Hybrid Image Enhancement Machine learning Method to Detect Tumour in MRI Scanned Images

C.Pandimani[1], Dr.E.Ramaraj[2]
1(computer science, Alagappa University, and karaikudi
Email: pandimanichinnu95@gmail.com)
2 (computer science, Alagappa University, and karaikudi
Email: dcsalagappauniversity@gmail.com)

Abstract:

Medical image processing is the study of interior organs of the human body with the help of scanned digital images. It helps to provide a visual representation of interior organs which are hidden by the skin and preserved by bones. Scanning of interior affected organs and analyzing the scanned image helps to diagnose and treat disease. In India human dies of tumor cancer every 8 minutes. so tumor cancer is very dangerous disease in Medical file. MRI scanned images plays a vital role in the predict cancer. MRI scanned images is used to identify tumor cancer using existing fuzzy c-means method. A machine learning concept is used to propose in this paper to improve the accuracy of tumor detection. A new method called HIEML (Hybrid Image Enhancement Machine Learning) proposed this paper to analyses the MRI scanned Image of the tumor by combining both image processing and machine learning technique. MRI scanned tumor image is collected from the primary health care center then pre-processing is done on the image to remove noise with the help of the filtering method. The proposed method finds out the tumor affected region the segmented and enhancement is done to improve the quality of the tumor image. Finally, the K-means clustering method is used to identify a similar case of tumor separated over the segmented region. The experimental results shown better results in predicting the tumor infected region of MRI scanned image and it is very useful for better treatment of cancer. The proposed HIEML method compared with existing respected quality matrix PSNR, MSE, CR.

Keywords — MRI, Machine learning, cancer detection, K-means clustering, fuzzy c-means.

I. INTRODUCTION

Tumours are gatherings of unusual cells that structure bumps or developments. They can begin in any of the trillions of cells in our bodies. Tumours develop and act unexpectedly, contingent upon whether they are dangerous (malignant), non-cancerous (considerate) or precancerous.

A. Cancerous tumor

Tumour Cancer can begin in any section of the body. When cancer cells form an irregularity or development, it is called a cancerous tumour. A tumour is cancerous when it:

- Develops into close-by tissues.
- has cells that can split away and travel through the blood or lymphatic framework and spread to lymph hubs and inaccessible pieces of the body
- Malignant growth that spreads from the primary spot it began (called the essential tumor) to another piece of the body is called metastatic disease. At the point when malignant growth cells spread and form into new tumors, the new tumors are called metastases.

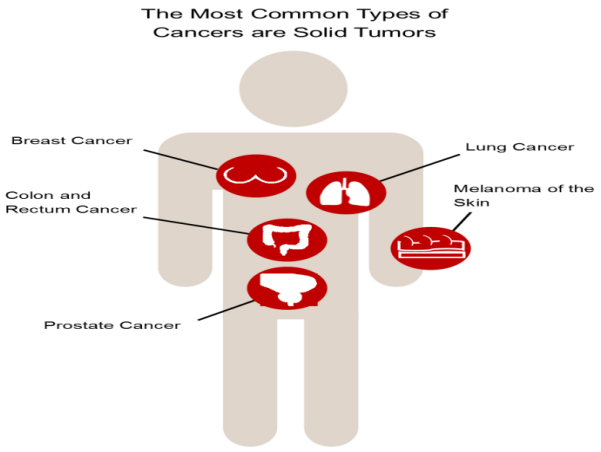

Fig: 1 Tumour markers

A tumour marker is anything present in or created by malignancy cells or different cells of the body in light of disease or certain considerate (noncancerous) conditions that gives data about a malignant growth, for example, how forceful it is, regardless of whether it very well may be treated with a focused on treatment, or whether it is reacting to treatment.

