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Implementation of clustering algorithm for Brain tumor detection

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Abstract— Medical imaging, including technologies such as microscopy, ultrasound, X-ray, Computed Tomography (CT), Magnetic Resonance Imaging (MRI) etc., have become an immensely important tool in many medical disciplines. The principle advantage of MRI is its excellent contrast resolution. With MRI it is possible to detect minute contrast differences in (soft) tissue, even more so than with CT images. By manipulating the MR parameters one can optimize the pulse sequence for certain pathology.

Keywords- MRI, CT, APPLICATIONS

I. INTRODUCTION

Brain is the central processing unit of world's most complicated machinery, that is, human being. Brain acts as the in charge of human thoughts, feelings, speech, and memory and also plays a pivotal role in controlling muscle movements. Brain helps in the interpretation of sensory information. A tumor is an abnormal new mass of tissue that serves no purpose. The term brain tumor is used to describe any tumor growing within the skull, though a more accurate term might be intracranial tumor. Brain tumor is defined as any intracranial tumor created by abnormal and uncontrolled cell division, normally either in the brain itself(neurons, glial cells, lymphatic blood vessels), in the cranial nerves(myelin), in the brain envelopes (meninges), skull, pituitary and pineal gland or spread from cancers primarily located in other organs .

- **Common types of brain tumor**

A brain tumor may be of primary or secondary type depending on its location of origin. Primary tumors originates in the brain itself while the secondary tumors originates in some other part of body and then spread to brain. There are two categories of brain tumors according to the most commonly used classification-

- **Benign-** Benign tumors are non-cancerous mass of cells that grows slowly in the brain. It usually stays in one place and does not spread. These tumors can be removed and they seldom grow back. Most of the benign brain tumors are detected by Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) scans. Benign tumors, however, can be life threatening because they can compress brain tissues and other structures inside the skull. The following are the most frequently diagnosed benign brain tumors- Meningioma, Schwannoma, Pituitary adenomas, Hemangioblastomasa, Craniopharyngioma .

- **Malignant-** A malignant brain tumor is a rapidly growing cancer that spreads to other areas of the brain and spine. Most of the malignant brain tumors are secondary but can be primary too. These tumors are life threatening. Common malignant brain tumors are- Gliomas, Ependymomas, Oligodendrogliomas, Mixed gliomas .

- **Edema**

Edema is commonly known as brain swelling which can occur in specific location in vicinity of the brain tumor or throughout the brain. It is the "extra fluid" within the tissue of the brain. Edema increases intercranial pressure which can prevent blood from flowing to the brain, thus depriving it of the oxygen it needs to function. Damage or death of brain cells may result .

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➢ **Diagnosis of brain tumor and edema**

One or more of the following methods may be used to detect the presence of a brain tumor having edema and if it has spread-

- Biopsy.
- Sterotactic Biopsy.
- Surgery.
- Lumbar Puncture.

➢ **Imaging methods**

- Computed Tomography (CT) scan.
- Magnetic Resonance Imaging (MRI).
- Positron Emission Tomography (PET) scans.
- Diffusion Tensor Imaging (DTI)

The symptoms of brain tumor depends on tumor size, type and location. Some common symptoms of brain tumor are-

- Headaches.
- Nausea and vomiting.
- Changes in speech, vision or hearing.
- Problems in walking.
- Seizures or convulsions.
- Changes in mood, personality or ability to concentrate.
- Problems with memory.

