Brain Tumor Detection using Novel Kernel Extreme Learning with Deep Belief Network and Compare Prediction Accuracy with Fuzzy C-means Clustering

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Abstract— **Aim - To identify the brain tumor according to the categorial identification by using the symptoms. Materials and Methods: To identify brain tumor using Kernel Extreme Learning Machine with improved accuracy over Fuzzy C-means clustering. Results: The proposed hybrid Kernel Extreme Learning Machine approach gives accuracy 93.31% which is significantly better in classification when compared to Fuzzy C-means clustering which has less accuracy 80.14%.and level of significance is 0.01 (p<0.05). Conclusion: Identifying brain tumor was achieved significantly better by using Kernel Extreme Learning Machine compared to Fuzzy C-means clustering.**

***Keywords*— Kernel Extreme Learning Machine (KELM), Fuzzy C-means clustering, Innovative functional glioma, Machine Learning.**

I. INTRODUCTION

We will identify brain cancers in this paper. The central nervous system, which controls all important activities, is made up of the brain column[9]. There have been 35 articles published overall, including 15 articles in research scholar. This article uses an approach that makes it easier to diagnose and predict the prognosis of brain tumors in numerous neurological diseases[6].]. Therefore, the proposed work must consider computational complexity and Limitations on memory [21] An emerging subject in various medical diagnostic applications is flaw identification in medical imaging using machine learning[1].The use of MRI in the diagnosis of brain tumors is extremely important because it offers reliable information about aberrant tissues required for treatment planning [5]. We have a wealth of information and research expertise, which has resulted in publications of the highest calibre. [14] [16][11][2] [3] [18][19] [13][22].

The research gap revealed by the literature review is that algorithms like CNN produce brain tumour images with lower accuracy and prediction efficiency. [23]. In order to improve accuracy and precision, the proposed work is applied with this aim.The goal of the study is to predict brain cancers and evaluate the prediction accuracy between Fuzzy C-means and Novel Kernel Extreme Learning (KELM) Learning more specific information regarding brain tumor identification via clustering rain[4].

II . MATERIALS AND METHODS

This study is being conducted at the Saveetha School of Engineering's Department of Computer Science Engineering.. In this study, there are two groups: the Enhanced Kernel Extreme Learning Machine (KELM) group and the Fuzzy C-means clustering group.. There are 10 samples in all, divided into 2 groups.Utilizing the statistical programme GPower, the sample estimator has a real power of 80%. In a statistical test comparing means, the alpha and beta values are 0.05, 0.80 for the G power, and 0.549323 for the effect size. Standard Deviation: 0.68669, Mean for KELM: 0.93, Mean for Fuzzy C-means Clustering: 0.81[12].

.A. Kernel Extreme Learning Machine

Numerous algorithms have been contrasted with the Kernel Extreme Learning Machine algorithm. The aforementioned problem is addressed in the current investigations. This encourages the use of the previous data to provide more information in a new multi-task learning algorithm dubbed the MultiTL-KELM algorithm[17].

Algorithm

Input: Activation function gi, regularization parameter Ci, kernel parameter I and input matrix X(i).

Output: the new data representation X(i+1), and the transformation matrix I

Step 1: Identify the kernel matrix.

k,j(i)K(xk,xj,i), where xk and xj are the t-th and j-th training samples, respectively,

Step 2: Determine the output weight by adding (i)ICi+(i)1X(i)T)..

B. Fuzzy clustering

To increase the accuracy of clustering under noise, mathematicians added the spatial term to the fuzzy clustering algorithm in the 1970s. A fuzzy logic model based on three HSL color space components—HSL, HSV—is described using fuzzy sets that are defined on these three components.