Cancer has various symptoms such as a tumour, abnormal bleeding, long-term cough, more weight loss, etc. There are near about 100 types of cancers affecting the human body. For cancer classification and prediction, requires various types of data and clinical resources. To overcome such issues and to develop an automatic system, in today's world various machine learning approaches are utilized. Tumours have three types: the first one is a benign (These are not harmful and can't spread. A considerate tumour will stay in its present structure. It shows that 1500 and above papers are published, which are based on the concept of the relation between cancer and machine learning. Most of the paper's point of interest is the use of machine learning methods for identification, classification, detection of cancer or tumour. Previously machine learning is only useful for cancer detection and diagnosis by fuzzy c means logic, but recent systems mainly focused on K means with machine learning to predict and identify cancer. Among machine learning algorithms are the most commonly used, for classification of images predicts tumour cancer.

I. LITERATURE REVIEW

Majd A. M. Alhaj [9] In their paper presented two order models (Rule Induction and Random Forest) to anticipate the survivability of cancer patients, and they present an examination between them in term of precision and execution time. Ali Ina [10] In their paper utilized best in class calculations with attention on the ongoing

pattern of deep learning methods is examined. At last, an evaluation of the present state is exhibited and future advancements to institutionalize MRI-based brain tumour division strategies into a day by day clinical routine are tended. Nalini Singh [11] proposed an image processing threshold, edge-based and watershed segmentation on mammogram breast cancer image and also presents a case study between them based on time-consuming and simplicity. The real-time implementation of this paper can be implemented using data acquisition hardware and software. Rose Merlin Jose1 [12] In their paper used about these submit Breast Cancer Classification using Feed Forward Back Propagation Neural Network (BPNN) classifier. the experimental result of Breast Cancer Classification using Feed Forward Back Propagation Neural Network classifier has achieved classification accuracy compared with the other technique like support vector machine. S.Perumal [12] To remove such annoying parts in an image, it is required some of the image pre-processing techniques for better visualization of the images before finding the diseases in particular. The core objective of this research work is to pre-process the Lung images and enhance the quality of the images using pre-processing techniques. Enhancement of the image quality is obtained by implementing filtering technique, removal of noise and contrast enhancement methods. The process of enhancing pixel intensity and image quality is also carried out after pre-processing. After the pre-processing, the image quality is increased. Moh'd Rasoul Al-Hadid [14] In their paper used a new method to detect breast cancer with accuracy. This method consists of two main parts, in the first part the image processing techniques are used to prepare the mammography images for feature and pattern extraction process. The extracted features are utilized as an input for two types of supervised learning models, which are Back Propagation Neural Network (BPNN) model and the Logistic Regression (LR) model with comparing the result and the accuracy for both models.

II. PROPOSED FRAMEWORK

This paper proposed uses to analysis the MRI Scanned Image of the tumor by combining both image processing and machine learning technique. A framework to extract the Detection of tumor cancer.

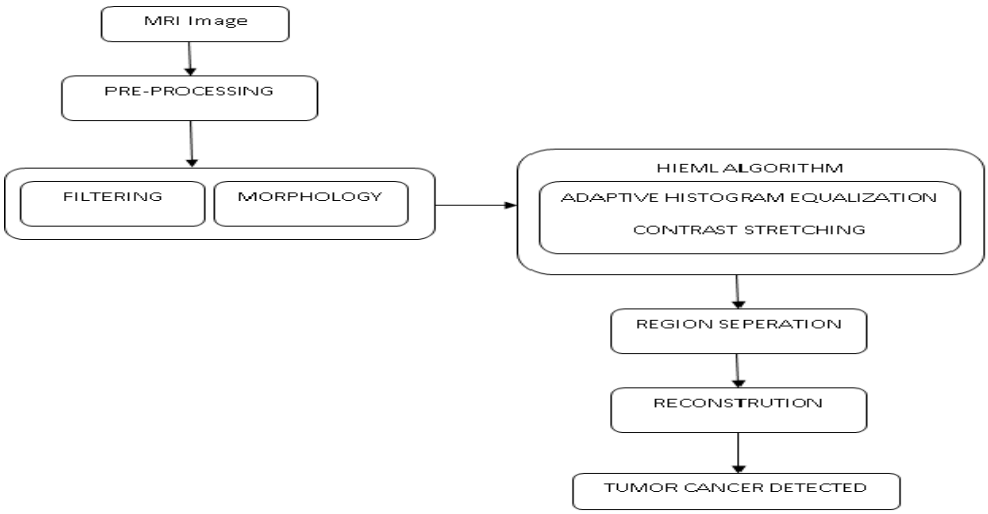

Fig2: HIEML Block diagram

The proposed methodology centres on the picture pre-processing system like filtering and segmentation. The filtering is utilized to expel the clamour from the tumour picture. The division is utilized to fragment and partitions the area. The calculation depends on separating of pictures which are utilized for diminishing the commotion over a picture and it was sectioned with sifted images.

