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Morphological Segmentation Classification and Extraction of Brain Tumor using Adoptive Water Shed Algorithm

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Abstract- The brain tumor is widely seen as cancer which is considered as the second leading cause of human bereavement. Abnormal growth of cells can be found inside or in the boundary of the brain. This kind of abnormality can affect the functionality of the brain or can harm the natural behavior of a person. In general, the brain tumor has two types: one is Benign and another is a Malignant tumor. The Benign tumor cannot spread out suddenly and cannot detriment the other parts of the brain, but the Malignant brain tumor is one type of cancer tumor that can uninterrupted to the patient's death and it will be prolonged with the worst condition and also affect the neighboring healthy brain tissues. The difficulty is that the tumor cell is not be identified at its initial stage and when they identified it's difficult to recover the patient in this means patients meet death. This study is contributing to the field of image processing so that the tumor can be identified earlier and with the help of early treatment lives can be saved as the burden on society will be reduced especially in the poor countries. The main technique for tumor identification is MRI imaging. There are many other techniques used for this purpose like CT, MRI, and X-Rays scientists are now working on the new techniques every day a lot of new ideas are developed and implemented. Still, now MRI imaging is a more reliable technique for tumor identification. But there is a need to improve accuracy on which better results are dependent. There is a lot of burden on the doctors to identify and separate the tumor from the images so there is a need to develop an automatic system that will reduce this burden. There is a bundle of algorithms that have been developed to sort this problem. But still now due to some problems or limitations of algorithms it is still unsolved. In this paper, we have proposed an automatic model with a complete framework of tumor identification, segmentation, and classification is proposed with 94% accuracy results achieved by Support Vector Machine (VSM). We used 200 MRI images for this experiment.

Keywords: Brain tumor, Support Vector Machine (SVM), Rigged boundary.

I.INTRODUCTION

The brain is a central processing area and all the activities directly and indirectly controlled by this organ. There is no replacement Our brain is made up of 100 billion cells known as neurons that are further divided into branches connected to make a complete network in the human body to perform daily takes like sleeping, hunger, eating, walking, thinking, even our thoughts are also controlled by our brain [1]. It is a non-replaceable part of the human body because it is made up of several soft tissues that are even sensitive to a jerk any damage can cause serious problems to our health [2-4]**.** In this way, daily activities are affected. Our brain is divided into three parts but manages is also considered as a part of the brain. Because meninges are the outer covering or layer that is around the brain layers of meninges are known as the **dura** mater, **arachnoid** mater and **pia** mater it provides the supportive frame to the brain one type of cancer that arises in meninges also known as meningioma that's why scientist consider it as a part of brain other parts are *cerebrum* it is the largest part of the brain which starts from front forehead and covers half of the brain connected to the stem of brain cerebrum is further divided into different parts like cerebral hemispheres. Each hemisphere is divided into lobes that are nominated as the frontal lobe, parietal lobe, temporal lobe, and occipital lobe according to the skull bones the surface of the brain is folded and these folding are on each other to form a structure with many folding's that are separated based on their positions, grey matter is arranged into these layers and white matter is generally referred to the central nervous system [5-9], *cerebellum* it is connected to the stem of the brain with pairs of tracts it is divided into anterior and posterior lobe cerebellum is based on an inner medulla of white matter and an outer cortex of richly folded grey matter, interior or posterior lobs plays coordination, smoothing role, *brain stem* it is under the cerebrum consist of midbrain and medulla it is identified at the end of brain and back of skull many nerve tracts that transfer the information to the different parts of the body pass through brain stem this is the last part of the brain. When a brain tumor begins it can cause pressure on the other parts of the brain and can even cause damage in neighboring cells of brains. This can cause brain damage and life threatening [10-13]. Manly cancer is divided into two main types benign and malignant, malignant is the most aggressive type of cancer. This type of cancer originates from a specific part of the body and replicate itself automatically in a little time it can spread to the whole body. This type of cancer a few times respond to the treatments and often it becomes aggressive with medical treatment. Still, now there is no perfect vaccine or medicine that can resist or safe from life losses. On the other hand, benign is another type of cancer that is less dangerous than cancer. It cannot spread to the other parts of the body. Only infect the part in which it can arise. This type of cancer responds to medical treatment. So, sometimes with the medical treatment the infected body part will removed or most of the time with treatment person can survive. Actually cancer is the abnormal growth which means may be older cells destroyed without need or new cells may be divided without need so that the abnormal division of cells is called cancer [14-19].

These all parts of the brain perform their responsibilities shown in Fig. 1

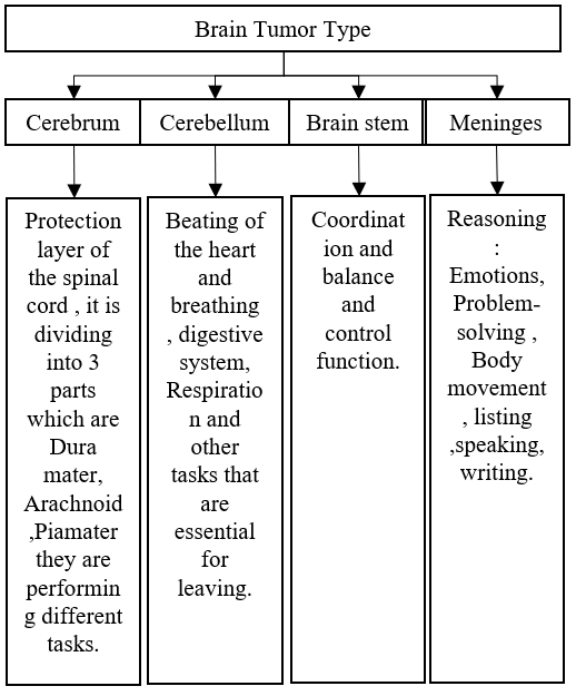


FIGURE 1: Brain tumor type.

Statistically, it is proved that the cancer is the first cause of death in this era. According to the world record, every year about 12.7 million persons diagnose as cancer patients and 7.6 million lose their lives per year this is the largest ratio of death because of any disease. Here are the type of the Brain Tumor and its effects on the human body.