Algorithm

begin
Fix c, 2cn; Fix, (for instance, =0.001) fix maxIterations (for example, 100); Any inner product norm metric is acceptable (e.g., Euclidean distance)
Fix m, 1 m, (for example, m=2); Randomly initialize the cluster centers V0=v1, V2, V3,....., vc; for t=1 to maxIterations, update the membership matrix U using equation (3);

calculate the new cluster centers Vt using equation (4);

determine the new objective function Jm using equation (2);

and if (abs(Jm-Jm-1)) then break;

else

Jm-1=Jm;

end if

end for

The Support Vector KELM and Fuzzy C-means clustering Algorithms were evaluated using software created in Google Colab and Jupyter Notebook using the Python programming language. The hardware setup included an Intel Core i5 processor and 8GB of RAM.The system type used had a 917 GB HDD, a 64-bit OS, and an X64-based processor. The Windows 10 operating system is a part of the software setup.

IBM SPSS was used to do the analysis. It is a piece of statistical software that is used to analyze data. Both the proposed and the existing algorithms underwent about 10 iterations with a maximum of 10 samples.The expected accuracy for each repetition was recorded for performance analysis. Utilizing the value gleaned from the iterations, an independent sample T-test was run.

This data is being trained, and the accuracy of the training is checked by employing a verification method. By taking into account this analytical component, which was afterwards used to assess the precision of the identification and to find the brain tumor indicated in it.

C. Statistical Analysis

Images are used as the sample size in this SPSS dataset preparation for the KELM algorithm and Fuzzy clustering method.Table 3 displays the average for KELM and fuzzy clustering algorithms. Group number 1 is set for KELM, and group number 2 is set for fuzzy clustering. The user interface for nutritional prediction using a user-input image is shown in Fig. 2. Then a comparison between the two algorithms needs to be computed. The proposed system is then compared to the optimization method. The study of this suggested algorithm reveals the Kernel Extreme Learning Machine (93.12%).

III. RESULTS

This research is that the Enhanced Kernel Extreme Learning Machine (KELM) results has gotten a preferable precision of 93.12% over the Fuzzy C-means clustering algorithm grouping calculation which just has an exactness of 80.13%. Fig. 1 shows the example Figshare dataset pictures alongside its ground truth Images. The time intricacy for the proposed result has been dramatically diminished contrasted with the current result. After the information assortment is completed the research should be possible. The proposed method is for estimating the data for achievement of better results.

In SPSS programming a sample size of 10 information is utilized for Enhanced KELM and Fuzzy C-implies bunching results. These 10 information tests for every result are utilized to compute the diverse factual qualities that can be utilized for the correlation as in Table 1. Here in this proposed work the Enhanced Kernel Extreme Learning Machine (KELM) calculation has accomplished an aftereffect of 93.13% precision. The precision has been further developed a ton contrasted with the Fuzzy C-implies grouping Algorithm which just delivered 80.13% exactness in assurance of illness dependent on the assessment upsides of the manifestations as displayed in Fig. 3. Gathering insights of Fuzzy C-implies bunching with mean exactness of 80.13. Table 3 shows the Independent example test T which is applied for the informational collection fixing certainty stretch as 95% and level of importance as 0.00.

I. TABLES AND FIGURES

Table 1**:** Group Statistics of FCM (Mean Accuracy of 81.91) Kernel Extreme Machine Learning (Accuracy of 93.13).

Algorithm	Accuracy	F1-Score
FCM	80.1	81.5
KELM	93.1	94.3

Table 2

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig	t	df	Sig (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Accuracy	Equal variances assumed	.007	0.02	-109.9902	18	0.000	-12.894000	.11732	-13.14.049	-12.647551
	Equal variances not assumed			-109.9902	17.958	0.000	-12.894000	.11732	-13.140453	-12.647447

Group Statistics of FCM (Mean Accuracy of 81.91) Kernel Extreme Machine Learning

(Accuracy of 93.13).

Algorithm	N	Accuracy	Average Deviation	Mean Std. Error
FCM	10	80.1229	1.63606	.51377
KELM	10	93.1370	1.38006	.43641

Table 3

Unbiased Sample Test T test is used with a 95% confidence interval and 0.00 level of significance for the data set.

