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BRAIN TUMOR DETECTION AND ANN CLASSIFICATION WITH FEED FORWARD BACK-PROP NEURAL NETWORK

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Abstract— Brain is an organ that controls activities of all the parts of the body. Recognition of automated brain tumor in Magnetic resonance imaging (MRI) is a difficult task due to complexity of size and location variability. This automatic method detects all the type of cancer present in the body. Previous methods for tumor are time consuming and less accurate. In the present work, statistical analysis morphological and Wavelet using Haar Transform techniques are used to process the images obtained by MRI. GLCM Feature Extract & Feed-forward back-prop neural network is used to classify the performance of tumors part of the image Normal and Abnormal stage Tumor Level Analysis Tumor Detection System. This method results high accuracy 95% and less iterations detection which further reduces the consumption time implementation of Matlab 2014a.

Keywords — : MRI; Feature Extraction; Feature Selection; Tumor Classification; Feed forward Neural Network; Back-Propagation Neural Network.

I. INTRODUCTION

Digital media archives are increasing to colossal proportions in the world today, which includes audio, video and images An Image refers as a picture produced on an electronic display .A digital image is a numeric representation of a two-dimensional image. Digital image processing refers to processing of digital images by using digital computers. Nowadays, most of the applications prefer digitalized version, to reduce memory space. Lot of application depends on digital images. One of the important application is medical image processing.

II. DIGITAL IMAGE PROCESSING

Digital imaging is the creation of digital images, such as of a physical scene or of the interior structure of an object. The term is often assumed to imply or include the processing, compression, storage, printing, and display of such images. In digital imaging, the total value of each pixel is represented in binary code. The binary digits for each pixel are called "bits," which are read by the computer to determine the analog display of the image.

The number of pixels-per-inch (PPI) is a good indicator of the resolution, which is the ability to distinguish the spatial detail of the digital image.

There are a wide range of options for storing digital images on a computer. Some common ones include GIF, JPEG, TIFF, and BMP. GIF, or Graphics Interchange Format, has a bit-depth of 1-8 bit, grayscale or color. It is limited to a 256 color palette. JPEG, or Joint Photographic Experts Group, has a grayscale of 8 bits and a 24-bit color scale. JPEG is most often used on web pages. TIFF, or Tagged Image File Format, is commonly used for scientific imaging. It supports an 8-bit color palette and 8- to 16-bit grayscale. TIFF 6.0 can provide up to 64-bit color, but most TIFF readers will support only a maximum of 24-bit color.

III. TYPES OF DIGITAL IMAGE

For photographic purposes, there are two important types of digital images: color and grayscale. Color images are made up of colored pixels while grayscale images are made of pixels in different shades of gray .

- **Grayscale Images:** A grayscale image is made up of pixels, each of which holds a single number corresponding to the gray level of the image at a particular location. These gray levels span the full range from black to white in a series of very fine steps, normally 256 different grays. Assuming 256 gray levels, each black and white pixel can be stored in a single byte (8 bits) of memory.
- **Color Images:** A color image is made up of pixels, each of which holds three numbers corresponding to the red, green and blue levels of the image at a particular location. Assuming 256 levels, each color pixel can be stored in three bytes (24 bits) of memory. Note that for images of the same size, a black & white version will use three times less memory than a color version.
- **Binary Images:** Binary images use only a single bit to represent each pixel. Since a bit can only exist in two states-ON or OFF, every pixel in a binary image must be one of two colors, usually black or white. This inability to represent intermediate shades of gray is what limits their usefulness in dealing with photographic images.

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The various basic steps are as follows

1. Image Acquisition
2. Image preprocessing
3. Image segmentation
4. Image Representation and Description
5. Image Recognition and Interpretation and
6. Knowledge base.

1) IMAGE ACQUISITION

In the process, the first step in the process is image acquisition→that is, to acquire a digital image. It highly requires an imaging sensor and the capability to digitize the signal produced by the sensor.