This growing rate of cancer increases a burden on society. There are numbers of different types of cancer is diagnosed in which brain tumor is one of the most rapidly growing and death causing disease. Brain Cancer or brain tumor is a collection of abnormally divided cells that can grow in an abnormal way inside the brain or around the sensitive layers of the brain. A tumor cell not only affects the cells around it, but it also affects the performance of other neighboring cells. The tumor is divided into two major types known as benign and malignant cancer it is further divided into several types. A benign tumor is a non-malignant one is less harmful as compared to benign cancer because it does not spread to the other parts of the body as well as not affect the other cells it is localized to the area where it arises. Mostly it is observed that benign tumors respond to the treatment. On the other hand, the malignant tumor is a more aggressive type of tumor this type is restricted to treatment and spread to the other parts of the body it is further divided into two parts primary and secondary tumors. These types of malignant tumors rapidly spread to the

other parts of the body and can cause sudden death. The brain is a powerhouse of our body every system of the human body is under control of the brain. Doctors divide the human brain into four parts on the bases of cancer. Manages which is not actually a part of the human brain but due to infection that can also affect the outer covering of the brain. It grows in the boundaries of the human brain and then spread to the adjacent cells. It is the deadliest disease that can infect the human lives and tends toward death. Over the word researchers and scientists continuously working on this disease to overcome the distraction rate.

II. PROBLEM STATEMENT

Challenging and important problems in medical imaging: *Image Segmentation*. The segmentation task relay on the countering exact location of region of interest on which the problem raised and we want to focus that area. The task becomes increasingly difficult when we get the pixels of same intensity or the boundaries and internal texture of image are same. The old MRI imaging technique is a quite typical process. Two-dimensional MRI slice, using some images to grasp the correct and precise location of infected area but the combination of gray and white liquid of brain is another metamorphosis difficulty. Sections with coherent characteristics are not essentially consecutive, and there possibly will be the case where the region is composed of blocks. Methods that are used now a day have high false positive rate and Less accuracy as well sensitivity and specificity respectively. Due to wrong identification of disease-ridden region.

III. SCOPE OF STUDY

As a lot of work is done on the brain tumor but still now there are a lot of problems that are not approach the solution stage. With the passage of time numbers of difficulties are increasing day by day. This work will be helpful for the doctors, radiologist and para medical staff that are directly involve in tumor identification and relief of patients from pain. This system not only identifies the tumor at very initial stage as well it will be helpful for the separation of both type of tumor. So that this will be used in hospitals as in clinics.

IV. CONTRIBUTION

This study is contributing in the field of study is that to build an efficient model that will recognize the infected area of tumor frequently and efficiently. The major contribution is to detect the infected cell at its initial stage such as micro classification and identification of tumor cell at its early stage which is difficult to visible due to poor contrast, and dense nerve system. The aim of this research is to handle the problems that are listed before.

1: The aim is to study and identification of the suitable segmentation for MRI images.

2: Improving a diagnosis process of brain tumor for the effective and timely treatment.

The most commonly used methods for diagnosis are. X-Rays, CT, MRI, PET, Angiogram, spinal tap, Needle biopsy, A combination of CT and PET. Here we use two type of MRI Images which are Diffusion MRI (observe the movement of the water), Functional MRI (movement of the blood).

V. PURPOSE OF THIS WORK

There is a lot of work that has been done the brain tumor and tumor identification now a day. But still now there enough satisfactory results have been obtaining. Still, some fliers are in the work that is creating problems for data identification. In this way, this disease is still under study, and scientists and researchers trying to make a system that may be helpful to reduce or cure this disease. Bundle of images that are taken from MRI is difficult to separate, image labeling, differences in patients' symptoms, fully automated systems, Variety of complex and piled tissues, overlapped boundaries of tissues. On the bases of these problems, this partially automated system will generate good results. SVM is used for classification purposes. The whole work is divided into three steps with five sections.

1.first step all the image data is feed by a system then the images are being passed through the thresholding process.

2.After getting the threshold data this material is passed through morphological operations. These operations will separate the area of interest from the whole area. It will also remove artifacts from data.

3.Then a classifier is applied to the extracted material. This classifier will separate the material by and classified it into the different groups.

VI. RELATED WORK

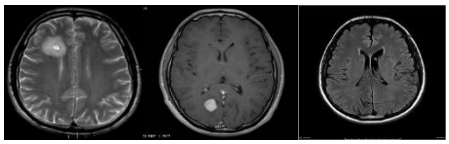
GUOLI SONG .et. Al. Emphasized on the difference between two major types of brain tumor. In the proposed methodology they have used standard images for the normalization background of image and noise is eliminated. On the second modified completed local binary pattern, gray-level co-occurrence matrix, hybrid features and KSVM (Kernel support vector machine) are utilized followed by swarm optimization for the training purpose of the classifier. Yamini Sharma et.Al. Introduced a technique exploiting images for brain tumor MRI. Morphological mathematics is used for the reconstruction of the image. Following the PSNR with the combined work of the K-means method is revealed. The quantity measured between the images that are original and reconstructed. They have used a self-organized map with the neural network and then train the data set on K-mean nearest neighbor and desecrate wavelet is combined in this model. An adoptive pillar K-means algorithm is cast-off for the segmentation of images and then the classification is done on the two-tire approach for classification. Proposed a model for image segmentation in which they have used deep learning-

based methods they used to pass images through pre-train CNN and feature learning is performed through Google net and Alex net region of tumor in images is separated by using different techniques like color segmentation axial view plane is used in their work to obtain information of top and bottom parts of the brain.

VII. METHODOLOGY

A. DATA SET AND ITS DESCRIPTION

Two data sets are used for the experiments first is a BRATS dataset and the second one is obtained from a local hospital of Karachi. The first one is a standard data set taken from the BRATS. This data set contains 250 images some are infected from tumor and some are without tumors. The second data set that is used in this assessment for the experimental approach is taken from a hospital of Karachi, Pakistan. Here about 500 images of different patients that are infected from the tumor are accessed. These images are taken from different patients that have visited the hospital with the complaint of continuous headache, these are also mixed images. This data set is used in more than 10 experiments. We use this data set for the separated module experiments and as well for the complete evaluation of data. First of all, 15 images are taken from this data set and used in experiments from this 100% accuracy obtained. After the first successful experiment 30 images are used with the followed accuracy of 95 % then the whole set is passed through classifier and feature extraction algorithms this time 95% again obtained. Here are the images f the dataset as shown in Fig. 2. The MRI images of the Brain with different angles.



