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ENHANCED SELF-ORGANIZED MAP (ESOM) FOR BRAIN TUMOR SEGMENTATION

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ABSTRACT - Data mining is an amazing method for mining valuable patterns or data from image and text-based data sets. Medical data mining is vital field as it has significant utility in healthcare domain in reality. In the medical field, the techniques of Data mining hold a significant stand. Larger part of which is adopted viably. Brain tumor is a dangerous disease which produces problems like brain harm, loss of memory and it very well may be indicated as a deformed mass of tissue wherein the cells duplicate suddenly and ceaselessly, that is there is no power over the development of the cells. The primary thought of this review paper is to introduce an outline about brain tumor detection system and different data mining methodEnhanced self-organized map (ESOM)used in this System and successfully utilized for brain tumor detection and avoidance at a beginning phase. This paper additionally gives a critical assessment of the literature reviewed, which reveals new facets of.

Keywords: [Data mining, Brain tumor detection, Clustering,Classification, Time series analysis, ESOM.]

1. INTRODUCTION

Brain tumor might be a cluster of abnormal cells developing inside the brain. It will happen in somebody at virtually any age. It will even amendment from one treatment session to progressive anyway its belongings probably won't be constant for each individual. Brain tumors appear at any area, in several image intensities, will have a spread of shapes and sizes. Brain tumors might be malignant or kind. Considerate brain tumors have a Homogenized structure and don't contain cancer cells. They will be either monitored radio logically or surgically Destroyed completely, and that they once in a while develop back. Malignant brain tumors have a heterogeneous structure and Contain cancer cells. During this system, we will in general square measure having the chance to execute a method which may classify tumor and gives extra right outcome. Early diagnosis and prompt treatment of brain tumor unquestionably builds the endurance odds of a person. Utilizing DM techniques plentiful data can be analyzed from different points consequently removing important data.

The Curing cancer has been a significant objective of medical researchers for quite a long time;however, development of new treatments requires some investment and cash. The development of abnormal cells in the tissues of the brain called brain tumor. Brain tumors can be amiable (not cancer) or malignant (cancer). As indicated by the public

cancer organization, estimated new cases 23,380 and passing's 14,320 from brain and other nervous system cancers in 2014. Human brain tumors are mind boggling and frequently aggressive pathologies of low pervasiveness however significant social impact. The accurate diagnosis of these tumors is fundamental to give a prognosis of tumor development. In medical field the brain tumor detection is finished with data mining techniques, manages the extraction or mining knowledge from tremendous volumes of different sorts of data. The review analyzes rundown of risk factors that are being followed out in brain tumor surveillance systems. Additionally, the data mining methods guarantees to be exceptionally efficient and exact for brain tumor detection.

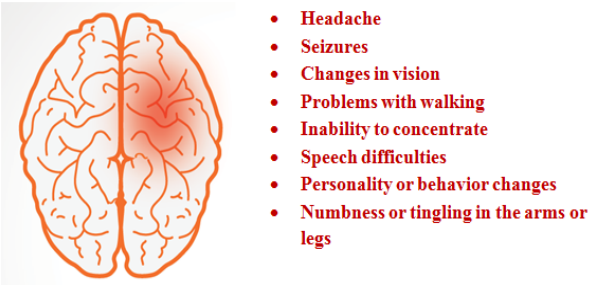

Figure 1.Brain tumor Symptoms

A wide range of sorts of brain tumors exist. Some brain tumors are noncancerous (benevolent), and some brain tumors are cancerous (malignant). Brain tumors can start in your brain (essential brain tumors), or cancer can start in different pieces of your body and spread to your brain (auxiliary, or metastatic, brain tumors).

General signs and symptoms brought about by brain tumors may include:

- New beginning or change in pattern of headaches
- Headaches that progressively gotten more frequent and more extreme
- Unexplained sickness or vomiting
- Vision problems, like obscured vision, double vision or loss of peripheral vision
- Gradual loss of sensation or development in an arm or a leg
- Difficulty with balance
- Speech troubles
- Confusion in ordinary issue
- Personality or conduct changes
- Seizures, particularly in somebody who doesn't have a history of seizures
- Hearing problems.

