An effective medical image segmentation of brain tumour using modified CNN algorithm

R.G.Sushmitha, R.Muthaiah

Abstract: *A brain tumour (BT) is an unusual proliferation of the cells inside the brain; major types of tumours are benign & malignant. Tumours can occur anywhere in the brain and contain almost any type of form, size and variance. BT is a hazardous disease that cannot be detected without hopping MRI. We present the efficient way to brainstorm the MRI films on this paper. Real datasets with different tumour shapes, sizes, locations, and internal texture are taken. Extracting the clinical data (a tumour), the aim of this paper is to come up with an effective segmentation using modified Convolution Neural Network-(CNN)where Elman network is involved. For these reasons we opt for the modified CNN based technique. It uses the MATLAB simulation.*

Index Terms: ***Brain tumor, Benign, Malignant, CNN, and MRI***

I. INTRODUCTION

Changing old or damaged new cells will cause normal cells to grow in control. For thoroughly understood reasons, tumour cells are reproduced uncontrollably. It is an unusual development in the brain. Brain tumours may be harmful or vulnerable. A benign brain tumour has slow growth and has unique boundary and may rarely spread Even if cell is not viral, benign tumours will be life threat ending if located in key area. A malignant brain tumour grows rapidly, spreads in irregular borders and adjacent brain areas. The brain tumours do not apply to the definition of cancer as it does not spread outside of the brain.

Human skull cannot expand to the growing mass of the brain. Hence it results in the formation of tumour and abnormal brain tissues. Some brain tumours result in a blocking of cerebrospinal fluid (CSF) which passes through the cerebrum and the spinal cord. This barrier increases infrared pressure and can increase hydroxides. Some brain tumours cause swelling (oedema). Quantity, pressure, and inflammation are the culmination resulting in the symptoms of the brain tumour.
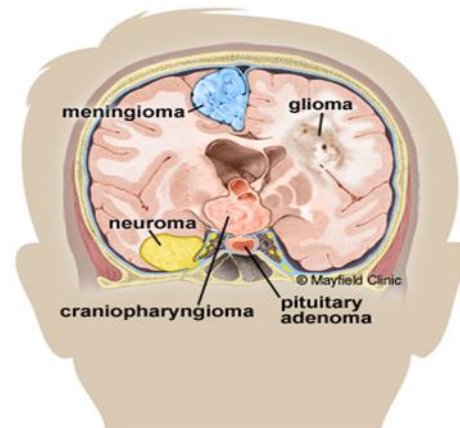

Fig 1. The brain tumours from various brain regions

Symptoms of brain tumour:

Brain tumours can cause damage by obstruction of the tissues or by increasing intra-cranial pressure. Various parameters
like size of the tumour its type, and its location in the brain determine its symptoms (Fig 2).
Generalized symptoms include:

- Morning Sickness
- Inactiveness
- Dilemma, dizzy feeling, difficulty in walk
- Speech issues
- Visual issues like unusual movements of the eye
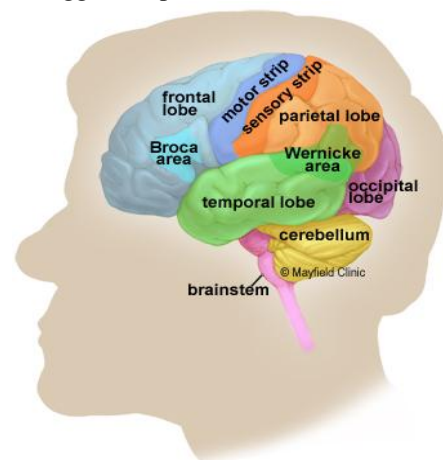- Insomnia, headache, nausea and vomiting, sluggish responses.

Fig 2. The brain tumours from various brain regions

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Specialized /Localized Symptoms include:

- Behaviour and emotional changes; Weak judgment, discouragement or prevention, Paralysis, reduced mental ability and memory loss.
- Weak speech, Writing, drawing or labelling issues; Unrecognized, Internal disorders and eyelid disintegration.
- Blurred vision, illusions.
- Temporary nerve tumours can cause difficulty in language comprehension. Memory deterioration, ,More aggressive behaviour.

II. IMAGE SEGMENTATION

Image segmentation holds its meaning as the partitioning of any image that is digital into many segments commonly called as pixels. The vision of image segmentation is simplification of image representation and also analysis is made easier.

Image segmentation enables the location of objects and boundary like curves, lines, etc. in an image. It also labels each pixel in an image such that the pixel with same label share certain characteristics. The resultant segmented image consists of a set of segments which cover the entire image.