The sensor could be a monochrome or color TV camera that produces an entire image of the problem domain every 1/30 sec. The imaging sensor could also a line-scan camera that produces a single image line at a time. In this case, the object's motion past the line scanner produces two-dimensional image. If the output of the camera or other imaging sensor is not already in digital form, an analog-to-digital converter digitizes it. The nature of the sensor and image it produces are determined by the application.

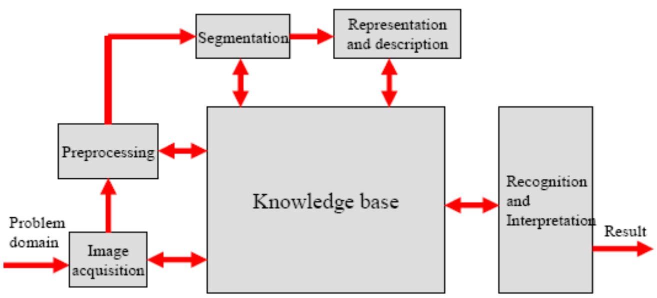


Figure 1.1 Fundamental steps in digital image processing

2) IMAGE PREPROCESSING

The key function of preprocessing is to improve the image in ways-that increase the chances for success of the other processes. Preprocessing typically deals with techniques for enhancing contrast, removing noise, and isolating regions whose texture indicate a likelihood of alphanumeric information.

i) Image Enhancement:
   - More suitable than original image for a specific application.

ii) Image Restoration:
   - A process that attempts to reconstruct or recover an image that has been degraded using prior knowledge of the degradation concept.

3) IMAGE SEGMENTATION

The next stage deals with segmentation. Segmentation partitions an input image into its small constituent parts or objects. In general, autonomous segmentation is one of the most difficult tasks in digital image processing. On the one hand, a rugged segmentation procedure brings the process a long way towards the successful solution of an imaging problem. On the other hand, weak or erratic segmentation algorithms almost guarantee eventual failure.

In terms of character recognition, the key role of segmentation is to extract individual characters and words from the background.

4) IMAGE REPRESENTATION AND DESCRIPTION

The output of the segmentation stage usually is raw pixel data, constituting either the boundary of a region or all the points in the region itself. In either case converting the data to a form suitable for computer processing is necessary.

The first decision that must be made, whether the data should be represented as a boundary or as a complete region. Boundary representation is appropriate when the focus is on external shape characteristics, such as corners and inflections.

Regional representation is appropriate when the focus is on internal properties, such as texture or skeletal shape. In some applications, however, these representations coexist.

This situation occurs in character recognition applications, which often require algorithms based on boundary shape as well as skeletons and other internal properties.

5) IMAGE RECOGNITION AND INTERPRETATION

Recognition is the process that assigns a label to an object based on the information provided by its descriptors. Interpretation involves assigning meaning to an ensemble of recognized objects.

For example, identifying a character as, say, c requires associating the descriptors for that character with the label c. Interpretation attempts to assign meaning to a set of labeled entities. For example, a string of five numbers are followed by a hyphen and four more numbers can be interpreted to be a ZIP code.

6) KNOWLEDGE BASE

Based on the above Discussion, the need for prior knowledge and or about the interaction between the knowledge base and the processing modules in Fig.1.1. Knowledge about a problem domain is coded into an image processing system in the form of a knowledge database.

This knowledge may be as simple as detailing regions of an image where the information of interest is known to be located, thus limiting the search that has to be conducted in seeking that information.

The knowledge base also can be quite complex, such as an interrelated list of all major possible defects in a materials inspection problem or an image database containing high-resolution satellite images of a region in connection with change-detection applications. In addition to guiding the operation of each processing module, the knowledge base also controls the interaction between modules.