1.1 Data mining

Data mining is an interaction utilized by organizations to transform raw data into valuable data. By utilizing programming to search for patterns in enormous bunches of data, businesses can become familiar with their customers to grow more powerful showcasing methodologies, increment sales and diminishing costs.

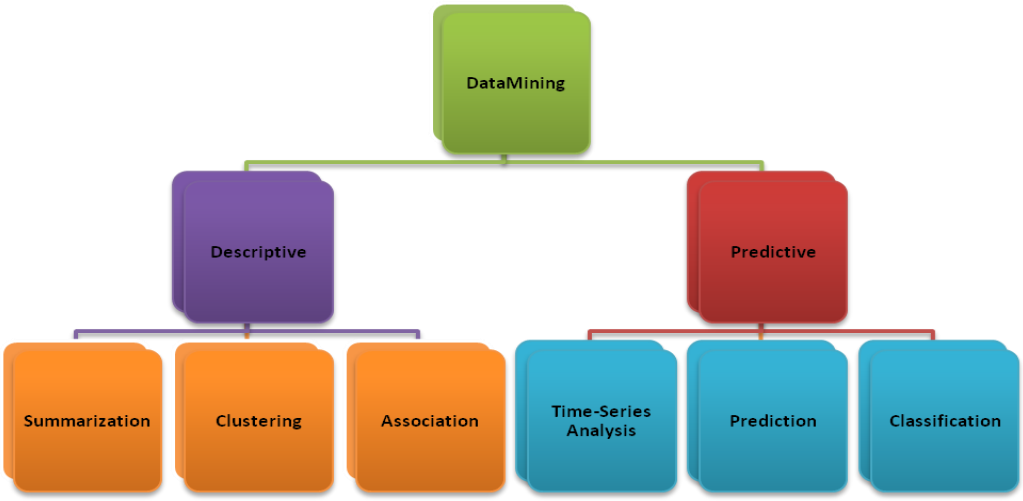

Figure 2.Data Mining Process

a. Predictive model

Predictive modeling is a process that utilizes data mining and likelihood to forecast results. Predictive models are utilized for results. At the point when results are simulated, at that point a static model is built.

b. Descriptive model

The descriptive model recognizes the plans or relationships in data and finds the properties of the data considered. For instance, Clustering, Summarization, Association rule, Sequence discovery, and so on.

Data Mining Tasks

c. Summarization

In summarization, the plan of information is engrossed that results into a more diminutive course of action of information which gives us an overall review of the information.

d. Association

Association additionally significantly affects the medical services industry to find the relationships between diseases, state of human wellbeing and the symptoms of the disease. An integrated methodology of us association and classification additionally improved the abilities of data mining. By utilizing this rule, compelling outcomes are created.

e. Classification

Classification contains two strides: - 1) Training and 2) Testing. The precision of classification model relies on how much classifying rules are valid, which is estimated by test data.

f. Clustering

Clustering is not the same as classification; it doesn't have predefined classes. Clustering algorithms find collections of the data with the end goal that objects in a similar cluster are more indistinguishable from one another than different gatherings.

g. Time series analysis

Time series analysis is a statistical procedure that manages time series data, or pattern analysis. Time series data implies that data is in a series of specific time periods or stretches. Time series data: A bunch of observations on the values that a variable takes at various times.

h. Prediction

Predictive analytics utilizes authentic data to anticipate future occasions. Normally, recorded data is utilized to assemble a mathematical model that catches significant patterns. That predictive model is then utilized on current data to foresee what will occur straightaway, or to propose moves to make for ideal results. Consequently, the data analysis task is an illustration of numeric prediction. For this situation, a model or an indicator will be constructed that predicts a continuous-valued-function or ordered value.