The pixels of a region are similar with some characteristics which can be intensity color or texture. Generally with regard to image segmentation as stack in medical imaging, the resulting contours after image segmentation are used to create 3Dimensional reconstructions by using interpolation algorithms such as marching cubes.

III.EXISTING SYSTEM

The statistical zone integration (SRM) is an algorithm used in the image section. [1] The method is used to evaluate valuations in a regional interval and to merge the basis of the unification basis, resulting in a small list. Some useful examples make up a generation group in the population, or group the neighbouring pixels based on the shadows falling into a particular gateway (qualification criterion) in image processing. The idea begins with a fraction of a pixel and is used in statistical experimentation in neighbouring circles (ascending order of radical differences).
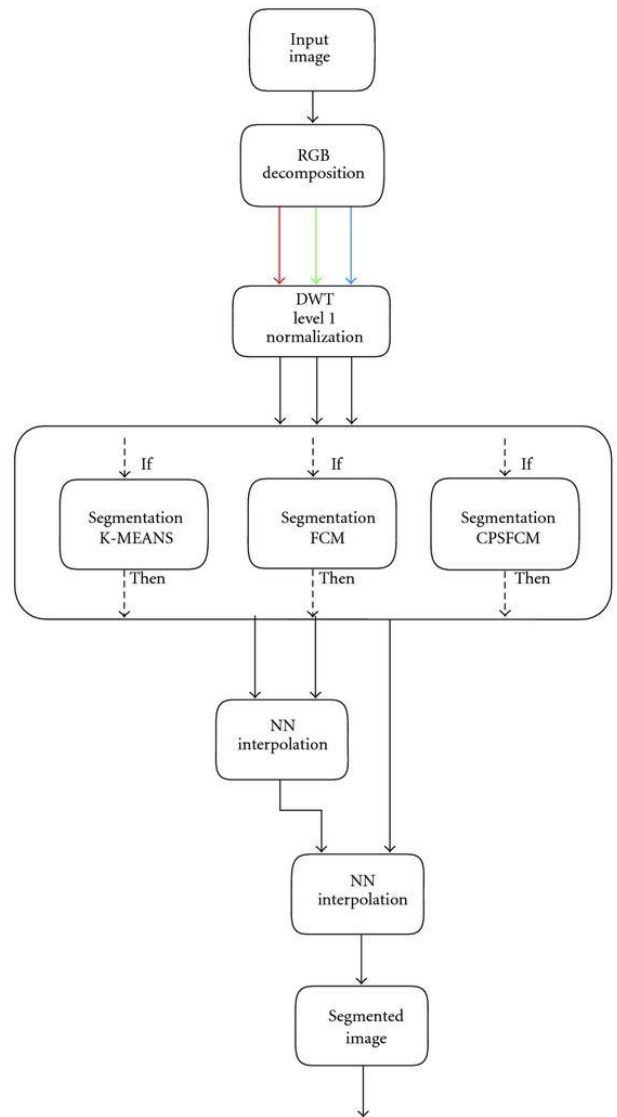

Fig 3. Block diagram of Existing system

IV. PROPOSED SYSTEM

In this paper, we have proposed design and implementation of tumor detection from brain MR images using Modified CNN algorithm using Elman Network.

This article provides a reliable detection method that increases CNN-based accuracy. A convolutional neural network (CNN) is used to replacing kernal in place of an image for getting the recovered design. The image processing techniques involving conversion of image, extraction of features and equalization of histogram pave way for detection and segmentation of the gliomas or tumours. The resultant image might prove to be clear and accurate as compared to existing results.
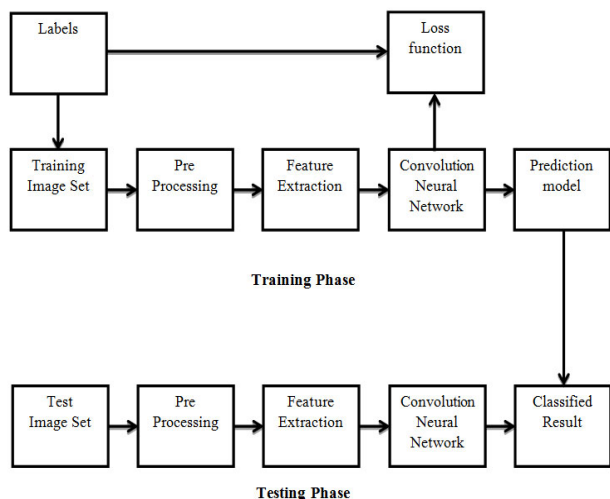
Fig 4. Block diagram of proposed method

METHODOLOGY:

A general digital image processing system consists these following steps to get the desired result:

[1] Image Modeling
[2] Image expansion
[3] Feature Extraction
[4] Recognition and identification

[1] Image Modeling: This step includes number of steps is as follows

Read the input image: The input image is loaded using the uigetfile() function, which is MATLAB inbuilt function, and the image window is displayed using the imshow () function and display in the image window.