Non-linear filtering consists of two types of filtering process. Generally, linear filtering is used in statistics & data analysis. It consists of a non-causal filter. These filters are working in various dimensions to get a clear image in image processing. This type of filters is changed various imperatives prompting distinctive structure strategies. In Linear filtering, the last procedure of the picture is weighted with a whole of information pixels. A canny Operator is a form of FIR (finite impulse response) filtering. Those value in a filtered image those coefficients than other pixels. The term canny filtering performs a filter operation and gets a pixel result directly from the image.

In this filter, masks of weights are arranged in a rectangle pattern for segmentation. By this operation that image performs multiple operations for pixels detection. Segmentation is a process that partitions an image into non-intersect regions. That region of the segmented image is homogeneous as well as two adjacent regions are also called as homogeneous.

The objective of that image is separated as digital segmentation and it's partitioned as a mutual and exhaust region. The fundamental point of division is to disentangle a co-activity of the info image which is increasingly noteworthy at that point lighter break down dependent on homogeneity criteria. In magnetic resonance (MRI) images are uploaded for segment process for treatment planning, Therapy monitoring examining radiation and drug-related treatments, It varies from studying the different subject of tumour analysis. There are many segmentation techniques which are useful in finding a segregated area in an image. Following are the techniques available for the segmentation process.

If the image has the tumour region, this image is needed to do pre-processing. To detect the tumor, we apply a filtering algorithm technique. Filtering indicates the original image pass through the filter and the desired structural features. Even the undesirable features of the image are blocked for filtering.

In the image we made a smooth, blur, sharpen or find the edges of an image by using Canny filtering technique. Sometimes spatial filtering is otherwise called as neighborhood image processing. It is an appropriate name because finding a center point of the image and it performs an operation (Filtering). When applying filtering neighborhood process are determined with mid/ Centre point. The output of image detects a midpoint value and gets a modified image.

Then use the new HIEML method. Adaptive histogram equalization (AHE) technique used to improve contrast in MRI images. It is therefore suitable for improving the local contrast and enhancing the definitions of edges in each region of an image.

Image segmentation is an important role in this proposed method. The consequence of image division is a lot of fragments that by and large spread the whole image or a lot of forms extricated from the image. Its exactness however subtle is exceptionally critical in territories as restorative, remote detecting and picture recovery where it might add to spare, support and ensure human life. The following ability are Edge-based, Clustering-based, Region-based, Threshold-based, and Morphological-based. Here we use K-means algorithm. The k-means strategy is a broadly utilized bunching system that tries to limit the normal squared separation between focuses in a similar group. Even though it offers no exactness guarantees, its straightforwardness and speed are exceptionally engaging practically speaking.

PSEUDO CODE OF THE ALGORITHM

Start

Input: RGB value of tumour image;

Output: the segmented image of the tumor;

Step1: Load the MRI scanned tumor image to the module.

Step 2: Apply filtering technique on the MRI scanned image to remove noise using.

$$\hat{f}(x,y)=\frac{1}{mn}\sum_{(s,t)\in s_{xy}} g(x,t) \ldots\ldots\ldots\ldots 1$$

Step3: do image segmentation to divide the region of the image using.

$$f(x,y) = \frac{H*(F_1,F_2)S_{XX}(F_1,F_2)}{H(F_1,F_2)2S_{XX}(F_1,F_2)+S_{nn}(f_1,f_2)} \ldots..2$$

Step4: image enhancement has done on the image to improve color quality using adaptive histogram equalization method by.

$$s_{k=T_{(r_k)}} = \sum_{j=0}^{k} \frac{n_j}{n} = \sum_{j=0}^{k} p_{r(r_j)} \ldots\ldots\ldots 3$$

Step5: contrast stretching done on the image to expand the range brightness value using.

$$g_{(x,y)=\frac{f_{(x,y)}-f_{min}}{f_{max}-f_{min}}*2^{bpp}} \ldots\ldots\ldots\ldots 4$$

Step 6: Region separation has done on the image to detect cancer affected region of the image using.