1.2 Literature Review

1.2.1. D. S. Gupta et al.applied Association rule mining-based examination for recognizable proof of clinical parameters likened to occurrence of brain tumor, which prompted the occurrence of brain tumor. Their way includes the collection, cleaning and storage of data, trailed by mining of knowledge frame, It partner it with the 'STATE' of brain, utilizing association rule for data mining. They utilized such parameters like high values of Creatinine, Blood Urea Nitrogen (BUN), SGOT and SGPT to be straightforwardly connected with tumor occurrence. A normalized regression model depends on these parameters alongside Hemoglobin content, Alkaline Phosphates and Serum Bilirubin for prediction of occurrence of STATE (brain tumor) as 0 (missing) or 1 (present). They proposed prediction model for the early diagnosis of brain tumor, however for its robustness and high accuracy the model proposed should be additionally approved by including data sets of patients experiencing distinctive sort of tumors.

1.2.2. W.H. Ibrahim, A.A.A Osman and Y.I. Mohamed proposed the classification of brain tumor utilizing MRI, they utilized neural network for classification of MRI. Their neural network comprises of three stages, preprocessing, dimensionality reduction, and classification. In preprocessing, import the images into MATLAB platform and through the image processing changed over images into binary structure as per threshold, MATLAB put away an intensity image as a single network for each image, those images are changed over into subsequent to preprocessing. In the following stage dimensionality reduction MR images utilizing principal component analysis (PCA) for decreasing the dimensionality of those images, they utilized those images in the wake of preprocessing was as a contribution to PCA algorithm and output of PCA has been. Presently those images prepared to enter the ANN for preparing. Last stage they have classified MRI utilizing the neural network, their ANN engineering comprise of the back-spread feed-forward network. They discovered classification of MRI. Their output stage includes the application of model to see how well model respond to undeveloped data and furthermore detection of abnormal tissue dependent on data. Presently they have classes for every (r), there are 4 classes typical, edema, cancer, and not classified. At last they have tested result demonstrates that the technique was serviceable with accuracy of 96.33%, quick in execution.

1.2.3. S.H.S.A. Ubaidillah, R. Sallehuddin and N.A. Ali,dealt with cancer detection utilizing fake neural network and support vector machine: A Comparative report. In this paper, they looked at the presentation on four distinctive cancer datasets utilizing SVM and ANN classifiers. In this examination, the ANN classifier got great classification execution on the datasets that have bigger measure of information features (prostate and ovarian cancer datasets) SVM additionally introduced great execution on datasets with more modest measure of info features (bosom cancer and liver cancer), however at long last SVM classifier gave better outcome to tumor.

1.3 BRAIN TUMOR DETECTION SYSTEM

Brain tumor detection system is one of the medical care applications and it is essential for beginning phase detection of tumor. It is a software-based application and it is utilized for better decision making in medical care industry. Brain tumor detection system will make an early diagnosis of the disease based on several methods like data mining, machine learning and so forth the vast majority of the current system comprises of preparing part and testing part for distinguishing the disease. What's more, it utilizes filtered brain MRI images as information data and train data. The system may comprise of preprocessing stage and diagnosis stage. In pre-processing stage, the preparation and testing MRI images are exposed to different image processing techniques for upgrading their quality. After that this upgraded images are exposed to feature extraction and diagnosis. The diagnosis part is done based on the removed feature. Such system gives incredible decision making and specialists can utilize it as a subsequent opinion to recognize the disease.

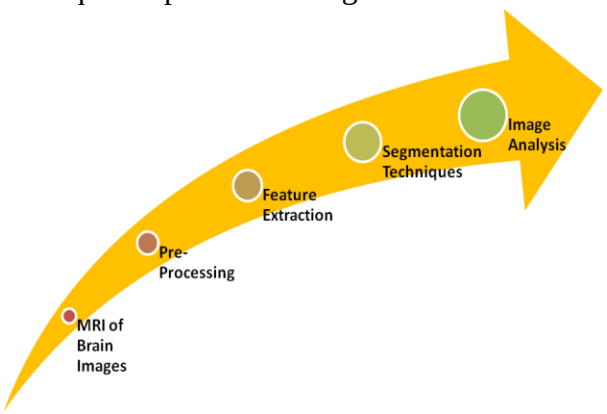

Figure 3.Brain Tumor Detection Steps

MRI of Brain Images

Imaging (MRI) of the brain is a protected and painless test that utilizes an attractive field and radio waves to deliver nitty gritty images of the brain and the brain stem. This is the initial step of our proposed project. In this data is

been given that is the attractive resonance images (MRI) that are been gathered in their original configuration's that are (. ima, dcm). For the most part the MRI images are of. dcm (DICOM) Digital imaging and interchanges in medicine. We have utilized document operations accessible in tangle lab to peruse MRI images. Here the dark scale MRI images are been given as contribution to the system.