RGB To Gray: RGB image has three arrays of red, green and blue, it's hard to eat, so gray is made and it's very useful and effective. Gray_scale = R + G + B / 3 Gray level, 3 bit image is $2^3 = 8$ gray level (ranging from 0 to 7) is pixel density ranges from 0 to 7 in the picture. rgb2gray () function is used.

Contrast Normalization: The difference of a picture can be enhanced using the Imadjust () function. That is, the intensity value in the image is extended. Contrary to the default, it is called a different plugin. It is used to improve the quality of the film.

[2] Image expansion: These steps are as follows:
Histogram Balancing: The Histeq () function is used for the histogram equation of the gray-scale image, which is used to adjust gray size in a picture.

[3] Feature Extraction:
To get this feature, multi-resolution is decomposed. Several resolutions are divided, such as HH (high-high), HL (high-low), LH (low-high) and LL (low low). It is composed of four different directions like vertical direction, horizontal direction, cross direction and angular direction. Tip of the tumour has high intensity, so it is necessary to change the bandwidth.

[4] Recognition and Identification:
The fusion of the film is made between the original image and the feature's extracted image.

Convolutional Neural Network (CNN):
CNNs are intensive ANNs, primarily used for image classification.(eg referring to the name they see), clustering them with unity (image search), and recognizing the object in the display. They are identical to the various aspects of faces, individuals, street signs, tumors, vertebrae and visual data Convolutional networks perform Optical Character Recognition (OCR) and making language processing in analog and written documentation CNN is used for flashing applications. More recently, Toolbar networks have been directly used with graphic Convolutional networks with text analysis and map data.

One of the main reasons that the performance of the modified nets (ConvNets or CNNs) in Image Recognition increases the profound learning capabilities of the world. They bring great improvements in computer aided vision which pave way to self-driven automobiles, robotics, drones, medical diagnostics, vision disorders.The picture below typical Convolution neural network network.
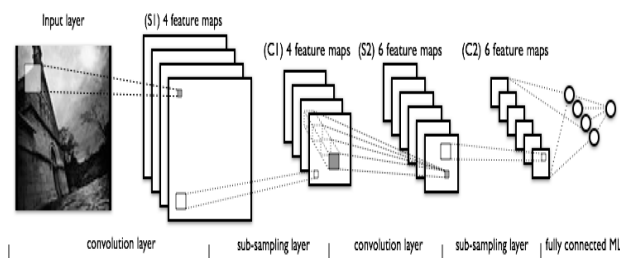

Fig 5. Block diagram of CNN

- Original input picture scanned for features.
- Functional maps are stacked together, one for each filter we use. The large rectangle is a link to the downside.
- Reduction by performance drawings.
- A functional maps newly is created to pass filters on the first down sampled stack.
- Second resize to fix second function maps.
- A complete attached layer that classifies a label output for a stamp.

If more and more information is lost, the activated forms through the revised net become more concise and far from the visual shapes we recognize and the networks cannot provide easy intuitions with deep growth.

Elman network: An Elman Network is a dual layer network (arranged horizontally as x, y and z on a graph) and a "set of units" (examples U). The standard (enclosed) layer is connected to these ecosystems standard with a weight.

Each time, the input and learning rules are used. Static-themed links store the contents of the previous values of the latter values in units in the context of the environment (they are spreading in relation to the learning method before being used). This allows the network to maintain a kind of state, allowing the performers to perform tasks such as queue-computation beyond the power of a regular multipurpose perceptron.

$$h_t = \sigma_h(W_h x_t + U_h h_{t-1} + b_h)$$
$$y_t = \sigma_y(W_y h_t + b_y)$$

(1)