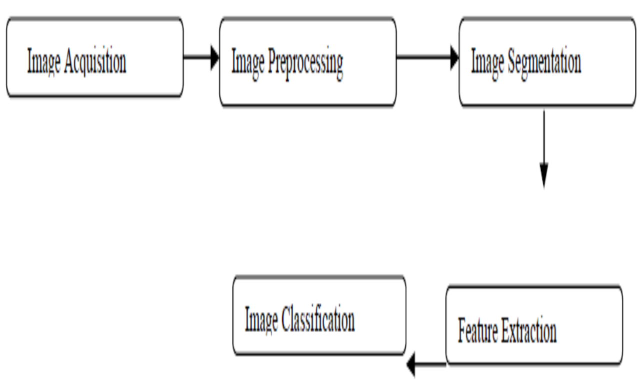
IV. DIGITAL IMAGE PROCESSING:

Digital image processing is the use of computer algorithms to perform image processing on digital images. As a subfield of digital signal processing, digital image processing has many advantages over analog image processing; it allows a much wider range of algorithms to be applied to the input data, and can avoid problems such as the build-up of noise and signal distortion during processing.

V. PLANT DISEASE DETECTION: A PRAGMATIC REVIEW

India is an agriculture based country. In this context agriculture plays vital role in Indian economy. 58 percent of rural people depend on agriculture as their principle means of livelihood. It is an important source of raw materials for many agro-based industries. There are many causes for plant diseases which affect the yield and hence the economical condition of both farmers and in turn the entire nation as whole. Plant diseases can be infectious or noninfectious. Noninfectious diseases are usually referred to as disorder caused by various causes such as nutrient deficiency, by waterlogged or polluted soil, and by polluted air from industry or excessive use of herbicides and pesticides. Infectious plant diseases (usually not visible to the naked eye) are caused by pathogens, living microorganisms that infect a plant and deprive it of nutrients.

The common approach used by the farmers to identify the plant diseases is by consulting the experts which is a very tedious, consumes more time and money. In addition there are some diseases which cannot be identified by the naked eyes. Hence in this context, a fast, reliable and automatic method is required to accurately identify the plant diseases. This paper provides the review of image processing techniques applied for identifying plant diseases detection. The figure represents the general image processing steps adopted for plant disease detection using image processing.



a. image acquisition: The digital images are acquired using a digital mobile camera or digital camera and given as input to the identification system. This is the image in which the leaf disease has to be identified by the system

b. Image Preprocessing: It is the technique for improving picture quality prior to computational processing and also used to remove the low frequency noise, reflections and masking portions of the images.

c. Image Segmentation: segmentation is the process of partitioning the digital image into multiple parts/segments. It helps in simplifying the image into more meaningful and easier to analyze

d. Feature extraction: After the segmentation process, various features are extracted from the infected region .The features which can be used in plant diseases detection are color, texture and shape etc.

e. Image Classification: It is most important part in digital analysis. Classification can be executed on spectral features like density, texture etc and then divides the features space into many classes using different machine learning algorithms.

VI. SYSTEM ANALYSIS:

Brain is an organ that controls activities of all the part of the body. Growth of abnormal cells of brain leads to brain tumor. Diagnosis of Brain tumor is very important now-a-days. Tumor basically refers to uncontrolled multiplication of cells. A cell rapidly divided from a micro calcification, Lump, distortion referred to a tumor. Metastasis is a process in which tumor occurring cells moves the other part of the body and tumors begin from that regular tissue reinstate. Meningioma and glioma are the types of brain tumor. Brain tumor is more curable and treatable if detected at early stage; it can increase the intracranial pressure which can spoil the brain permanently. Brain tumor symptoms depend upon the size of tumor, location and its type. Detection of tumor can be done by MRI and CT scan. Brain angiogram procedure can be applied in which blood vessels are illuminated in the brain and feed blood the tumor part. Procedure of biopsy is also including tissues or sample of cells are taken from the brain at the time of surgical treatment, this will help to predict the benign of cancerous brain tumor. Sometimes cancer diagnosis can be delayed or missed because of some symptoms. The principle aim of this paper is to analyze the best segmented method and classify them for a better performance.

VII. SYSTEM DESIGN

A. EXISTING SYSTEM:

In the present work, statistical analysis morphological and Thresholding techniques are used to process the images obtained by MRI. Feed-forward back-prop neural network is used to classify the performance of tumors part of the image.

