, the accuracy is poor for them (Grossi et al. 2019). In the other previous study,Autism Spectrum Disorder examined EEG for ASD detection; they have used a standardized test to detect any problem in patient activities . The best research article out of all is that examines and provides a comprehensive diagnosis of ASD based on MRI function and hybrid imaging techniques similar in the EEG signal. They have used 2 techniques, among which is that the EEG signal gives the proper value and clear graph. This method is best present in all the functions of autism in the EEG signal (brain) because it develops the ASD patients more brisk and activation. It also gives the best result among others and their accuracy was 0.79%.Previously our team has a rich experience in working on various research projects across multiple disciplines(Balusamy et al. 2020; Arvind and Jain 2021; Zhao et al. 2020; Hani et al. 2020)

Several studies have been conducted to determine the potential of the percentage of autism. Many studies have shown an association between ASD, collective attention, and eye movement. Inefficient early detection of autism that eliminates human error rates is the major key point that motivated us to work on this project to determine the presence of autism at an early stage by figuring out accuracy (%) and sensitivity (%). These diagnostic strategies are predicted to be much less steeply-priced and clean to enforce so they may be integrated into habitual infant checkups and it ends in many drawbacks. Inefficient early detection of autism that gets rid of human mistakes fees is the most important key factor that inspired us in this challenge to decide the presence of autism at an early degree through identifying accuracy (%) and sensitivity (%). The authors had experience in the field of machine learning algorithms and were able to conduct comparative studies on Novel Gaussian Kernel Smoothing And KNN. The principal goal of this research is to compare Autism Spectrum Disorder utilizing EEG signals with Novel Gaussian Kernel Smoothing and KNN, as well as to determine its accuracy and sensitivity..

MATERIALS AND METHODS

This study was carried out at Saveetha School of Engineering,Chennai. There's no ethical constant in this study. The sample size was calculated using past study findings from clinical.com while keeping the alpha error-threshold at 0.05, enrollment ratio as 0:1, 95 % confidence interval, and power at 80%. Group 1 was Novel Gaussian Kernel Smoothing (N=40)

and group 2 was KNN (N=40). The total sample size is 80 (Cook et al. 2019).

The number of groups that participated in this analysis is 2, Group1 Autism Spectrum Disorder using EEG signal for Novel Gaussian Kernel Smoothing by the accuracy and sensitivity. Group 2 Autism Spectrum Disorder using KNN. The study work was validated by using the Python programming language.

The dataset's value was derived from several patient samples. The dataset was classified according to the classifier. This methodology has been implemented according to the standard protocol. Artificial Intelligence is mostly exploited in Python Source code.First,aPython software program to teach the supply dataset, then the records were imported to the classifiers. The novel Gaussian kernel Smoothing and KNN classifiers have accumulated and accomplished via a coding process. The records become processed via a software program with the right algorithms. The trained dataset first undergoes the method referred to as dataset augmentation, wherein the dataset is elevated into many datasets, then it'll go through the method referred to as preprocessing, that is to make all sizes into unmarried size.It goes through an optimization method to maximize the version and loss minimization to reduce the noise generated during training. Finally, it will go through a procedure known as which will be assessed after constructing a model utilizing the testing dataset and predicting the presence of EEG signal in Autism Spectrum Disorder.. The input code is allowed to run and the datasets are implemented in Python 3.7. The predicted output is obtained and its accuracy (%) and sensitivity (%) is compared between both the methods.

Statistical Analysis

In validate the results of both, statistical analysis was performed using the IBM-SPSS software. As the two algorithms are independent to each other, independent samples t-test was performed for the two independent variables accuracy and sensitivity. There was no dependent variable present in this study (Cook et al. 2019).

RESULTS

In this study of Autism Spectrum Disorder using EEG signal, both the techniques appear to produce accuracy is higher (54.57%) in Novel Gaussian Kernel Smoothing and sensitivity is better (45.55%) in KNN. Table 1a represents the accuracy and sensitivity for autism using the EEG signal for Novel Gaussian Kernel Smoothing. Table 1b represents the accuracy and sensitivity using autism in EEG signals for KNN.