(MRI Images of the Brain)

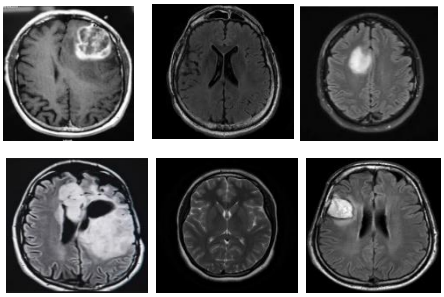


FIGURE 2: MRI Images of the Brian

B. BASIC DATA

For the experimental cause, data is taken from Brat's standard sets and a local hospital's radiology center Karachi. Standard data were taken as a benchmark it is observed that the data that is taken from any standard website will also help to get standard results. In private data that is taken from a private hospital, about 150 MRI images are taken from a private center. A total of 5 patients are observed under this experimental time. Patients 1, 2, 3, 4, 5 are observed after different intervals of time.

This interval was based on the 4 months that is an average time for scrutinizing a tumor patient during these 4 months a patient is facilitated with medicines during this time. But on each interval examining tools was different so that the exact location size and the infected area will be clear for doctors. On the bases of these reports that are generated after this examination the obtained results were satisfactory so it is proved that the automatic system that is proposed in this paper is reliable than the previously introduced methods. MRI images are taken from different angles so that we get approximately four different images from each patient.

These are nominated as T1-weighted images, T2-weighted images, PD-weighted images, and FLAIR. These images that are taken from the patients are quite different from each other. T1-weighted images are different from the T2-weighted images as in the sequence of PD-images and FLIER. These are different from each other on the bases of thickness and the location of the tumor founded cell and the area that is in the circle of these images. There are several diagnoses and different treatments that are available for the cure of tumors. The results after comparison of this image the outcome that we got are different like T1-weighted and PD-images are different from the FLIER. FLIER produces good and graphic results. The images that are from one patient are aligned in one row so that are maybe corresponding to each other. Some images are taken from MRI are provided.

C. IMAGE SEGMENTATION

Extracting tumor area from the whole MRI images is an important task. One of the best approaches to extract the tumor from the MRI images is thresholding. Thresholding is a technique in which on the bases of pixel value and intensity of pixels different kernels are used to differ the main object from the rest of the image. The value that we have used in simple thresholding is 0.6 when we move toward the 0.9 all the objects become blur and irregular. On the other hand, when we use the least value then unable to get the right values. Image segmentation is done on the bases of this technique, several thresholding techniques are available and applied to images for different purposes. Otsu is one of the popular methods for image thresholding with the combination of different values so that the area that is needed will be extracted from the rest of the image. The next method for segmentation purposes is Morphological operators that are used to remove enhanced values and smooth the area of the image. In our paper, we used different methods of morphological operations so that we can get the right values. Morphological operators are used with different kernel values that are necessary for image conversion and segmentation purposes.

a) feature Selection Processes.

1: Creation of classes (Functional MRI, Diffusion MRI)
2: Manipulation of classes
3: Criteria to stop processing

b) Creation of classes

This step involves the selection of features in some specific environments. For the extraction of features, we have used GLCM which will read many of the features of an image.

c) Manipulation of classes

The set that is obtained from the first step will be used in many ways. But the main ways are only two. 1st is using a universal set that evolves all the elements and then observing that the dimensions will be decreased by elements. The 2nd method is to use a single element and try to enhance the dimensions of the work. This will increase the dimensions of a set that is obtained after the manipulation process.

d) Criteria to stop processing

This is always set on the manual hands so (on some condition it is set manually). This is not to be evaluated it's the process of comparison. Comparison of resultant sets with each criterion that is set to attain the mandatory material. This comparison process is continuous and all the sets are compared with repeatedly so that the criteria that are required for stopping will reach. Most of the time the software will not do this, this is set yourself instead of automatic performance.

This will affect the accuracy and the results that we obtained from the process. The vital results are only obtained if the characteristics and the subsets must have suitable material as process demands. In this work, we have used the SVM algorithm. SVM (support vector machine is one of the popular algorithms) it uses a hyper plan to draw a line between different classes and images are divided on the bases of similarity. On these bases these are placed into different groups then a hyper plan is used to draw between these groups.

D. ALGORITHMS FOR FEATURE SELECTION

GLCM (Gray-Level Co-Occurrence Matrix) is an artificial numerical method for feature extraction. This method examined how the pixels are closely related to each other on specific qualities. This provides the mathematical values extracted from images. GLCM calculates the values by creating an equal number of rows and columns. In these rows and columns, images are arranged according to the sequence. Four important features of GLCM are Angular Second Moment (energy), (inertia moment), Correlation, Entropy, and the Inverse Difference Moment. GLCM is ranked at the second-order for feature extraction techniques used for both images.

E. PRINCIPLE COMPONENT ANALYSIS

Another method PCA is a very popular classical method for feature extraction. This use prognostication conversion method in this the data is extracted from the previous material that is provided and after extraction; it will encompass the new place with new axes. The obtained axes have new values so that they are considered as the new level of energy. When the sum of two co-ordinates is calculated and derived value reaches 95% then it will be included in the further operation and the remaining axis will be dictated. Therefore this is according to the principal axes because the values are according to the principal axes.
The energy level can be set on the requirement or it will be done by the user. It lies between 80-90%. The greater values will remain in the matrix and the values that are below then the fixed percentage that is provided are removed in our images.

F. MORPHOLOGICAL OPERATORS

Morphological Operators are mathematical operators. Mathematical morphology is used for the calculation and exact location of the pixel in the image. It will emphasize the pixel intensity and the intensity of pixels shows that the picture will be brighter on this spot shown in Fig. 3.