Drawback:

- High consumption time,
- Mismatched Output using Threshold tech,
- Low Accuracy

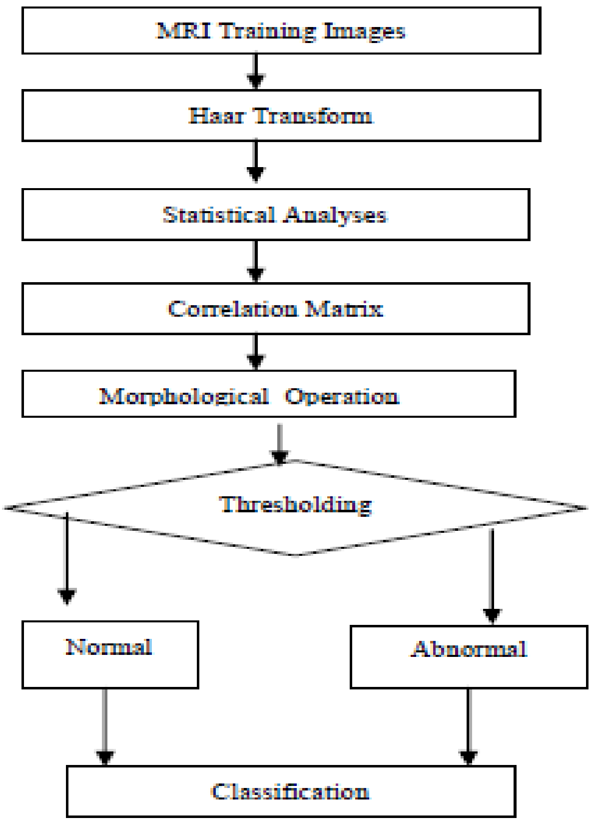


Fig.3.1: Flow chart

B. PROPOSED SYSTEM:

In the present work, statistical analysis morphological and Wavelet using Haar Transform techniques are used to process the images obtained by MRI. GLCM Feature Extract & Feed-forward back-prop neural network is used to classify the performance of tumors part of the image Normal and Abnormal stage & Tumor Level Analysis Tumor Detection System.

Advantage:

- ✓ This method results high accuracy 95% and less iterations detection which further reduces the consumption time.

VIII. SYSTEM IMPLEMENTATION

1) IMAGE ACQUISITION OF DISEASED PLANTS

The RGB color images of most frequently encountered Phyto-pathological problems affecting Cotton leaves were captured using camera. Images were stored in.JPG format

BLOCK DIAGRAM:

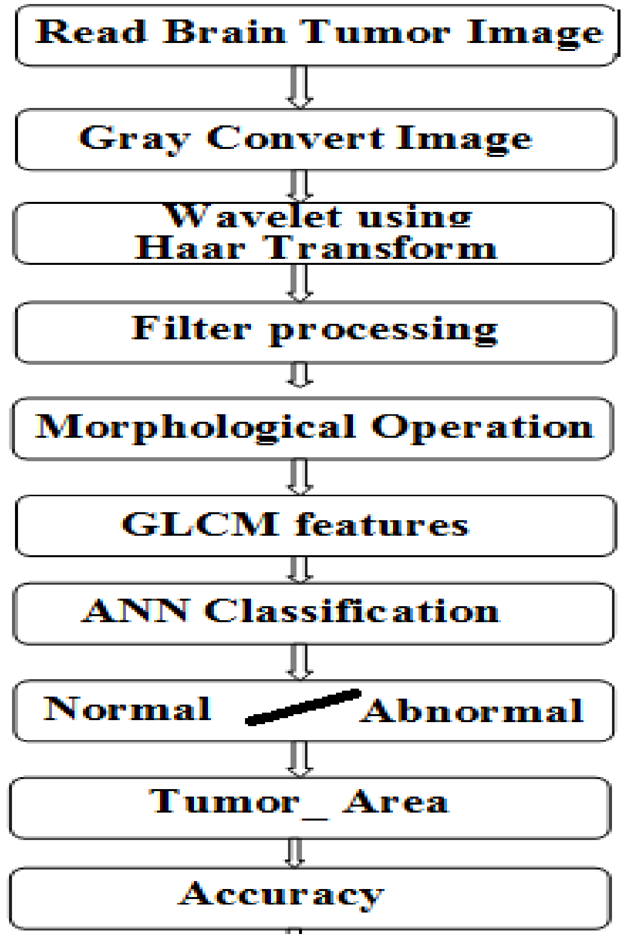


Fig.3.2: Block Diagram

2) INPUT – RGB IMAGE:

RGB color model is an additive color model in which red, green, and blue light are added together in various ways to reproduce a broad array of colors. The name of the model comes from the initials of the three additive primary colors, red, green, and blue. The main purpose of the RGB color model is for the sensing, representation, and display of images in electronic systems, such as televisions and computers, though it has also been used in conventional photography. Before the electronic age, the RGB color model already had a solid theory behind it, based in human perception of colors.

3) MEDIAN FILTER

Median filtering is used as a noise removal in order to obtain a noise free image. After segmentation is done, the segmented image may still present some unwanted regions or noise. So to make the image a good and better quality, the median filter is applied to the segmented image. We can use different neighborhood of n × n. But generally neighborhood of n = 7 is used because large neighborhoods produce more severe smoothing.

4) IMAGE PRE-PROCESSING AND SEGMENTATION

The pre-processing involved the procedures to prepare the images for subsequent analysis. The affected lea images were converted from RGB color format t gray scale images. Segmentation refers to the process of clustering the pixels with certain properties into salient regions and these regions correspond to different faces, things or natural parts of the things. We proposed Haar transform and Morphological segmentation technique to fragment goal areas. Target regions are those areas in the image that represented visual symptoms of a fungal disease.

5) Wavelet Using Haar Transform:

The proposed method uses the discrete wavelet transform (DWT) coefficients as feature vector. The wavelet is a powerful mathematical tool for feature extraction used for extracting the wavelet coefficient from MR images. The main advantage of wavelets is that they provide localized frequency information about the function of a signal, which is particularly beneficial for classification. The discrete wavelet transform is a linear transformation that operates on a data vector whose length is an integer power of two, transforming it into a numerically different vector of the same length. It separates data into different frequency components, and then studies each component with resolution matched to its scale. DWT can be expressed as

$$\mathrm{DWT}\,x(n) = \begin{cases} d\,j,k = \sum \left(x(n) h * j(n - 2jk) \right) \\ d\,j,k = \sum \left(x(n) g * j(n - 2jk) \right) \end{cases}$$

The coefficients dj,k refer to the detail components in signal x(n) and correspond to the wavelet function, whereas aj,k refer to the approximation components in the signal. The functions h(n) and g(n) in the equation represent the coefficients of the high-pass and low-pass filters, respectively, whilst parameters j and k refer to wavelet scale and translation factors. The main feature of DWT is multiscale representation of function. By using the wavelets, given function can be analyzed at various levels of resolution. illustrates DWT schematically. The original image is process along the x and y direction by h(n) and g(n) filters which, is the row representation of the original image. Because of this transform, there are four subband (LL, LH, HH, and HL) images at each scale. Subband image LL is used only for DWT calculation at the next scale. To compute the wavelet features in the first level, the wavelet coefficients are calculated for the LL subband using Haar wavelet function.

6) Haar Transform

The Haar transform is one of the basic transformation from the space/time domain to a local frequency domain, which reveals the space/time-variant spectrum. The feature extraction of the Haar transform, including fast for implementation and able to analyze the local feature of the image. The family of N Haar functions hk(t)are defined on the interval $0 \le t \le 1$Error! Reference source not found. [8].. The shape of the Haar function, of an index k, is determined by two parameters: p and q, where

$$k = 2^p + q - 1$$

Moreover, k is in a range ofk = 0, 1, 2, ⋯ , N − 1.
Whenk = 0, the Haar function is defined as a constant $h0(t) = 1/\sqrt{N}$; when k > 0, the Haar function is defined as

$$h_k(t) = \frac{1}{\sqrt{N}} \begin{cases} 2^{p/2} & (q-1)/2^p \le t < (q-0.5)/2^p \\ -2^{p/2} & (q-0.5)/2^p \le t < \frac{q}{2^p} \\ 0 & \text{otherwise} \end{cases}$$

From the above equation, one can see that p determines the amplitude and width of the non-zero part of the function, while q determines the position of the non-zero part of the Haar function.