Elman networks feed forward networks are in addition to the back links linking the plate delays.With the availability of full dynamic derivative calculations (fpderiv and bttderiv), Elman Network is not recommended except for historical and research purposes. Try more accurate learning time delay (timedelaynet), layer back (learate), NARX (narxnet), and NAR (nerate) neurological networks.
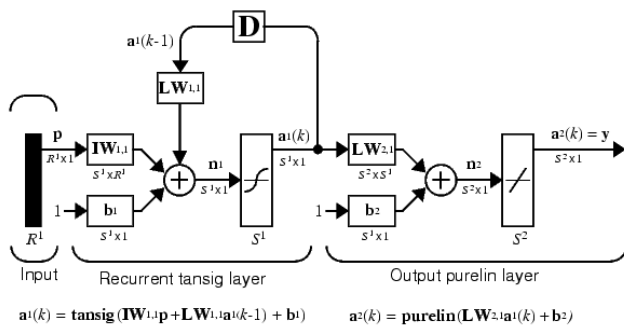

Fig 6. **Elman Network layers**

The Elman Network is a two-layer network behind the first layer input from the first layer output. This repeated back link allows the Elman Network to detect twice and create different forms of time. A two-layer Elman network is shown below. This Network has Dansic neurons in its hidden (repeat) layers, and its output layers have pure nerves. The mix is special in two layer networks with transactional functions, It can randomly calibrate randomly with any functionality (with a finite number of crashes). Only the need for sufficient neurons to the hidden layer is required. More complicated neurons are required as a complex problem increasing activity.   The first layer has the link back that differs from the regular two-layer networks of Elman network. This connection delays the values from the previous time format used in the current time hierarchy. Therefore, both Elman networks, with the same weights and functions, have given similar entries in the given time form, although their outputs may vary due to varying feedbacks.   Because the network stores information for future reference, it can learn temporary forms and animated forms. Elman Network is trained to respond and create two types of forms.

V. SOFTWARE USED

MATLAB:

MATLAB is a tool which does computation, visualization and programming into an user friendly environment, which provides problems and solutions for complex problems Its applications include:

- Mathematics and calculation
- Algorithm development
- Sampling, simulation and prototype
- Data analysis, analysis and visualization
- Science and Engineering Graphics
- App Development, including graphical user interface builder.

MATLAB is an essential sequence to exchange within its basic data element is an interactive method. This allows us to solve many technical computational problems with matrix and vector formulas, especially in a portion of time, when writing a program in a non-scalar non-interactive language like C, or FORTRAN. The MATLAB version used in this project is MATLAB version 2012(MATLAB R2012b).

Application development tools.

- Image Processing
- Signal Processing
- Control System
- Communications
- Neural Network
- Instrument Control
- Aerospace
- Fuzzy Logic
- Embedded MATLAB

VI. CONCLUSION

Smaller formal understanding, despite the growing importance of technology in health supply chains exists on the integration of technologies, the selection or performance implications of technology integration. In this paper we implemented an efficient brain tumour segmentation using modified CNN algorithm involving Elman network. Normal CNN based segmentation algorithm gives good performance and their accuracy rate is **82.7133%.** Our proposed method gives better accuracy rate than the existing method with **93.9842%** compared to CNN algorithm. It was compared for various sample input brain MR Images. So we conclude that the modified CNN algorithm involving Elman network gives efficient accuracy rate compared to the existing method.

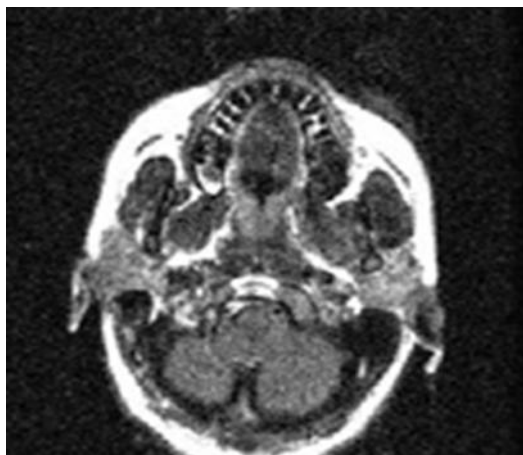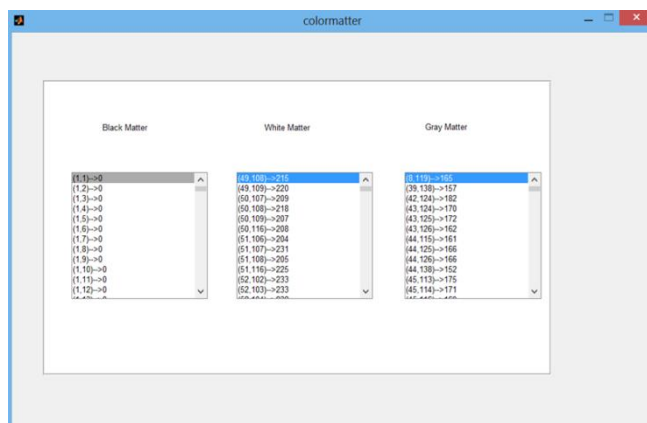**OUTPUT SCREENSHOTS**