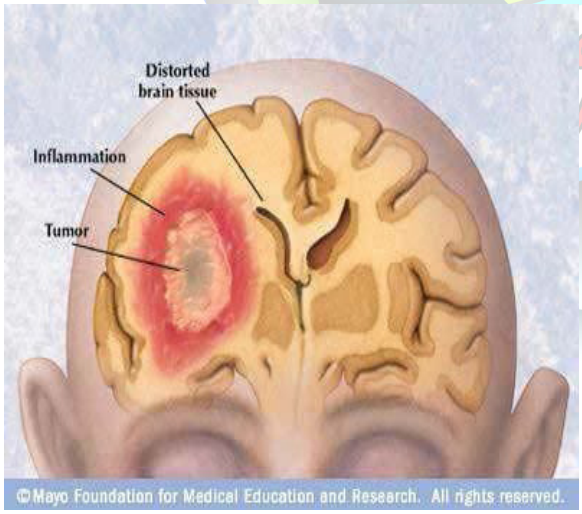

Figure 1. The presence of brain tumor

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II. FEATURE EXTRACTION

In pattern recognition and in image processing , feature extraction is a special form of dimensionality reduction. When the input data to an algorithm is too large to be processed and it is suspected to be notoriously redundant then the input data will be transformed into a reduced representation set of feature (features vector). Feature extraction is helpful identifying brain tumor where is exactly located and help in predicting next stage. Transforming the input data into the set of features is called feature extraction. In this paper we are extracting some features. They are

a. Contrast
b. Correlation
c. Homogeneity
d. Energy
e. Entropy
f. Shape
g. Colour
h. Texture
i. Intensity

III. K-MEANS CLUSTERING

The process of grouping a set of physical or abstract objects into classes of similar objects is called clustering. A cluster is a collection of data points that are similar to one another within the same cluster and are dissimilar to the objects in other clusters. A cluster of data points can be treated collectively as one group and so may be considered as a form of data compression. In many applications, the notion of a cluster in not well defined. To better understand the difficulty of deciding what constitutes a cluster, look at Figure 2, which shows twenty points and three different ways of dividing them into clusters. The shapes of markers indicate cluster membership. Figures 2 (a) and 2 (d) divide the data into two and six parts, respectively. However, the apparent division of each of the two larger clusters into three sub clusters may simply be an artifact of human visual system. Also, it may not be unreasonable to say that the points form four clusters, as shown in Figure 2(c). This figure illustrates that the definition of a cluster is imprecise and that the best definition depends on the nature of data and the desired results.

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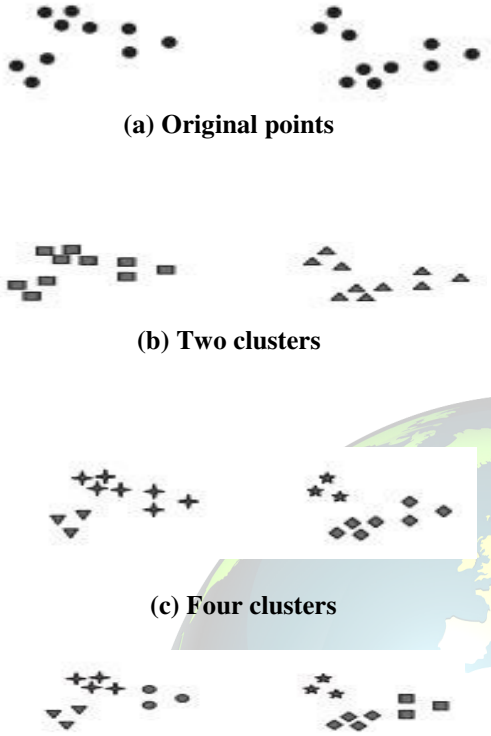