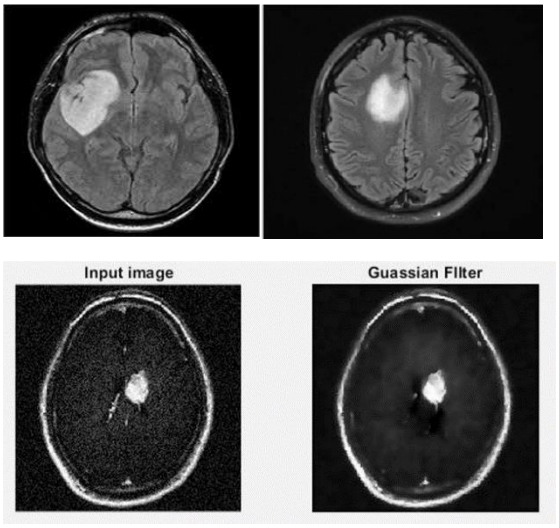


FIGURE 3: Pixel intensity of image spot.

G. DIFFUSION OF MORPHOLOGICAL OPERATORS

Morphological operators made the image arrangement on an increasing scale without distortion of edges. To access the human perception these operators are helpful to simplify data

and then store the important information like shape and some characteristics and eradicates the immaterial to approach better results. This feature of morphological operators makes them unique and essential for the keen operations to remove undesirable material from the images and then even the surface of the image.

Dilation
It represents the growth of an image in size.

Erosion
It is the opposite process of the dilation process. It causes the image to be lost or reduced in size.

Opening
It is a combination of erosion and dilation. This shows that it is the mixture of erosion and dilation and the erosion of the image happens by the specific structuring element.

Closing
Closing is a combined operation of erosion and dilation as like opening.

H. THE FRAMEWORK OF SYSTEM

Figure 4 shows the total process of tumor detection is divided into two main categories in the first part detect the tumor area from the MRI images and in the second part obtain the tumor cells. If the region segmented is not accurately identified it will affect the accuracy of the algorithm. The identification of this cell is also very important in tumor identification. If tumor cells are separated accurately it will helpful for the initial treatment of a patient in this way it is a life securing effort. According to the previous researches, cancer is the deadliest disease that can cause death. It is a common disease in all ages from children to old age persons.
The most dangerous thing is these tumor cells are not identified at its initial stage so that the treatment is not started at the right time and when it is identified it damages most of the brain. In this framework, the whole process is divided into two-step and three categories first are preprocessing second is segmentation and the third one is a classification by using classifier SVM.

The classification algorithm used in the proposed system is supervised, the method and the classifier used in the system for learning classification is SVM. The designed classifier needs to train the learning process, so the next task after registration is to build a training matrix. This process is divided into two steps, Selection of sample points and generation of feature vectors. Perform a random selection of sampling points on random FLAIR slices it consists of a team of doctors with extensive experience and medical knowledge. The sample contains the tumor area is divided into two categories. This operation can not only ensure the accuracy and reliability of a random sampling point but also reduce subjectivity in the selection process. Tumor identification based on the classification of SVM. Modification of region on the bases of region growing system and an adaptive follow-up subsystem and a final watershed theorem. On the first step, classification is done on the bases of whole tumor separation from the data set and then separating classes by using p SVM and watershed theorem. The refinement system will improve the image that is obtained after the first step of the process.

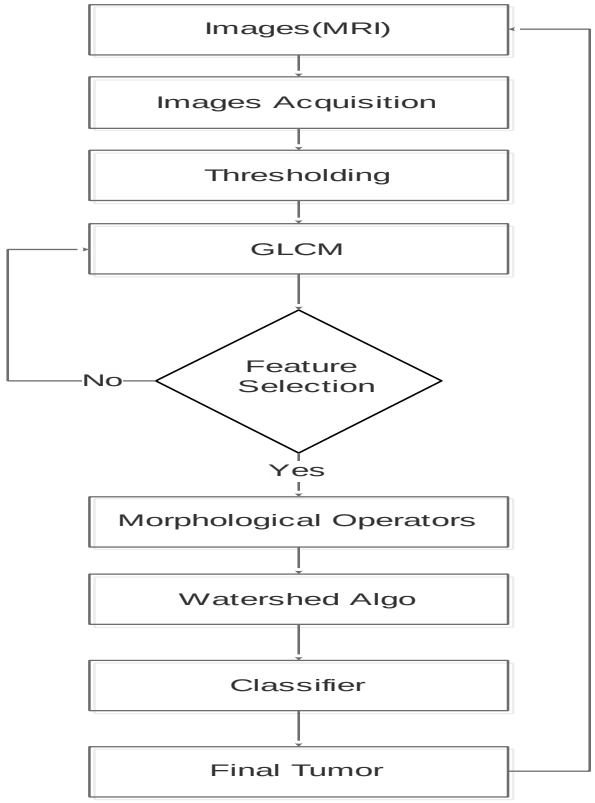


FIGURE 4: Processes model for Brain Tumor Extraction.
When data is obtained after the first examination of the patient shown in Fig. 5, it must register them to confirm that the pixels are in front of effected tissue reported from the machine. The images that are taken from different angles are arranged with the help of an analyst so that these sequences are helpful for the evaluation of data. This data after arrangement and fusion it is easy to understand and maintain the exact correspondence of data.

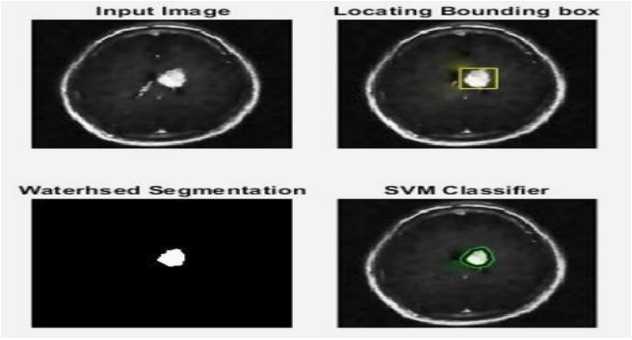


FIGURE 5: First examination of data.