Table 2 reflects Comparison of mean, accuracy and sensitivity using EEG signal with Gaussian Kernel Smoothing and KNN.Group statistic comparison of accuracy and sensitivity for autism using EEG signal prediction with gaussian kernel smoothing and KNN classifier. The accuracy of gaussian kernel smoothing Algorithm (54.57%) is higher than KNN (0.504%) and the sensitivity of gaussian kernel smoothing Algorithm (45.555%) is higher than KNN (0.438%). Table 3 shows the results of the Independent sample t-test for predicting the accuracy and sensitivity of autism using EEG

signal for Novel Gaussian Kernel Smoothing and KNN classifier. There appear to be statistically significant in accuracy and significant in sensitivity differences ($p<0.05$) in both the methods.

Fig. 1. Confusion matrix represents the true positive rate is 1.4%, while the false positive rate is 7%. False negative accounts for 2.4% and true negative accounts for 11%. Using the Medium Gaussian kernel smoothing classifier the overall accuracy is determined to be 21.8%. Fig. 2**.** Simple bar chart mean of accuracy and mean of sensitivity using gaussian kernel smoothing and KNN. The above bar graph represents the comparison between mean accuracy and sensitivity of gaussian kernel smoothing and KNN. The gaussian kernel smoothing appears to produce the most consistent result in accuracy and sensitivity with minimal standard deviation when compared to the KNN. X-axis Gaussian kernel smoothing vs KNN and Y- axis mean with +/-1SD.

DISCUSSION

In this article of predicting Autism Spectrum Disorder using EEG signal with the accuracy of gaussian kernel smoothing algorithm is 54.57% ($p=0.001$) is higher than KNN 50.4% and the sensitivity of gaussian kernel smoothing algorithm is 45.55% ($P=0.001$) is higher than KNN 43.8%.

In previous study based on datasets for autism in infants and autism in adults, a prediction version is advanced which predicts the danger of ASD traits in order that parents / guardians can early step out the problem and the overall performance price of each approach implemented turned into deciding to select the pleasant classifier version and precision price done for pleasant classifier version is 43% (Greifeneder et al. 2020). In another article they proposed gaining knowledge of multi-channel capabilities from EEG signals for human emotion recognition, in which EEG signals are inspired by sound signals. They have carried out the primary SoC based 8-channel EEG patient-unique/non-unique emotion class processor and the use of KNN classifiers that could help in the mastering and cognitive improvement for CND patients. The proposed processor constantly detects human feelings using the valence and arousal class. The processor examined the use of DEAP and SEED emotion class datasets (Jatoi and Kamel 2017). In other overview articles, they have supplied the evaluation of emotion class research that advises novel strategies for emotion popularity and the usage of EEG signals (Anbarjafari et al. 2018). The overview additionally shows a distinctive technique closer to emotion class, theuse of VR because of the emotional stimuli presentation platform and the want to grow a brand new database primarily based totally on VR stimuli (Geslin et al. 2020).

The goal of the study is to determine the value of EEG signals using the brain can improve the classification accuracy and sensitivity. The gaussian kernel smoothing scores best among all the classifiers evaluated in the prediction of autism in terms of accuracy and sensitivity. The autism generation is used within the clinical subject and the way it could assist with extra correct detection of different illnesses or illnesses close to destiny. A large database of real-time applications, mixed with different devices gaining knowledge of and machine

studying algorithms such as naive bayes and many others, is needed to produce higher results. A consistent and smaller sample size is a factor in the validation results. The results will increase proportionally as the sample size and the proportion of the training data set increase.

CONCLUSION

In this result Autism Spectrum Disorder (ASD) using EEG signals the Novel Gaussian kernel Smoothing algorithm accuracy (54.57%) and sensitivity (45.55%) is higher compared to KNN.