Fig 7. Input noisy image

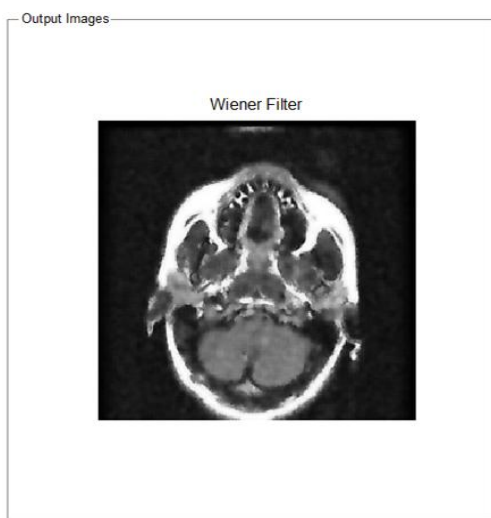Fig 10.Black matter Gray matter White matter values

Fig 8. Weiner filter output

Fig 11. Estimated bias field

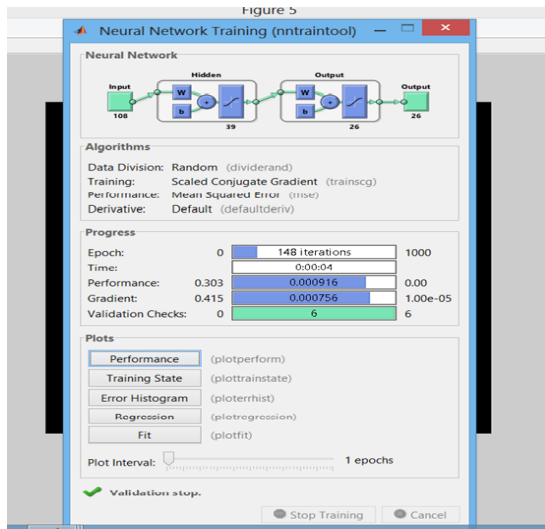Fig 9. Histogram graph

Fig 12. Segmentation result

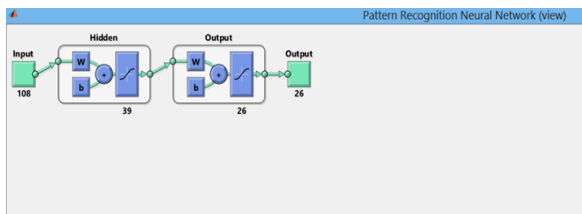**Fig13. Neural network training**

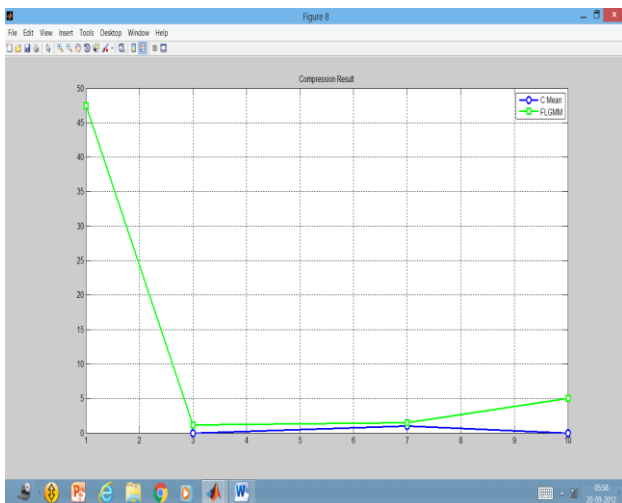**Fig14. Pattern recognition neural network view**
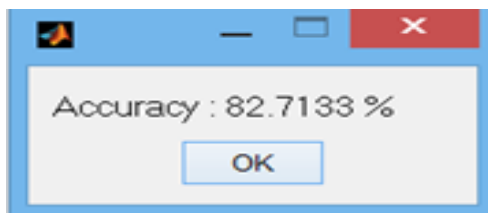

Fig 15. Compression Result
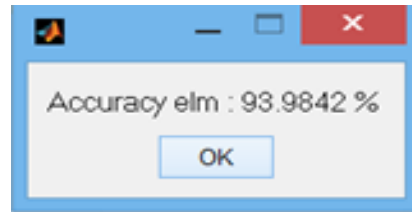

Fig.16 CNN Accuracy

Fig 17. Elman Network accuracy

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