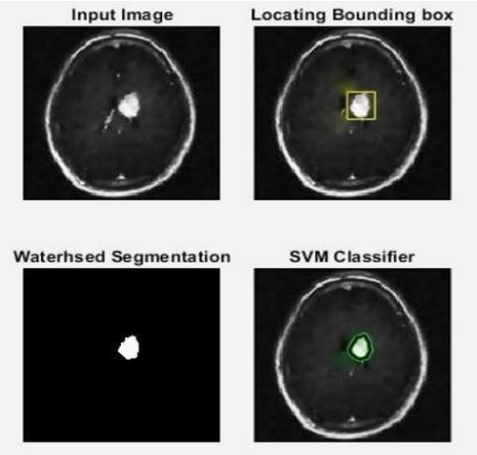


FIGURE 6: Algorithm application.

Algorithms that are utilized in this paper are watershed and SVM shown in Fig. 6. The learning model is used as a supervised learning model. Due to the supervised learning model, it is necessary to train the process, so when data is processed by the first registration process the training matrix is prepared. Random samples are selected by the expert team of doctors and a team of radiologists then these selected samples are divided into two categories that contain tumor means inside of the tumor and the area that is not filled with infected pixels outside of tumor area. This step will provide correct information about correctly selected data and also remove errors and irrelevant material so that the machine will be able to operate on fewer data and takes less time to generate results. The results are fair so that it will be helpful for the treatment of the patient.

After the selection of the sample, the next thing is to make the training matrix for the classification purpose to pass to the classifier. In this model, we tried to extract a large number of features that are extracted with the help of the Gray Level Co-Occurrence Matrix (GLCM), and then the reduced data is obtained by using Principle Component Analysis (PCA). It is observed that the single image that is obtained from MRI also contains some fliers like noise, artifacts, unwanted labels, for this purpose Gaussian filter and salt and paper filter are used to remove this undesired thing that can affect the total accuracy of the result.

The matrix that is taken from the first step is then applied to the data for verification purpose and the results are obtained from this are saved then the material is further proceeds to the next step. A classifier that is mention above used for creating classes so that the accurate location of the tumor is identified without time-consuming. This is one of the beneficial techniques for data evaluation.

Morphological operators are used for the region's growing and region decreasing based techniques that are vital to remove unbalance areas and enhance an area that is out of boundaries. These will remove the extended area, bridges and incomplete lines enhancing will complete the missing lines and wholes so the exact and align boundaries are taken.

Following up by the subsystem that is mentioned as the area for classification the MRI images then passed to the system that automatically identifies the region that is tumor infected. It will automatically separate the images that are infected from the data set that we feed to the machine for the classification purpose.

It is true that human sets every machine according to the demand but on the other hand it is also true that machines generate more accurate results than a human. Specific equations that are used to obtain the feature are:

(1) Mean Value:

$$\overline{m}_w = \sum_w x_i / a^2$$

(2) Standard Deviation:

$$SD_W = \sum_w (x_i - \overline{m}_w)^2 / (a^2 - 1)$$

(3) Geometric Mean:

$$G_W = (\Pi_W x_i)^{1/a^2}$$

(4) Harmonic Mean:

$$H_w = a^2 / \sum_w (1/x_i)$$

(5) Skewness:

$$S_W = \sum_w (x_i - \overline{m}_w)^3 / (a^2 - 1) SD_W^3$$

(6) Kurtosis:

$$K_W = \sum_w (x_i - \overline{m}_w)^4 / (a^2 - 1) SD_W^4$$

When the feature selection is done the matrix, which is completely stuffed with features it's the real matrix. This matrix is used to obtain the finest parameters of classifier than the selection of classifier that is needed to apply on all the images. The basic tumor region is detected and for the improvement purpose of the initial image region the counter region growing based technique is used which will balance the values that are missing and near the edges. The system is used to evaluate the data set and it is following up by a subsystem that is used to assess the condition of patients. This system will segment the image region on the first step then it will be evaluated on the next step after the segmentation and the segmented area will be refined so that the missing area will be enhanced by region growing and then separate the two different types of tumor. The system will evaluate the images and improve the system on the other hand compare the tumor size with the other images and the segmented area.

Selection of features:

Feature selection is one of the crucial steps it's too difficult to select the features that are suitable for the results that are

needed to be obtained. If there is any wrong decision the results will be also wrong that we get. For feature selection, we used GLCM and PCA for margin purposes. Algorithms are used for this purpose are Watershed theorem and SVM.

Subsystem for region growing:

Data that is needed to be trained are selected on the bases of feature selection. All the material like duplication of data, extra material, and noise is also included in the selected data. When we remove any material from this selected data the little amount of information is also removed from the selected data that loss of material can even cause low accuracy.

The boundary tissues and the tissues that have any abnormality mixed with the normal tissues so that it is impossible for the separation of these issues. The actual problem that is found on the boundaries of tissues where there is always overlapping occur due to less distinguishing problems between normal and other tissues. So, there is a need for the selection of the right algorithm that will accurate in the separation of boundaries of tumor.

The system that is involved in this process is:

1: The first and the only interaction between data and humans were at the doctor's end when the first MRI was observed by doctors to separate the infected and uninfected pictures. There is no previous knowledge about the tumor size and shape time required for examining a tumor is about four months and, in this time, doctor tries their best to control the growth of the tumor by using radiations and medicines. So that for the right operations morphological operations are used. In this system the points for sample or sample points are selected by machine automatically and more the sample point more the expected correct result is in chance but when there are more sample points so that it will increase the burden on the system and can even a cause of the noise.

When after the four months the MRI is observed again there is no change in the tumor size and shape. But it's just due to the effect of medicine but this time medicines and instruments for the tests are changed so that the clear classification is done on the image and this will helpful for the cure of tumors. This time the seed or sample points are selected by using the machine which is directly effective on the accuracy of the model. It is necessary to refine the tumor that is detected at the first evaluation process.

I. BOUNDARY/REGION DETECTION BY USING A WATERSHED THEOREM.

Watershed is a transformation that is applied to the binary data. It works on the nodes and highlights the bridges or lines that run through the image shown in Fig. 7.

