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Email : ijitce.editor@gmail.com or editor@ijitce.com

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# Abnormality Feature Extraction in the Spinal Cord MRI Using K-Means Clustering

*Ms. Noore Ilahi, Ms. Masrath Jahan, Mrs. Rayees Fathima*

***Abstract: -***

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***2. "Vertebra identification using template matching modem and $ $ K $ $ K-means clustering," by Sad Malamud, Mohamed Amine, Mohammed Benjelloun, and Latham. 9, no. 2 (2014): 177–187 International journal of computer assisted radiology and surgery***
***3. Vandal Shah, Britisher N. Shah, and Piyush M. Patel In a medical application, "image segmentation utilizing K-mean clustering for identifying malignancy." IJCTT 4, no. 5 (2013): 1239–1242 International Journals of Computer Trends and Technology.***
***4. "Automated edge identification technique for Pap smear pictures using moving K-means clustering and modified seed based region growth algorithm," by Nor Aside Mat Isa. Worldwide Journal of.***

## INTRODUCTION

In our body, the spinal cord is crucial. The significance of the spinal cord is not widely known. All of the information leaves the brain via this primary pathway. The entire human body. It transfers data across the body from one location to another. The spinal cord has a disc, spinal canal, and vertebral column. The entire spinal column is divided into four types: cervical (type 8), thoracic (type 12), and lumbar (type 5), which regulates the hip and thigh functions, and sacral (type 5) which controls the leg functions. 150 articulations between the cervical and sacrum allow for movement. Around the world, spinal cord injuries are a prevalent occurrence. Two are present.

Previous research has shown that tumors are common in the brain and even in other internal organs, but not in

the spinal cord. The vertebral spinal cord tumor of today is commonly used. Age is not a factor in the likelihood of spinal abnormalities. It is unknown what caused the spinal vertebrae to calcify. Calcification mostly affects the cervical and inter vertebral discs of the thoracic and lumbar spine. Pains brought on by full and partial disputes may become worse. Initial signs of the condition include numbness, edema, weakness, and a change in gait. It is always preferable to treat a condition before surgery. The best method of diagnosis appears to be to use an MRI to visualize the suspected location or problem. The purpose of this paper is to:

In this work, many strategies are employed to diagnose the unhealthy situation early on in order to prevent advanced consequences. Clustering is a crucial type of partitioning. Method that many researchers employ for their fruitful research. The related and unrelated objects in the provided medical data are clearly distinguished. Using an MRI scan of a spinal cord tumour, the well-known and often employed K-Means Clustering technique was applied. Data from various age groups have been grouped together. The most effective method is this one. The sections of this essay are as follows:

The Related Works Done in the same and Different Domains are described in Section II. The explanation of the proposed work's theoretical and mathematical representation is found in Section III. Images are tabulated beside the IV Result and Discussion of the task completed. Section V completes the section by

1,2,3 Assistant Professor
1,2,3 Department of CSE
1,2,3 Global Institute of Engineering and Technology Moinabad, Ranga Reddy District, Telangana State.

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## II.RELATED WORK

Different domains employ K-Mean Clustering. The K-mean Clustering concept is examined, and significant contributions made by many authors are examined and put to use in this paper. A novel technique to manually identify a vertebral column in the spinal cord was described by Mohamed Amine Latham et al. in their study [2]. They employed contrast and edge detection to pre-process the image before utilizing Generalized HT to manually mark the alignment. Finally, it appears that the region was found using k-means clustering. Alignment of the vertebrae is extracted. Future work will involve automating their tasks, enhancing their learning models, and segmenting data. On various sets of medical photos, Piyush M. Patel [3] applied the K means technique to identify a particular section of the image. Isa or Ashidi Mat [4] First, K-means clustering is used to find the threshold value and with this MSBRG is applied for edge detection. As per the result it has given better outcome after comparing with different algorithm for the same. Selvamani.K et.al [5], implemented K-means algorithm to segment the Brain image. This Work is done by Segmenting MRI brain tumour with k tissue values. Estimated mean intensity at each location for each tissue types. Performance of the algorithm is tested using different and large patient data. The future and on-going work is segmenting coronary arteries in a sequence of biographic image while preserving the topology of the vessel structure.
K. Vijay, K. Selvakumar [6] developed a new model for segmenting FMRI images integrating both PCA and K Means algorithm. First, it is applied to avoid the problems occurred while segmentation. After this interaction K mean clustering is applied on the FMRI for the same clustering purpose. The result shows that it performed well and gave the accurate result.
Ming-Ni Wu1 et.al [7], proposed a colour based method to segment the brain MRI. K means clustering is used to Perform this task. It is not a common one, this k mean first convert the Grey scale image to colour space image then Partition the tumour from the given image. This result is compared with the histogram clustering method. Result Shows that this method works efficiently and as per the statement defined, it is an easiest method for the Segmentation.