Step7: Reconstruction has done to the pure tumor affected region of the image using (Psnr, Mse, Cr, and Bpp).

$$\overline{r_i} = \frac{1}{ki}\sum_{j=1}^{k_i} r_{i,} \; i = 1, \ldots, k \ldots \quad \ldots..5$$

Step 8: k-means clustering technique uses applied to the RGB value of the image to cluster the tumor affected region of the image.

End.

III. RESULT AND DISCUSSION

The execution of different DE-noising calculations with various channels has been completed utilizing MATLAB. Here the image considered is MRI tumour image, in RGB and greyscale influenced by clamours like Poisson Noise, Speckle Noise, and Gaussian Noise. MRI scanned tumour image is collected from the primary health care center and scanned center. 20 MRI medicinal images are been taken for the examination of the clamour and its expulsion. That images are collected from this image have been prepared in the MAT LAB by adding various clamours to an image. After adding the commotion to an image distinctive clamour separating calculation is utilized to expel the commotion from a tumour image. The majority of researches in medical image segmentation certain to its use for MR images, and there are a lot of methods available for MR image segmentation. Among them, fuzzy c-means segmentation methods are benefits but enhancement level may vary because they could retain much more information from the original image than hard segmentation methods. Implementing with K-means and machine learning to process image enhancement pixel density of image may high and resolution of the image not affected. So, get more accuracy than the previous work of Fuzzy c-means.

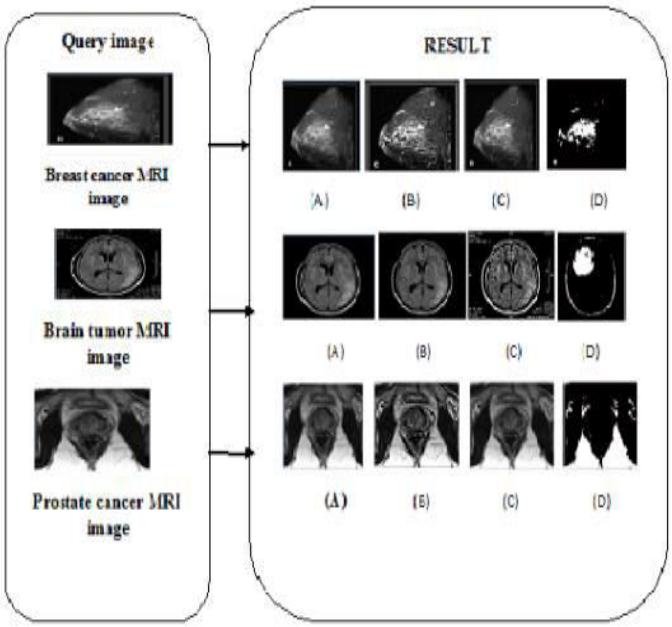

Fig3: Tumour cancer detected images

Fig 3 (a) pre-processing (b) image Enhancement (c) region separation (d) reconstruction (f) Segmentation

Type of cancer	PSNR	MSE	FCM
Breast cancer	26.4345	0.0133279	79.3910
brain tumor	23.5372	0.0256245	78.8237
Prostate cancer	24.6345	0.0128590	79.5193

Table1. List of Existing performance

Type of cancer	PSNR	MSE	k-means
Breast cancer	36.4545	0.0033279	95.8878
brain tumor	33.0964	0.0156245	95.8222
Prostate cancer	36.7843	0.0028590	95.9577