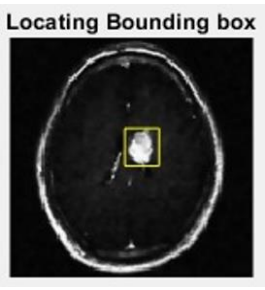


FIGURE 7: Highlights of bridge.

J. COMPARISON OF FEATURE SELECTION AND THEIR ANALYSIS

The method of feature extraction and SVM is used in combination. Feature selection is used to reduce the difficulties and feature selection. Support Vector Machine used different functions like kernel function for similarity and distance that is found in the form of flier and sample classes.

There are more than 15 images are used on the first segment for the little segmental experiment. This threshold is applied to the pictures to get a separate area. The threshold will separate the background from the foreground so that the area of interest will be focused. On the next, these images are passed through the GLCM, when GLCM is applied to these images their features will be calculated and on the behalf of these features the results are calculated. When the feature extraction is done this data is passed to the next step for more refinement under the experiment of morphological operators.

The main four operations are performed on these pictures for the removal of little enhanced areas that is not required and for the removal of wholes and then join the bridges so that there will be no artifact that will remain. In this framework the from thresholding feature extraction then morphological operators the refined images will pass down to the watershed theorem which will highlight the area and draw a rigid boundary around the area that we provide it at the last step we have used Support Vector Machine so that the accuracy will be calculated.

After this, the same sequence is repeated on the next segment of images this time we take 30 images as an experimental material after this we take 50 images and on the fifth and last step, we take 200 images and repeat the same steps on it. These experiments give us different accurate and reliable results.

For the verification of the feature extraction results, we proposed a cross-validation method in which the 70 images divided on the bases of 60 and 40 percent. These images are grouped into two classes the first class is used as the training class after applying cross-validation and getting results from training to check this training the next class is applied to the SVM for testing purpose. A group is directly applied to the SVM as test data to get accurate results. If the test data sample that is used as training data have the same label category of the label and have some samples. It is easy to get higher class accuracy from the model from the test samples. This part of the experiment as cross-validation is applied more than 40 times on the samples to check accurate results.

Support Vector Machine that is proposed in the past with traditional SVM theory that is used in it there is no feature selection operation is used here. Data used as input in this

technique is the fusion of selected features from the FLIER, T2-Waited images, and FD-images. This point is confirmed that the feature matrix that is selected for this process may contain some noise, and a large amount of interface will increase the computation time as well. It will reduce the accuracy of the applied algorithm. The parameters selected for the traditional SVM will also restrict the performance of the system. The cross-validation will improve the results of the system as well and we obtain relatively better results from this process.

K. CLASSIFICATION SVM, NB DEPLOYMENT

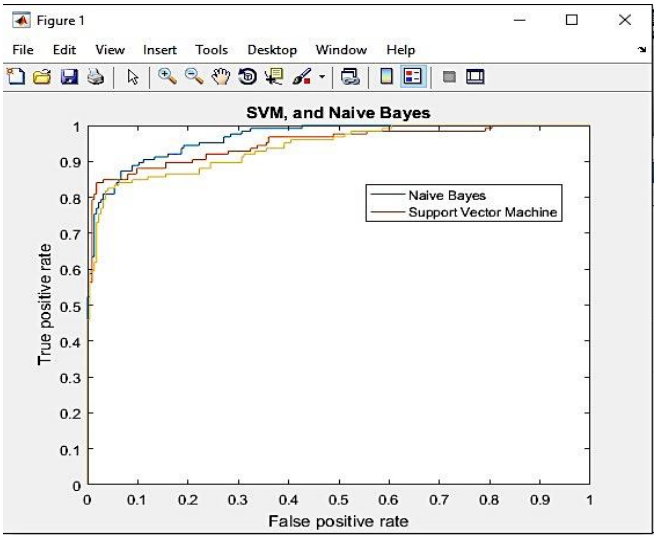


FIGURE 8: Classification SVM, NB

The purpose of feature selection is to analyses the effect of features that are selected on the results shown in Fig 8.. It depends on the selected feature that can affect the accuracy model and also affect the area that is needed to be discussed and given in Tab. 1 and Tab. 2.

stats =

Centroid		MajorAxisLength	MinorAxisLength
116.5	124.15	273	233.56
43	80	1.1547	1.1547
91.931	93.743	101.58	79.417
50	104.38	4.4301	3.2849
53.667	104	3.8541	1.4264
53	107	1.1547	1.1547
56	99	1.1547	1.1547
56	102	1.1547	1.1547
57	51	1.1547	1.1547
57.5	85.75	3.5867	2.1914
61	65.5	2.3094	1.1547
63.5	94	2.3094	1.1547
65	91.5	2.3094	1.1547

TABLE 1: Statistics obtained

TP	This is the ratio of several pixels in the intersection and a total number of pixels in the ground truth.
FP	False-positive is the ratio of the number of pixels in the part after the removal of intersection from the tumor segmentation results and the total number of pixels in the tumor segmentation results.
FN	False-negative is the ratio of the number of pixels in the part after the removal Of the intersection from the ground truth and the total number of pixels in the ground truth.
Total Error	The total error is the sum of FP and FN.

TABLE 2: Fictional values and results.

L. KEY FACTORS SELECTION

The side length of the window for the feature extraction and threshold in the GLCM are key parameters of the feature extraction. These two parameters have a great effect on the analysis of parameters and processing of other things.

The dimension of the feature vector can be affected by the side length of the window used in this whole process. If the sides of this window are longer the dimension of the vectors is higher. More information that is contained in length, side, and redundancy increase the feature selection that is, directly and indirectly, depends on these features, and calculation of the features becomes more difficult. If the selected thresholding scale is set at the very low scale so that the feature that is extracted on the bases of this selected threshold is enough and are at the higher level and on the other hand if the selected thresholding scale is a greater value so that the selected features are not at enough scale so that the most of the features are ignored and in this way, it also affects the accuracy.