Shiva Ram Dubai et al [8], Presented the work which implements the k means in two different ways. First, Clustered the pixels based on the color and spatial feature. Second, the clustered objects are merged to a particular Region value. By this they believed that computational efficiency is increased to avoid the feature extraction of Every pixel in the image. Result shows that the approach is promising.

## III THEORETICAL AND MATHEMATICAL REPRESENTATION OF THE PROPOSED WORK

The two-step procedure of the suggested technique is detailed. Initially, medical pictures of the spine acquired by magnetic resonance imaging (MRI) are used as Input, and pre-processing is performed on the images to increase their adaptability for further Processing. It is necessary to first automate the decision-support system such that Anomaly detection is the primary focus while examining given data. Histogram-based image enhancement features. No processing is necessary if the image is healthy. In the second step, anomalous data is clustered using a means technique to extract features. Figure presents the methodological framework. The next step is to calculate how far underground the abnormalities go.

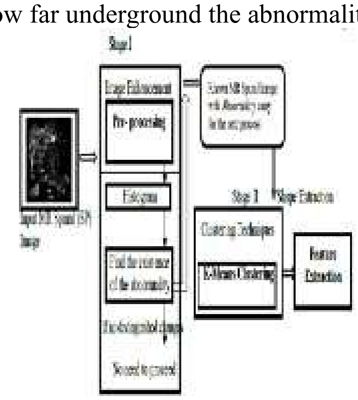


***Fig 1: Over view of the different steps of the proposed Framework.***

**a) Data set**

This study makes use of normal and aberrant MRI pictures of the cervical spinal cord obtained from Dr. G. Balamurali, a spine specialist at Chennai, India's

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Carvery Hospital. Medical imaging and communication technology is abbreviated as DICOM. Medical image formats are specified by the Digital Imaging and Communications in Medicine (DICOM) International Standard. Any kind of data item may be stored in a DICOM file. Definition. Images of this kind often include patient metadata such as age, sex, imaging modality, study description, date of picture capture, image size, image type, etc. This approach processes both typical and atypical data. Sagittarius t2-weighted MR spinal images of the tumour are acquired. Within the suggested Method, 20 patient photos are used for evaluation.

**b) Histogram**

The image's histogram is a graphical depiction of the image's pixel values at various intensity levels. Specifying either an appropriate image data file or the histogram statistics is necessary for producing the desired histogram result. Pixels make up everything. Fig. 2 is a histogram showing how the data from the provided datasets is broken down. There are 256 potential values for an 8-bit grayscale picture. Compare the intensity shift to locate the distorted picture. Photos' aesthetic worth. Only by altering the histogram can we see the differences between the photographs. Therefore, Histogram adjustments must be made for this technique. Let the input image's histogram, Ho, and the uniform histogram, Hu, stand in for themselves. The primary goal is to get, from the input histogram Ho, values of intensity variation histogram H c that are near enough to H to minimise the disparity between H c and Hub to a minimum. As an optimization issue, it can be stated as:

$$H' = \alpha H + (1 - \alpha) Hu,$$

Where $0 \leq \alpha \leq 1$.

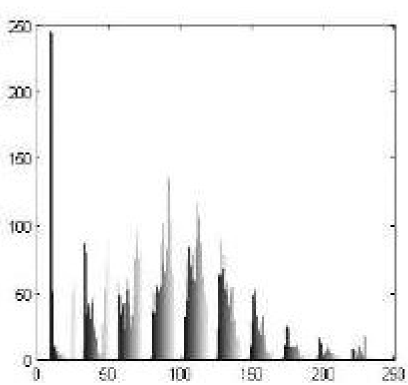


*Fig 2: Histogram of MR Spinal Image*

**c) K-Means algorithm**

The K-means clustering technique is the most basic and widely used in practise. Assigning each piece of input to one of a set of mutually exclusive clusters, wherein objects with shared characteristics are grouped together, is the work at hand. This approach is effective since it clusters the multidimensional data into only K groups. The given estimate data cluster index is returned. The approach will reduce the variance in cluster assignment vectors. Each vector's value in the cluster and the cluster center's value will be updated iteratively once they are assigned.