DECLARATIONS

Conflict of Interests

No conflict of interests in this manuscript.

Authors Contributions

Author SR was involved in data collection, data analysis, and manuscript writing. Author PN was involved in conceptualization, data validation, and critical review of manuscript.

Acknowledgement

We would like to express our special thanks of gratitude to the management, Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences (Formerly known as Saveetha University) for providing me with the necessary infrastructure that was required in completing the project.

Funding

We thank the following organizations for providing financial support that enabled us to complete the study.

1. Axia clinics Pvt. Ltd, Hyderabad
2. Saveetha University.
3. Saveetha Institute of Medical and Technical Sciences.
4. Saveetha School of Engineering.

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TABLES AND FIGURES

Table 1a. Represents the accuracy and sensitivity for autism using EEG signal with Gaussian kernel smoothing

Sample	Accuracy (%)	Sensitivity (%)
1	18.39	18.45
2	11.2	15.21
3	18.38	14.21
4	18.53	12.98
5	18.45	11.78
6	17.91	15.65
7	17.57	1787
8	18.32	18.11
9	17.78	16.24
10	16.32	17.21
11	12.35	14.21
12	15.74	11.85
13	16.21	10.28
14	14.28	12.54
15	18.32	13.85

16	16.89	14.54
17	15.21	15.65
18	17.32	18.1
19	12.21	17.21
20	13.58	18.08
21	13.58	16.21
22	12.85	17.28
23	16.12	11.54
24	17.65	12.54
25	15.17	13.85
26	16.98	14.85
27	17.54	15.21
28	12.45	17.21
29	11.21	11.54
30	14.96	10.21
31	15.28	10.85
32	14.65	10.44
33	12.98	12.47
34	17.85	13.98
35	18.32	14.85
36	14.85	15.87
37	11.21	16.14
38	10.6	15.74
39	17.21	11.87
40	18.65	15.54

Table 1b. Autism sample using KNN

Sample	Accuracy (%)	Sensitivity (%)
1	21	21
2	24	85
3	45	74
4	74	25
5	25	21
6	85	85
7	69	32
8	32	98
9	65	21
10	32	54
11	64	98
12	85	65
13	21	32
14	32	45
15	65	28
16	98	17
17	97	14
18	32	15
19	45	16
20	12	58
21	78	25
22	65	85
23	41	45
24	21	47

25	12	12
26	15	26
27	17	28
28	19	96
29	65	58
30	85	24
31	78	47
32	98	14
33	65	65
34	32	32
35	56	17
36	23	58
37	89	65
38	78	21
39	45	32
40	12	54

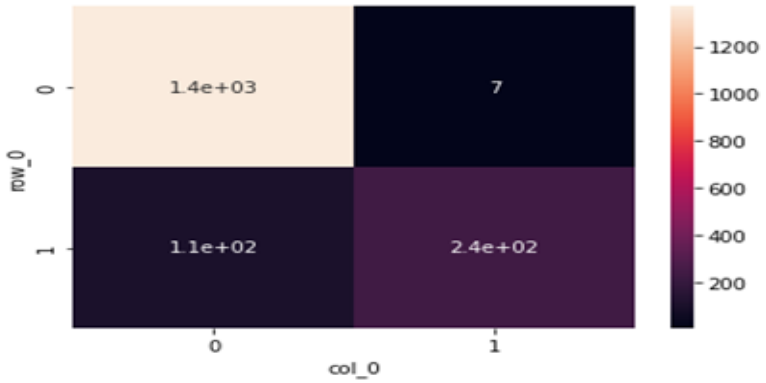
Table 2. Comparison of mean, accuracy and sensitivity using EEG signal with Gaussian Kernel Smoothing and KNN.Group statistic comparison of accuracy and sensitivity for autism using EEG signal prediction with gaussian kernel smoothing and KNN classifier. The accuracy of gaussian kernel smoothing Algorithm (54.57%) is higher than KNN (0.504%) and the sensitivity of gaussian kernel smoothing Algorithm (45.555%) is higher than KNN (0.438%)