Pre-processing

Pre-processing phase of our undertaking primarily includes those operations that are commonly essential before the objective analysis and extraction of the necessary data and customarily geometric rectifications of the underlying image. These enhancements embrace revising the information for inconsistencies and undesirable region noise, evacuation of non-brain element image and changing over the data with the goal that they are effectively reflected in the original image. The initial step of preprocessing is the conversion of the given info MRI image into a reasonable structure on which further work can be performed. This conversion of DICOM image to .jpeg is finished by utilizing function dicom2image (). Major issues identified with the preprocessing stage are as per the following: - a. Noise, b. Obscure Low Contrast, c. The inclination, d. The halfway volume impacts. This pre-processing stage is utilized for decreasing image noise, highlighting significant segments, or showing evident parts of digital images.

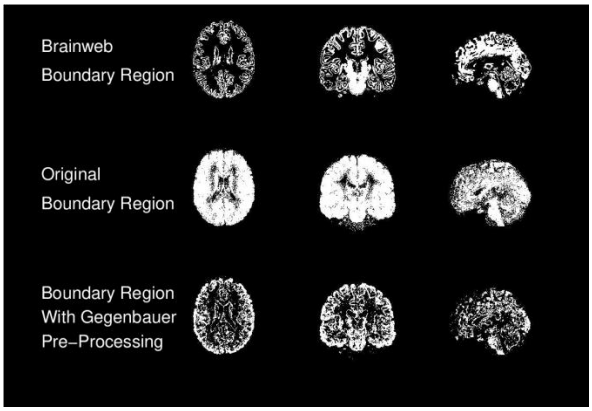

Figure 4. Pre-Processing Image

Feature extraction

Feature extraction is the name for methods that select and/or join variables into features, successfully lessening the measure of data that should be processed, while still accurately and totally depicting the original data set it is the process of gathering higher-level information of an image like shape, texture, color, and differentiation. Truth be told, texture analysis is a significant parameter of human visual discernment and machine learning system. In this phase the features of the given information image is been separated. These features incorporate smoothness, entropy, variance, kutosis, skewness, idm, correlation, homogeneity, mean and standard deviation. Also, based on these features the image is analyzed and the detection of the tumor region is been finished. Underneath in the figure 2 there are output consequence of a MRI image uptill the feature extraction phase of the task.

Segmentation

Image Segmentation is a typical technique of digital image processing. Of late, Brain tumor image segment in MRI has prodded up as a famous exploration in the domain of medical imaging system. The process of Segmentation By segmentation in this undertaking means the method of dividing an image to numerous segments anyway the most difficulties in segmenting are related with degree of pictures and pictures is additionally non-inheritable inside the continuous domain like on X-beam film, or in distinct house as in MRI. In 2-D distinct pictures, the placement of each movement is named an element and in 3-D pictures, it's alluded to as a voxel. For effortlessness, ordinarily we utilize the term 'pixel' to see each the 2-D and 3-D cases.

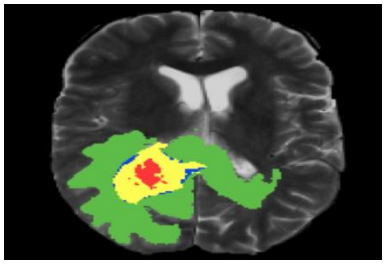

Figure 5. Segmentation of image

2. PROPOSED METHODOLOGY FOR IMAGE SEGMENTATION IN DATA MINING

The proposed technique for Image segmentation can be accomplished by using clustering methods. Grid-based methods, partitioning methods, Model based methods are the methods of clustering. Partitioning methods which depend on the distance work are for the most part used to shape groups.