Changed (reallocated) (reallocated).

Different vectors for the same k will undergo the same procedure. Finally, this collection or cluster approach, known as the cluster Process [13, 14], is an unsupervised grouping technique. Because of its ability to unearth previously unseen patterns in raw data, this clustering technique has broad applicability but finds particular value in image processing.In data mining, the input parameter k determines how the algorithm separates a collection of n items into k clusters, with the goal of increasing similarity within one cluster while decreasing it within another. If an interpretation (x1, x2, x3, X4,...an) is not in the correct dimension, then it must be changed. The goal is to minimise the sum of squares of the inner clusters by dividing the n observations into k sets (k n) S = S1, S2,... Ski.

$$\arg\min_{s} \sum_{i=1}^{k} \sum_{xj \in si} \|X_i - \mu_i\|^2 \quad (2)$$

**V RESULT AND DISCUSSION**

Tumor detection in this study is accomplished by extracting information from the pixel values of MR Spinal scans. The picture is processed in the DICOM Image format. MATLAB Software was used to create the source code. The Process and Its Results are as Follows. When working with Preprocessing, it is necessary to first enter the source photos. Have been finished. Histogram is used to automatically process the resulting picture. The next step is to run Sample Cluster on the provided pictures. The data from the preceding sections is tallied and shown in tables and figures. The time has come to complete the quantitative analysis.

The first step is to a) feed in the source photos. Information provided in DICOM format need conversion to.JPG format before it can be processed in Fig. 3. There might be some fuzziness and blurriness in the picture. Medical images containing noise make pre-processing tasks like clustering and segmentation challenging. Therefore, picture

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enhancements such as converting from RGB to Grayscale, sharpening, and smoothing, are required. Clarity and sharpness are brought out in a picture via sharpening. An image's noise may be eliminated using a smoothing filter. The MR Spinal image input is provided here.

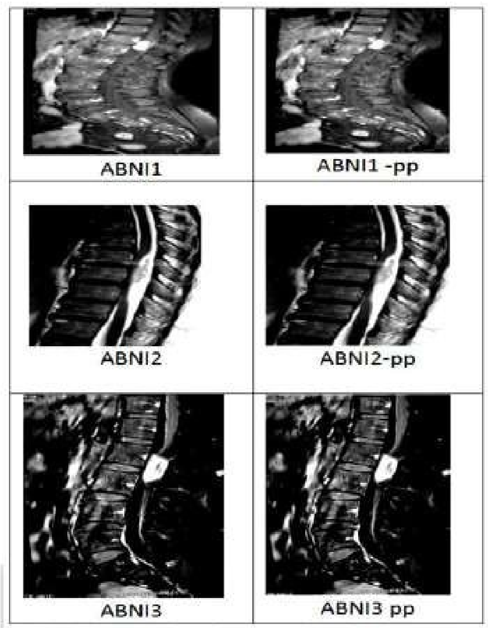


*Fig 3: Input image (with pre-processing)*

**c) Histogram**

Here, we automate the process of checking for the presence of amalgamation by identifying and analysing the values of pixels over a distributed histogram. We speculated that a value in the 40–89 bracket may emerge. It's likely that the data includes calcification, which causes clustering, if the pixel distribution is as shown by the aforementioned numbers. Unless otherwise specified, no Whenever there are problems with the information available, the procedure will end. Figure 4 shows the presence of out-of-the-ordinary values shown by the red rectangle. In a test with 50 seeds, this figure proved to be accurate. This provides a rough idea of the range of pixels across which the highest density region (of interest) in an MR Spinal picture is distributed. Therefore, we used automation to make the model and the decision-making mechanism more efficient. This has to be tried out with a larger sample size of datasets so that the effectiveness of the approaches can be evaluated.

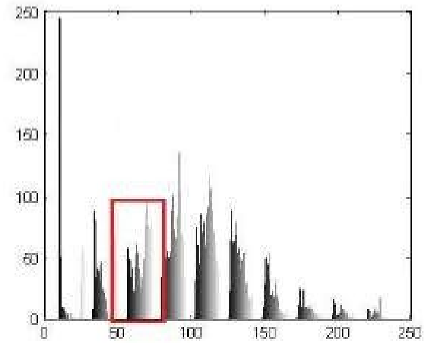


***Fig 4: Histogram of MR Spinal Image with suspicious Amalgamation.***

Example of Cluster Analysis for the Specified Image Fifty seeds are used in the algorithm's execution. The clustering findings for the three different tumour photos are shown in the table below. We already know that there are four and eight individual clusters. Abnormal Brain and Nerve Signal Abnormality in the Spine. Tumor Spinal Image Cluster Outcomes at the C1-C4 and C1-C8 Levels, Determined by the Cluster Center Value k. It's shown in Fig. 5 and Fig. 6.