Table2. List of Proposed performance

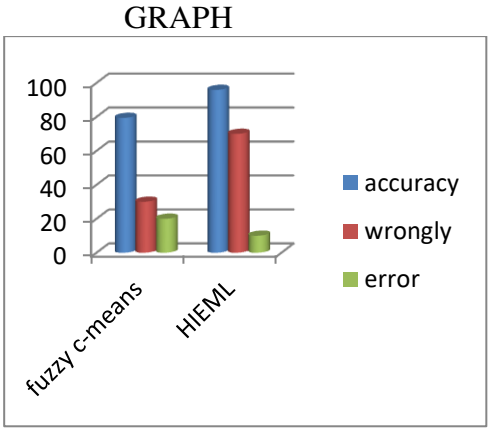

Fig: 4 Shows bar Chart of Existing and Proposed Method for Accuracy, Wrongly, Error.

IV. CONCLUSION

In this work, used Detection of cancer with the machine learning process is the best for finding the accuracy of image process. It will be helpful to find affected areas and level in all-purpose. By using k-means with a Machine learning algorithm to get an accurate result with 95 % .deep learning connect used to more to improve the accuracy of tumour detection in the future.

ACKNOWLEDGMENT

This article has been written with the financial support of RUSA-Phase 2.0 grant sanctioned vide letter No.f.24-51/2014-U, policy (TNMulti-gen)Dept of Edn. Govt.of.india, Dt.09.10.2018

REFERENCES

1. W. H. Organization, "Cancer," 2009. Retrieved 2015-05-05.

2. G. L. Patrick, An Introduction to Medicinal Chemistry, Fourth Edition. Oxford Univ Press, 2009.

3. L. Foulds, "The experimental study of tumor progression: a review," Cancer Research, vol. 14, no. 5, p. 327, 2014.

4. D. Hanahan and R. Weinberg, "The hallmarks of cancer," Cell, vol. 100, no. 1, pp. 57–70, 2014.

5. L. LA., "Matador phenotype may be required for multistage carcinogenesis," Cancer Research, vol. 51, pp. 3075–3079, 2011.

6. J. Rahnenfuhrer, N. Beerenwinkel, W. Schulz, C. Hartmann, A. Von Deimling, B. Wullich, and T. Lengauer, "Estimating cancer survival and clinical outcome based on genetic tumor progression scores," Bioinformatics, vol. 21, no. 10, p. 2438, 2015.

7. Arvan Aulia Rachman & Zuherman Rustam "Cancer classification using Fuzzy C- Means with feature selection" Conference: 2016 12th International Conference on Mathematics, Statistics, and Their Application (ICMSA)

8. Sara Tarek , Reda Abd Elwahab & Mahmoud Shoman "Cancer classification ensemble system based on gene expression profiles" 2016 5th International Conference on Electronic Devices, Systems and Applications (ICEDSA)

9. Majd A. M. Alhaj & Ashraf Y. A. Maghari "Cancer survivability prediction using random forest and rule induction algorithms." 2017 8th International Conference on Information Technology (ICIT)

10. (Ali Ina, Cem Direkolub, Melikeahc) "Review of MRI-based brain tumor image segmentation using deep learning methods" 2016

11. Breast Cancer Mass Detection in Mammograms using K-means and Fuzzy C-means Clustering (Nalini Singh, Ambarish G Mohapatra, Gurukalyan Kanungo) 2011 by IJCA Journal

12.Breast Cancer Classification using Feed Forward Back Propagation Neural Network (BPNN)Classifier(Rose Merlin Jose1, Sangharsh Syal,)2017 by International Journal of Innovative Research in Computer and Communication Engineering

13.Preprocessing by Contrast Enhancement Techniques for Medical Images (S.Perumal1 and T.Velmurugan2) International Journal of Pure and Applied Mathematics Volume 118 No. 18 2018, 3681-3688

14. Breast Cancer Detection using K-nearest Neighbor Machine Learning Algorithm (1Moh'd Rasoul Al-hadidi, 2Abdulsalam Alarabeyyat, 3Mohannad Alhanahnah) 2016 9th International Conference on Developments in eSystems Engineering