In the same way, when the threshold that is set for the process is 0.5 to 0.6 frame that is set for this purpose is 7*7 and 8*8. The threshold value if we set from 0 that is corresponds to all features. The dimensions in which the retained features are available will not jump to the next stage so that the frame remains the same. In this way that the GLCM and PCA will remain with the highest values. PCA does not require any value from threshold so that the comparison also increases value in computation of PCA and GLCM.

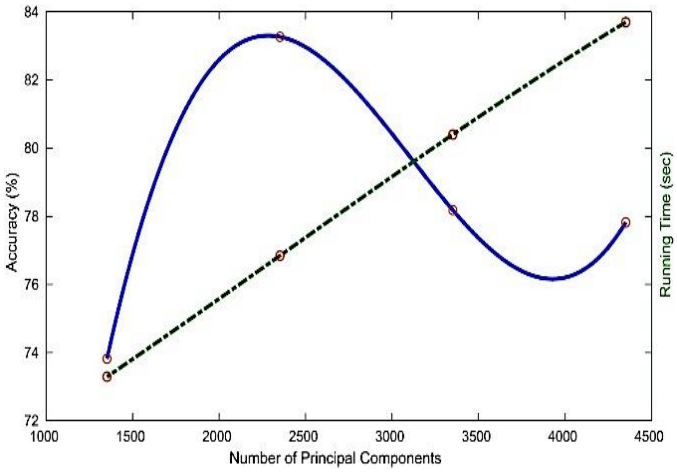


FIGURE 9: Experimental results.

The experimental results that are derived from GLCM are shown in Fig. 9. The size that is used for the window frame. The feature extraction window is used for the size of 11*11.

M. EFFECTS OF THREE-D FEATURES

Three-dimensional effects have a more reliable effect as compared to the other techniques because MRI appears as three-dimensional images. All the images that are corresponding to the three-dimension that is proposed in this paper. Images that we take from MRI is always corresponding to the assigned values of three-D. The points that are used in this are top, left, right, and bottom these are the points allocated for corresponding values as three-D values. This paper includes segmentation based on the analysis of images, thresholding, and morphological operators. For the improvement of results change the basic algorithms for the basic improvement. Steps that are required for the refinement of data and results.

1: Select the region of interest in the first step. Instead of choosing the simple points that are a little bit irrelevant to the desired description. In the method of the previous tracking method. Only one thing is prior knowledge that is taken to the next stage. There is nothing as before given to the next except the region of interest that is obtained from the step previous to the next. This is very important for the segmentation process and the algorithm is dependent on it also affects the accuracy of an algorithm.

2: In this era when there is a lot of different methods are developed and people are working on it as per day and night but still now there are not any logically strong methods. These methods are according to the latest requirements but still, now few lakes are unable to fulfill the requirement of the three-D image. In this way, three-D MRI images with some flaws are needed more improvement in this paper we have to enhance the past discussed methodologies.

3: On the division of vector into two parts the features are divided into two parts the first vector contains the first half feature and the next are for the second feature. Especially these two feature vectors contain the specific feature information about the MRI. These are in the sequence of FLAIR, T2-Weighted, and PD-Weighted. At the final step, the three vectors are joined with each other so that the connection will make a strong relation in them.

4: There is a need to set the window length and size. Their features are three times more than the features that are divided into the simple feature vector division. In this method, we used GLCM with the help of this the features are calculated and the results are not repeatable. After extracting the feature and after their comparison with the others these are compared to the ground truth.

N. EFFECTS OF DIFFERENT EXPERIMENTS OF MORPHOLOGICAL OPERATORS.

The main two operations of opening and closing performed on the different images to erase incomplete boundaries and for the removal of bridges, unwanted texture that can make the results unexpected will be removed during this operation.

Thresholding is used on the images for the difference of low valued pixels and the pixels that are at a high rate. Simple thresholding is set on the value of 0.6. So, the tumor area is detected in a picture that is on the second number then a circular boundary is generated around the infected area.

Region prop is used during the estimation of central radii. The centroid is used for the identification of infected areas. The area with a large number of blue stars indicates the region of interest. Then a circle is drowned with different diameters for the circular identification shown in Fig. 10.

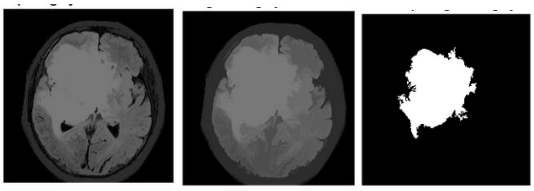


FIGURE 10: Tumor area.

Erosion and dilation morphological operators are used for reconstruction and dilation of the rigged area then the skull boundary bone is dilated for the error-free results. The last picture indicates the region that represents the tumor shown in Fig. 11.

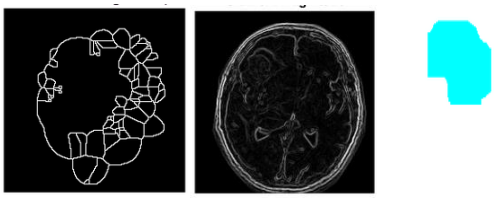


FIGURE 11: Effected tumor area.

These images represent the represents the results taken from the implementation of the watershed theorem. First indicates the rigged boundary of lines that encompasses the soft tissues of the brain. The enhanced area shows enhanced lines. The

second picture indicates the gradient's results used with a combination of the watershed theorem. The last picture is the color identification of the tumor region.

VIII. DISCUSSION

EXPERIMENTAL RESULTS

First, the images are registered that are obtained from the MRI. These MRI images are arranged in the sequence according to the T1-Weighted images, T2-weighted images, PD weighted images, and FLIER. The importance of arranging these images is to approach the sequence of images so that we get the pixels that are corresponding to each other in these different pictures. After this built a statistical model for each image pile and estimate residual error for each one. Generate the report for the feature extraction of images by using GLCM.

There is a great difference between the patient and the MRI images that are obtained from many sources. These differ because of the difference in imaging equipment and the environment. For the universal acceptance of MRI at any place, we have no previous knowledge and any system at all. In this system when images are passed from the system algorithm that we used only to extract the feature which is based on the characteristics of the area of tumor location of the tumor and spreading speed which can be calculated by using these algorithms after some specific time of intervals.