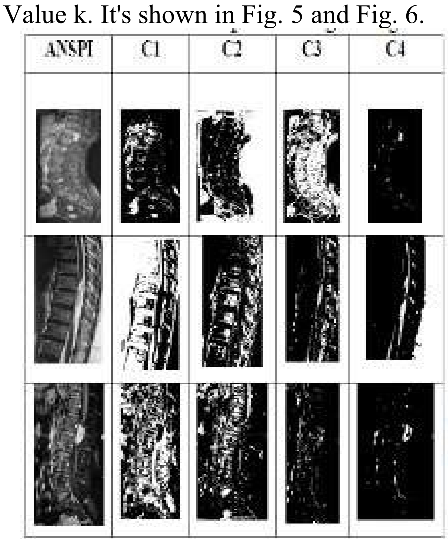


***Fig 5- Figures (ANSPI) of k mean algorithm when k=4***

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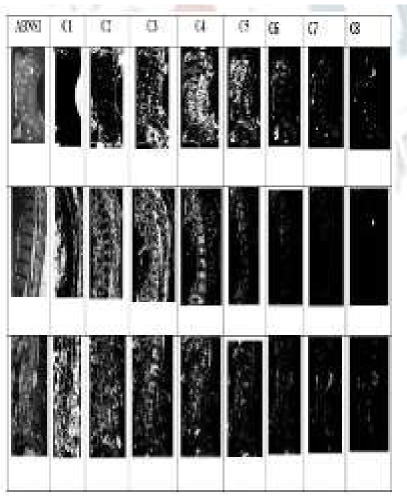

***Fig 6- Output of k means algorithm at k=8***

Three distinct ABNSI samples are used to evaluate the efficacy of the K means method. Following is a graphic comparing the execution times of these three seeds and expressing the tumour pixel densities at 4 and 8 clustering. The ABNSI's impressive results are shown in a bar graph.

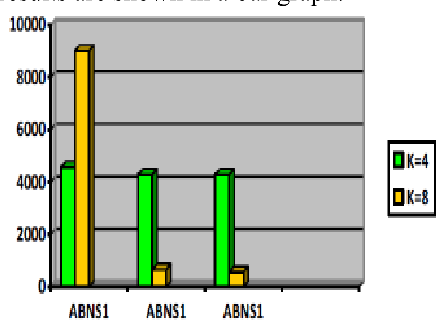


***Fig 7- Performance of the K means Algorithm***

True Positive (TP), True Negative (TN), False Positive (FP), and False Negative (FN) values are used to determine the sensitivity and specificity indices for the K-Means algorithm's quantitative analysis. GT and PM stand for ground-truth region and area discovered by the proposed method, while JI and DC stand for the Jaccard index and Dice Coefficient, respectively.

$$\%SEI = (TN/(TP+FN))/100 \quad (3)$$

$$\%SPI = (TN/(TN+FP))/100 \quad (4)$$

$$JI = \frac{GT \wedge \Theta PM}{} \quad (5)$$

$$DC = 2 \times \frac{\Theta PM \quad M}{} \quad (6)$$

The three seeds from Table 1 are used to determine all of the indices. Results from plugging these inputs into the aforementioned equations. This result demonstrates improved performance on the provided dateset.

| | ABNS1 | ABNS2 | ABNS3 |
|---|---|---|---|
| SEI | 85.49 | 86.23 | 88.14 |
| SPI | 90.23 | 93.41 | 91.28 |
| JI | 0.863 | 0.849 | 0.873 |
| DC | 0.913 | 0.875 | 0.812 |

***Table 1 -K means algorithm performance Indices***

## V. CONCLUSION

In this work, we demonstrate how to use Histogram and the K-Means Algorithm to automate the decision-support system. In order to classify the tumour area, this technique is used using MR Spinal Images. The tumour was located in the area that was most central to the clustering results. The algorithm's accuracy and compatibility are checked. This will aid neurologists in extracting a higher Spinal-tumor ratio and provide clear Automated segmented pictures of the spine. The next step is to put it through its paces with a larger sample size of datasets, at which point classification will be used to determine the tumour pictures' depth, and from there, the tumour kind.

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