Enhanced Self-organize map

Artificial neural networks are tasking frameworks closely resembling natural neural networks, introducing neurons, axons, dendrites, neural layers, transfer functions, etc. Their model falls in three principal classifications: Enhanced self- organized, supervised and reinforce. This arrangement considers the measure of information required for the preparation period. Supervised networks utilize past information about the ideal yields, so that the mistake between the real information and expected yield is a reasonable boundary.

ESOM developed by Korhonen is a strong methodology in image processing for segmentation, pattern recognition and data mining. ESOM has a feed-forward structure. It contains a bunch of huge input nodes and output nodes. All input node is related to the output node through customizable weight vector and it is updated in each interaction of unsupervised iterative. ESOM likewise uses a neighboring function, so that node's neighbors of the best matching unit additionally get updated. Korhonen proposed an algorithm which is the ESOM algorithm principally 4 stages comprise of initialization, competition, co-operation and learning ESOM.

1. Initialization stage: An initial weight is assigned to all nodes using random, linear and other method for initialization.

2. Competition: All input node competes for the winner of input patter. Node with minimum Euclidean distance is considered as the winning node or best matching unit (BMU).BMU is found by using the equation

$$U_w(t) = \text{argmin}_i\{||x(t) - w_i(t)||\} \quad (1)$$

Where x(t), x∈X, the input vector at time t and $w_i(t)$ is the prototype vector association to unit i.

3. Cooperation: winning neuron makes the neighboring nodes to change their weight. Gaussian neighborhood function equation is

$$h_{ui}(t) = e^{\frac{-\|r_u - r_i\|^2}{2\sigma(t)^2}} \quad (2)$$

Where $\| r_u - r_i \|$ represent the distance between winning unit and unit i on the outer space and σ(t). controls the reduction of Gaussian neighborhood in every iteration as per a time constantτ_1.

$$\sigma(t) = \sigma_v e^{\left(\frac{-t}{\tau_1}\right)} \quad (3)$$

4.Learning process: the winning neuron and its neighbors are adjusted with the given rule,

$$W_i(t) = W_i(t) + \alpha(t) h_{ui}(t)\left(x(t) - W_i(t)\right) (4)$$

Where α(t) exponential decay learning factor and$h_{ui}(t)$ is the neighborhood function, neighborhood function shrinks in each iteration.

The combination of the highlights in the self-organizing map happens considering a few restrictions on the addition factor while refreshing the loads. Image highlights are addressed by their chromaticity esteems. Chromaticity is attained by normalizing the RGB segments of the image i.e.,

r =R/(R+G+B) (Chromaticity of R) (5)

g=G/(R+G+B) (Chromaticity of G) (6)

b=B/(R+G+B) (Chromaticity of B) (7)

ALGORITHM

SOM algorithm

Take a Brain image as feed.

Acquire k clusters onset.

Pick little arbitrary weights for cluster nodes.

Rehash for N cycles.

In order to counter height= 1 to height to counter width= 1 to width

Express R, G, and B segments as far as their chromaticity esteems.

r=R/(R+G+B) (Chromaticity of R)
g=G/(R+G+B) (Chromaticity of G)
b=B/(R+G+B) (Chromaticity of B)
In order to counter cluster= 1 to cluster.
(Each cluster node is inspected to figure out which one's weights are most similar to the feed vector. This is finished by processing the Euclidean distance between the information vector and the cluster node.)
Distance= ((r-Weight Matrix[k][0])2 + (g-Weight Matrix[k] [1])2+(b Weight Matrix[k][2])2) 1/2
Distance Matrix [counter cluster] =Distance;
End loop.
Discover best Matching unit (BMU).
(BMU is the node with least file). Then, decide BMU's neighborhood.
Neighborhood Radius=Map Radius * e (-Iteration count / Time Constant) Where, Map Radius= Number of Clusters and Time Constant=Total number of iterations / log (Map Radius) Find out the nodes that exist in this neighborhood radius.
Revamp the weights of BMU and its adjacent.
W (t+1) =W (t) + L (t) * A (t) * (I (t) – W (t))
Where, Learning rate L (t) = Learning rate parameter * e (-Iteration count / Total no. of Iterations.)
Learning rate parameter = 0.1
Amount of Influence A (t) = e (-distance * distance / 2 * Neighborhood radius * Neighborhood radius.)
Distance = distance among hub and BMU End circle.
End loop.