(a) Original points

(b) Two clusters

(c) Four clusters

(d) Six cluster

Figure 2: Different ways of dividing points into clusters

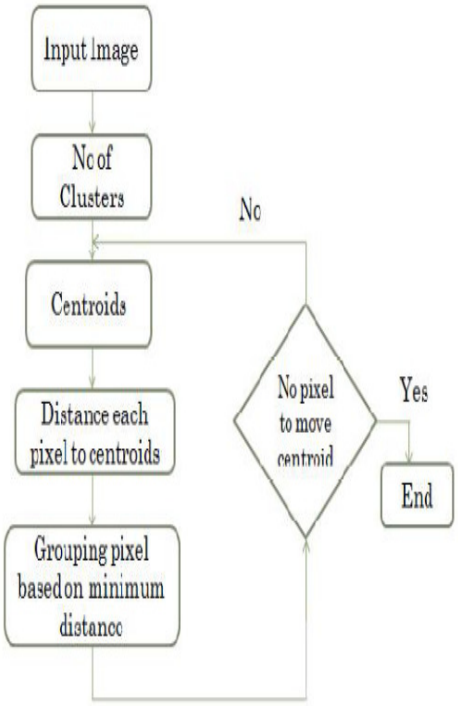

Figure.3 -Working methodology of K-Means clustering algorithm

The limitations of K-means clustering are many iterative rounds may be required. The main argument of the proposed modifications is on the reduction of intensive distance computation that takes place at each run (iteration) of K-means algorithm between each data point and all cluster centers. To reduce the intensive distance computation, a simple mechanism by which, at each iteration, the distance between each data point and the cluster nearest to it is computed and recorded in a data structure is suggested. Thus, on the following iterations the distance between each data point and its previous nearest cluster is recomputed. In the proposed method, segmentation and the K-means clustering have been combined. A brain Image consists of four regions i.e. gray matter (GM), white matter (WM), cerebra spinal fluid (CSF) and background. Therefore, an input image needs to be divided into these four classes. In order to avoid the chances of misclassification, the outer elliptical. shaped object should be removed. After the enhancement of image morphological process is carried out to extract the required region. The Next step is by implementing K-means with clusters exact result is produced.

The execution time for K-means clustering was less compared to the other clustering methods. The proposed

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work also reduces the computational complexity and also provides an accurate method of extracting the Region of Interest (ROI).More importantly, the supervised segmentation method requires considerable amount of training and testing data which comparatively complicates the process. This study can be applied to the minimal amount of data with reliable results.

STEPS FOR K-MEANS:

1. Give the no of cluster value as k.
2. Randomly choose k cluster centres
3. Calculate mean or centre of the cluster
4. Calculate the distance b/w each pixel to each cluster centre
5. If the distance is near to the centre then move to that cluster.
6. Otherwise move to next cluster.
7. Re-estimate centre.
8. Repeat the process until the centre doesn't move

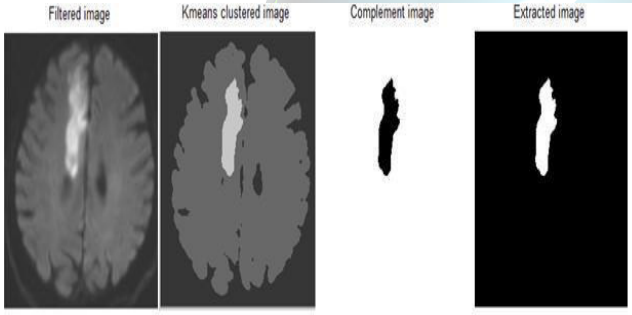

Fig 4: (a)Filtered image (b)Clustered image (c)Complement image (d) Extracted image.

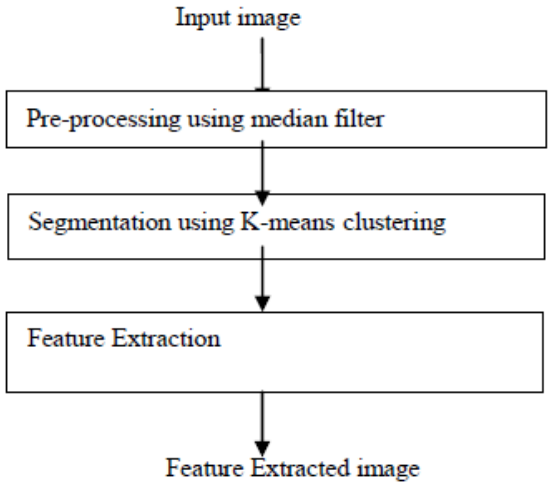

Fig. 5 block diagram

IV. Conclusion

In the present work k-means clustering method is used which gives more accurate result with help of the complement of segmented brain tumour image. Using the K-means algorithm, it has an advantage of less computing time. In other words, the partitioned clustering is faster than the hierarchical clustering. Further it is also helpful for feature extraction. In this feature extraction technique we are use two different types of algorithm so it gives efficient result.

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