7) MORPHOLOGICAL SEGMENTATION

Morphological Segmentation is an Image that combines morphological operations, such as extended minima and morphological gradient, with watershed flooding algorithms to segment grayscale images of any type (8, 16 and 32-bit) in 2D and 3D.

Morphological Segmentation runs on any open grayscale image, single 2D image or (3D) stack. If no image is open when calling the plugin, an Open dialog will pop up.

The user can pan, zoom in and out, or scroll between slices (if the input image is a stack) in the main canvas as if it were any other Image J window. On the left side of the canvas there are three panels of parameters, one for the input image, one with the watershed parameters and one for the output options. All buttons, checkboxes and input panels contain a short explanation of their functionality that is displayed when the cursor lingers over them.

8) Morphological Operators

After converting the image in the binary format some morphological operations are applied on the converted binary image. The purpose of the morphological operators is to separate the tumor part of the image. The portion of the tumor in the image is visible as white color which has the highest intensity then other regions of the image. Some of the commands used in the morphing are strel which is used for creating morphological structuring element, imerode which is used to erode or shrink an image and imdilate which is used to for dilating i.e. expanding an image. After segmentation and thresholding some percent of noise will be there, in order to remove this noise two important morphological operations have been used: opening and closing..

9) FEATURE EXTRACTION

The symptoms associated with various Phyto-pathological problems of cotton leaves under investigation visible on the affected leaves were extracted from their respective images using Morphological. The image analysis was mainly focuses on the extraction of shape features and their color based segmentation. The image analysis technique is done using Gray-level co-occurrence matrix. The affected areas vary in color and texture and are dominant in classifying disease symptoms. So, we have considered both color and texture features for recognition and classification purpose. Picture texture, explained as a function of the spatial variation in pixel intensities (gray values). The use of color features in the noticeable light spectrum provided additional image characteristic features over traditional gray-scale representation. GLCM is a method in which both color and texture features are taken into account to arrive at unique features which represent that image.

10) Statistical Test:

To generate a color co-occurrence matrix, each pixel map is used, which results into three color co-occurrence matrices, one for each of H, S, I. Features called as texture features, which include Local homogeneity, contrast, cluster shade, Energy, and cluster prominence are computed for the H image as given in Eqs.

CONTRAST=∑N−1i,j=0(i,j)2C(i,j)
Energy=∑N−1i,j=0C(i.j)2
Local Homogeneity=∑N−1I,j=0C(i,j)/(1+(i−j)2)
Entropy=−∑N−1i,j=0C(i.j)log C(i.j)

Magnitudes that are workable to guess via the co-occurrence matrix are:

- Energy,
- Entropy,
- Homogeneity,
- Contrast,
- Mean,
- Standard Deviation,
- RMS,
- Variance,
- Smoothness,
- Correlation.

11) ANN CLASSIFICATION

At present ANN is popular classification tool used for pattern recognition and other classification purposes. Artificial neural networks (ANN) are a group of supervised learning methods that can be applied to classification or regression. The normal ANN classifier takes the set of involvement data and calculates to classify them in one of the only two separate classes. ANN classifier is trained by a given set of training data and a model is willing to classify test data established upon this model. Most habitual classification models are established on the empirical risk minimization principle.

ANN implements the structural risk minimization principle which pursues to reduce the training error and a sureness interval term. A number of submission showed that ANN hold the superior classification capability in production with minor sample, nonlinearity and high dimensionality pattern identification. Support Vector Machines are based on the concept of decision planes that define decision boundaries. A decision plane isone that splits among a set of objects having different class association. Classifier that separate a set of objects into their corresponding classes with a line. Supreme classification tasks, however, are not that modest, and regularly more difficult structures are needed in order to make an optimal separation, i.e., correctly classify new objects (test cases) on the basis of the examples that are available (train cases). All the evidence from beyond processes is given to multiclass ANN .The Multiclass ANN were used for cotton disease classification.