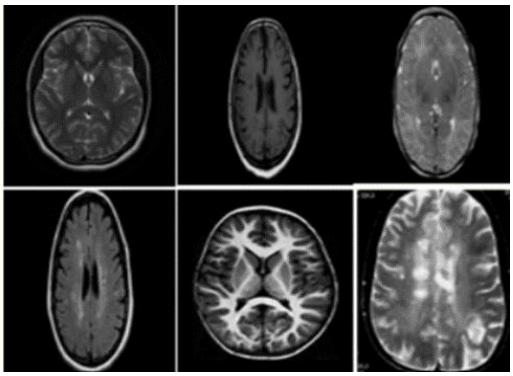

Fig. 1. Pictures from a sample Figshare dataset and associated Group truth images

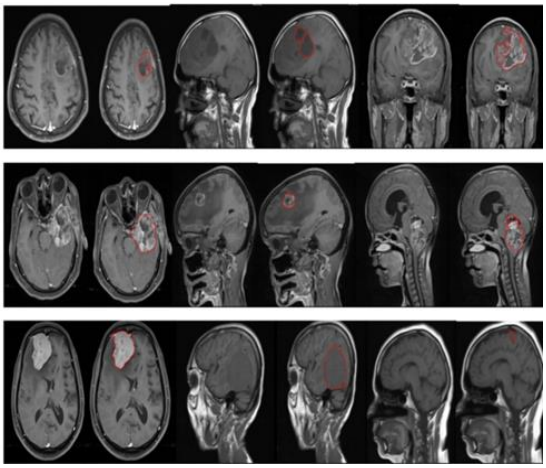

Fig. 2.a sample of ground truth and aberrant MRI scan images.

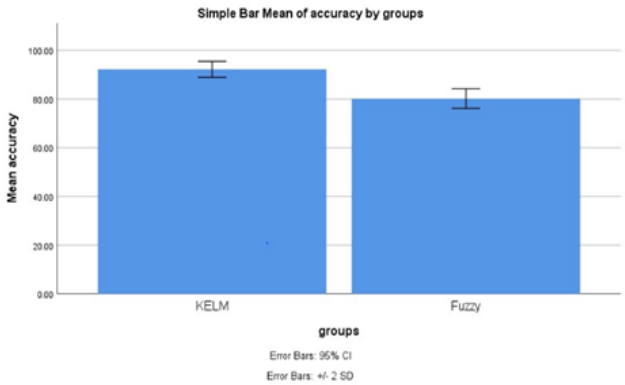

Fig.3

comparison of the mean accuracy of the KELM algorithm with the FCM classifier. Compared to FCM, KELM''s mean accuracy is higher and its standard deviation is marginally lower.

IV. DISCUSSION

Based on the above study it has been observed that KELM has better accuracy of 91.1% over the Fuzzy C-means clustering which has an accuracy of 80.3%.

In this work[8] the approach is ordered to develop Kernel Extreme Machine Learning for supervised Brain Tumor image recognition, where these KELM are trained to classify the Brain tumor images.[7] It proposes the KELM Brain tumor images by MRI image datasets. Researcher[15] proposes the real Brain Tumor images by Kernel Extreme Learning Machine and various techniques are proposed for the KELM algorithm and its training, detection accuracy higher than 93% achieved. Researcher [10] proposes a model that investigates the effective use of nutrition labeling intake according to the age groups. There are no opposing findings related to this work.

The limitations of the proposed algorithm is that the Kernel Extreme Machine Learning cannot be integrated with other devices and analyze the live data which is constantly changing.

In future various applications can be made by working together with the combination of other algorithms. Even the Brain tumor image value data can be uploaded into the platform for the future reference and availability of the data through which more users can be able to access the data in real time.

V. CONCLUSION

In this we have observed that the Enhanced Kernel Extreme Learning Machine Algorithm has obtained a better Accuracy of 93% . The time complexity has been exponentially decreased.

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