3. EXPERIMENTAL RESULT

Brain image has been utilized to carry out the analysis. Classified image has been created utilizing self-organized feature map algorithm. Result examination has been appeared in the underneath figure. Image classification has been finished utilizing 5,8,10 number of classes. As the number of classes rises the classification precision will decrease. ESOFM gives more exactness in image classification. Image classification time will rise if there should arise an occurrence of ESOFM and number of emphases will likewise increment in the event of ESOFM algorithm.

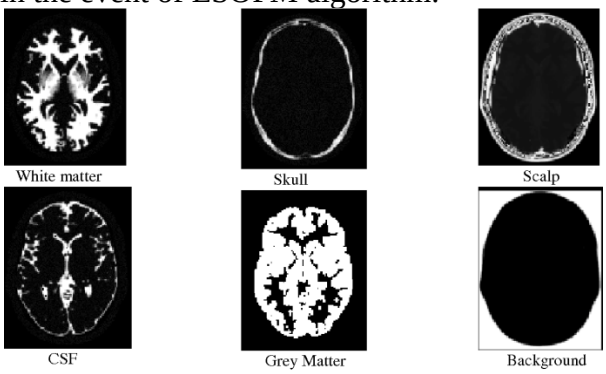

Figure 6. The Segmented tissues using self-organized feature map

Image analysis is the extraction of meaningful information from images; chiefly from digital images by means of digital image processing techniques. Image analysis tasks can be pretty much as straightforward as perusing bar-coded labels or as modern as distinguishing a person from their face. Improve the exhibition and decrease the complexity includes in the medical image segmentation process, we have investigated Berkeley wavelet transformation (BWT) based brain tumor segmentation. Moreover, to improve the accuracy and quality rate. After the sort of tumor is been distinguished the image analysis is been done to decide the accuracy of the outcome. Here in this undertaking four kind of accuracy are been shown that are Rbf accuracy, Linear accuracy, Polygonal accuracy and Quadratic accuracy. These exactnesses help in analysis of the image result.

Advantages

- Brain tumor detection at beginning phases can build the odds of the patient's recuperation after treatment.
- The consolidating the entirety of the extricated features increment the classification accuracy of long transient memory network when utilizing it as the brain tumor classifier.
- The brain is the front most piece of the focal nervous system. The noggin, a hard box in the skull ensures it. Virtually every movement or thought about our own is

constrained by our brain. In this way, it's exceptionally perilous when the legitimate functioning of the brain is impeded. Brain tumor is one such disease which if not recognized early and treated as needs be, can demonstrate lethal.

- Healthcare industry need to give more consideration in tending to hazardous brain tumor diseases. For better decision-making medical services industry began utilizing data mining techniques to recognize the presence of such kind of diseases.
- Data mining techniques are useful for Brain MRI image classification that can analyze brain tumor and different diseases.
- The DM approach gives incredible brain tumor detection. The proposed algorithm is executed on different images and the output recovered is ideal and viable.

CONCLUSION

The brain tumor detection is a muddled and sensitive task; therefore, accuracy and dependability are constantly doled out a lot of significance. This paper is centered on understanding different methods for brain tumor detection which is an essential decision-making feature and is a piece of healthcare application. There exist numerous data mining methods for beginning phase detection of brain tumor from checked brain images like MRI. In this paper proposed method used an unsupervised segmentation algorithm for MR brain image segmentation based on ESOM classifier.ESOM is trained by different number of features vectors.All the means for identifying brain tumor that have been talked about beginning from MRI image acquisition, pre-processing steps to effectively classification of the tumor using the two segmentation techniques is been finished.

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