12) ACCURACY:

In pattern recognition and information retrieval with binary classification, precision (also called positive predictive value) is the fraction of retrieved instances that are relevant, while recall (also known as sensitivity) is the fraction of relevant instances that are retrieved.

13) Precision:

In the field of information retrieval, precision is the fraction of retrieved documents that are relevant to the query:

$$\text{precision} = \frac{|\{\text{relevant documents}\} \cap \{\text{retrieved documents}\}|}{|\{\text{retrieved documents}\}|}$$

14) Recall:

Recall in information retrieval is the fraction of the documents that are relevant to the query that are successfully retrieved.

$$\text{recall} = \frac{|\{\text{relevant documents}\} \cap \{\text{retrieved documents}\}|}{|\{\text{relevant documents}\}|}$$

Precision and recall are then defined as:

$$\text{Precision} = \frac{tp}{tp + fp}$$

$$\text{Recall} = \frac{tp}{tp + fn}$$

Recall in this context is also referred to as the true positive rate or sensitivity, and precision is also referred to as positive predictive value (PPV); other related measures used in classification include true negative rate and accuracy.[6] True negative rate is also called specificity.

$$\text{True negative rate} = \frac{tn}{tn + fp}$$

$$\text{Accuracy} = \frac{tp + tn}{tp + tn + fp + fn}$$

IX. CONCLUSION

In this study, manipulated with classification method to distinguish normal and abnormal brain MRIs. In this system Propose work, statistical analysis morphological and Wavelet using Haar Transform techniques are used to process the images obtained by MRI. GLCM Feature Extract & Feed-forward back-prop neural network is used to classify the performance of tumors part of the image Normal and Abnormal stage Tumor Level Analysis Tumor Detection System.

According to the experimental results, the proposed method is efficient for the classification of the human brain into normal and abnormal. The proposed method accuracies on both training and test images are 95%, has been obtained by the classifier ANN.

FEATURE ENHANCEMENT

GLCM Feature Extract & Genetic Algorithm is used to classify the performance of tumors part of the image Normal and Abnormal stage Tumor Level Analysis Tumor Detection System.

REFERENCES

[1] Yudong Z., Z. Dong, Lenan and Shuihua W., "A hybrid method brain image classification", in Elsevier journal, of selected topics in Expert Systems with Applications 38 (2011) .

[2] Chaplot, S., Patnaik, L. M., & Jagannathan, N. R., "Classification of magnetic resonance brain images using wavelets as input to support vector machine and neural network". Biomedical Signal Processing and Control, 1, 86–92, (2006).

[3] Raghaveerm R., S. Bopardikar,"wavelet transform, introduction to theory and applications". Pearson education Asia, (2002).

[4] Vrushali S., Takate and P. Vikhe"Classification of MRI Brain Images using FP_ANN ", in Elsevier journal, (2013).

[5] K. Karibasappa, S. Patnaik, "Face recognition by ANN using wavelet transform coefficients", IE (India) J. Computer Eng, (2004).

[6] D. Bouchara , J. Tan, "Structural hidden Markov models for biometrics: Fusion of face and Fingerprint"; Pattern Recognition ,(2008).

[7] T. Rosenbaum, VolkherEngelbrecht, Wilfried, Ferdinand A. van Dorstenc, Mathias Hoehn-Berlagec, Hans- Gerd Lenard; MRI abnormalities in neurobromatosistype 1 (NF1): a study of men and mice; Brain & Development 21 (1999).

[8] P. Ravirajand M.Y. Sanavullah," The Modified 2D-Haar Wavelet Transformation in Image Compression", Middle-East Journal of Scientific Research, 2007.

[9] M. Sasikalal and N. Kumaravel," Comparison of Feature Selection Techniques for Detection of Malignant Tumor in Brain Images," IEEE Indicon (2005) Conference, Chennai.

[10] Haralick, R. M., "Statistical and Structural Approaches to Texture", Proceeding of the IEEE.