Parameters	**Classifiers**	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
Accuracy	Gaussian Kernel Smoothing	40	54.57	2.44575	0.38671
	KNN	40	0.504	0.28005	0.4428
Sensitivity	Gaussian Kernel Smoothing	40	45.55	2.44236	0.38617
	KNN	40	0.438	0.26393	0.4173

Table 3. Independent sample t-test for predicting the accuracy and sensitivity of autism using EEG signal for Novel Gaussian Kernel Smoothing and KNN classifier. They appear to be statistically significant in accuracy and significant in sensitivity differences ($p<0.05$) in both the methods.

Independent Sample t Test

Parameters		**Leven's test for equality of variance**		**T-test for equality of variance**					**95% of confidence interval of difference**	
		f	**sig**	**t**	**df**	**Sig (2-tailed)**	**Mean difference**	**Std. error diff**	**lower**	**upper**
Accuracy	Equal variances assumed	87.25	<0.001	38.712	78	<0.001	15.0680	0.389	14.293	15.842
	Equal variances not assumed			38.712	40.02	<0.001	15.06800	0.389	14.281	15.852
Sensitivity	Equal variances assumed	79.91	<0.001	36.344	78	<0.001	14.11675	0.388	13.343	14.890
	Equal variances not assumed			36.344	39.91	<0.001	14.11675	0.388	13.331	14.901



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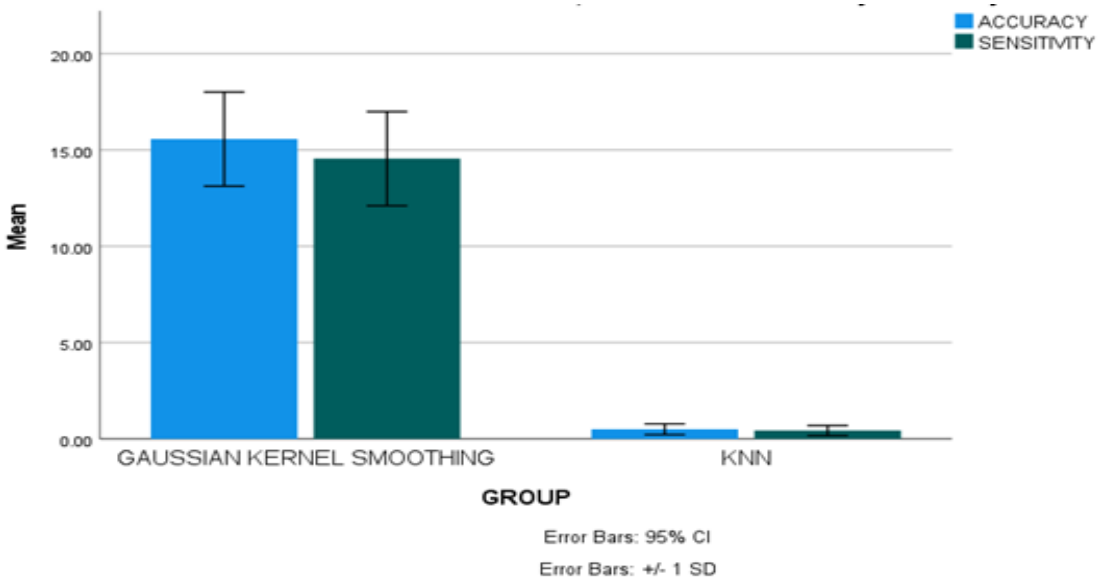

Fig. 2. Simple bar chart mean of accuracy and mean of sensitivity using gaussian kernel smoothing and KNN. The above bar graph represents the comparison between mean accuracy and sensitivity of gaussian kernel smoothing and KNN. The gaussian kernel smoothing appears to produce the most consistent result in accuracy and sensitivity with minimal standard deviation when compared to the KNN. X-axis Gaussian kernel smoothing vs KNN and Y- axis mean with SD+/-1.