From this step, we gained some information as prior knowledge and retain for further use.

In the first experiment, we use images from 4 to 5 patients and from image data, it was about 40 to 50 images. These points are selected on the behalf of random selection with the help of doctors who suggested these random images. Feature extraction is based on the selection of location if the location that is chosen by the user is exact then the feature will be exact according to the algorithm and if the mentioned location is wrong it will directly affect the features that are extracted.

The total system of different frames that are going to be evaluated is based on the window that is squared and sample points are arranged at the center of the frame and side length and size and grey level values are obtained. Features are derived for mathematical transformation for each window the obtained data is arranged in the form of rows and columns.

The classification of tumor SVM classifier is used on the data of patients that are collected from a private hospital and also used on the standard data from BRATS. This technique is used on both different data sets to compare the results later. The tumor that is obtained from the first refinement image is refined furthermore on the next step that is useful to obtain the area of interest. The tumor is passed through the tumor counter refinement so that the region growing based segmentation will be done on the tumor. Then all the obtained regions are arranged in the sequence of FLIER.

There is a difference between two types of the tumor if there is only one tumor it will be identified separately but when there are two tumors in the same place So that the most infected cells will be separated with the help of some thresholding software then the separated area pass to the classifier shown in Fig. 12.

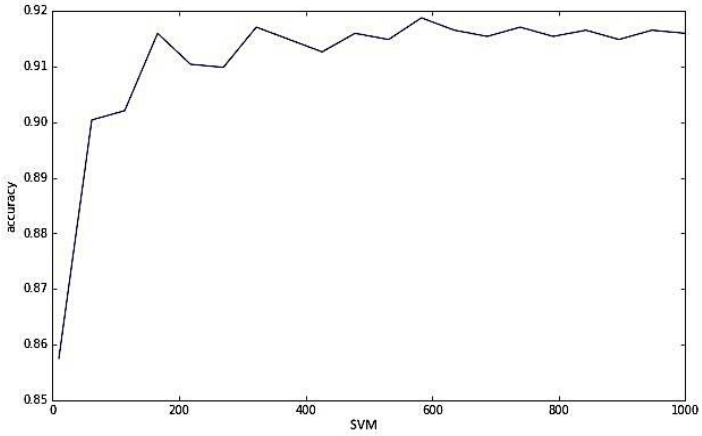


FIGURE 12: Result of SVM.

The idea and results are in one picture is shows below here we shows the original image and the threshold MRI image after processing and then connected concern are means brain tumor are now making segmentation of this area and then the tumor masking and the image make more clear for us for extraction and extraction will help us to reach our goal and we also required the intensity of the tumor which means how much the effectiveness of the brain tumor from graph in our case brain tumor intensity is high shown in Fig. 13.

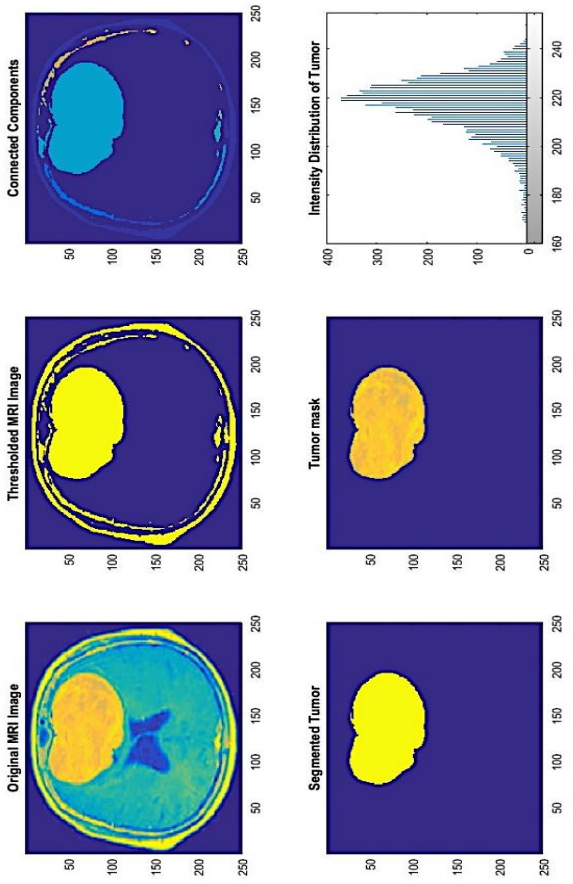


FIGURE 13: Images brain tumor intensity.

IX. CONCLUSION

MRI images are one of the most important techniques that are used in the diagnosis of tumors and other abnormalities found in the human body. This technique is used sound mechanism and clear imaging of the soft tissues will helpful for the diagnosis of tumors and extract the area that is most infected from the disease. This is also helpful for the treatment of the tumor which will be identified in this process. In this way, this method will improve the accuracy as well as it will reduce the workload done by the doctors and analysts that are bounded during this disease identification. The results are also reliable because of machine accuracy and there is not any confusion of human error that may occur during the human observation period as machines are error-free from human mistakes.

This paper will present a model that is semi-automatic with the combination of Support Vector Machine and the theorem that is used as a watershed theorem. This will produce the results after examining the MRI images that are taken from the first examination process. The system that needs only the first time some random selection from data on the next time the results are produced by the computation of first-time random selection of material. All the examination to the next step is automatically obtained from the previous knowledge just on the first the prior knowledge is required but moving to the next the material is obtained automatically.

The segmentation that is occurred on the first step will be from the tumor to the single tissues of the brain. On the step that is just starting a tumor is mapped and then separated from the not infectious area so it will be helpful for the doctors for further treatment. The SVM that is used on the traditional value-based multiclass SVM is used for this purpose and from T2-Weighted images, PD-images, and FLIER some images are selected randomly that are corresponding to the features needed. The feature matrix is prepared on the selection of the most important features that are placed in this feature matrix. The matrix that is prepared from these best features is used for the training purpose and set as a standard. This system that we have purposed has about 94% accuracy which is much better than the previous system accuracy.

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