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Early Stage Identification of Brain Tumour using HV Scan Axial Partition Method

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Abstract: A manual identification is labour intensive and tedious due to the large amount of medical data to be processed and the presence of small lesions. Automated tumour segmentation from magnetic resonance imagery (MRI) plays a significant role in cancer research and clinical practice. However, tumour segmentation is an extremely challenging task: clinicians believe that a gamut of prior domain knowledge and clinical data should be used, along with the MR image. In this paper a novel approach for segmenting the structure of malignant brain tumour is proposed. The method is general enough to segment different types of abnormalities.

Keywords: Brain Tumour, Region growing, MRI, Segmentation, Texture analysis, Edge detection etc.

I. INTRODUCTION

This paper describes a novel approach for distinguishing brain abnormalities in MRI images. However, tumor segmentation is an extremely challenging task: clinicians believe that a gamut of prior domain knowledge and clinical data should be used, along with the MR image. As a step toward tumor segmentation, we illustrate here a real-time algorithm to locate the brain abnormality in an MR image by putting a bounding box around it. Generally a brain has symmetrical structure. In the proposed method a set of 2D MR images of various patients is taken. The input images then pro-process for information enhancement and for boosting up the further processing.

For each slice of MRI we (1) Pre-process the slice, (2) Remove skull (3) divide the brain part into two half (4) Take one part as a reference and compare it with other half of the brain (5) Any diversity in the comparison is mark and histogram is of the parts are calculated to identify tumor part. The output is a relating set of the slices that encompass the tumors with bounding boxes. The proposed methodology depends on an unsupervised change recognition strategy that hunt down the most different area between the left and the right parts of a brain in a axial perspective MR slice. This change recognition process utilizes a novel score capacity in light of Bhattacharya coefficient computed with gray level intensity histograms. We demonstrate this score function concedes a quick (linear in picture height and width) search to find the bounding box.

II. PRE-PROCESSING & REMOVAL OF NON-BRAIN PARTS

Standardization is the first phase of pre- processing. Standardization is done to decrease the variability of raw picture intensities and subject introduction; this is essential both for the segmentation and consistent feature assessment. For further examination of segmented region of interest (ROI) utilizing factual textural properties, it is imperative to recognize the ROI from its environment. So the pre- processed pictures ought to be sectioned from mind MRI with least loss of tumor tissue. This should be possible by utilizing mathematical morphological operations, correlation filtering and thresholding. Fig. I demonstrates the outline of the different operations done on the raw MRI to acquire the segmented ROI.

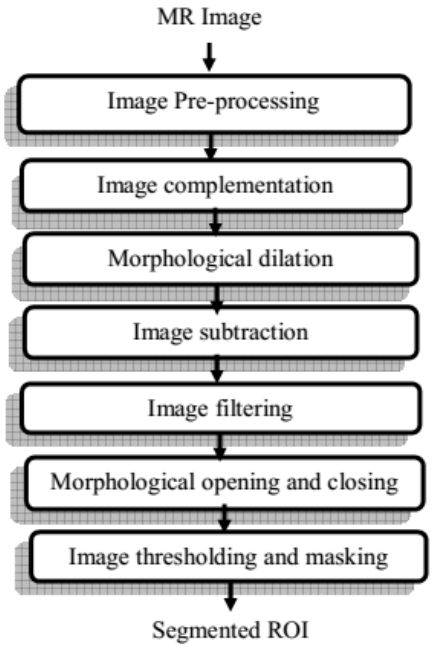

Fig I: Flow chart of operations performed during image preprocessing.

The operations are done as given beneath.

Step 1: Standardization is finished by partitioning every pixel gray level values by unquestionably the most

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extreme gray level pixel value present in the picture. After standardization, the scope of gray level pixel values will be somewhere around 0 and 1.

Step 2: As first part of the segmentation methodology, the pre- processed picture (Fig. II (b)) is complimented and dilated (Fig. II (c)) utilizing square formed (dark level) SE, for intensity alteration. The complemented and dilated picture is subtracted from the standardized picture. This is for decreasing noise artifacts and incomplete volume impact present in the picture and improving tumour limit. The subsequent picture experiences spatial domain filtering by correlation method with a filter mask, w= [1, 1]. The separated output (Fig. II (d)) experiences morphological opening with a circle shaped SE.

The main challenge in the tumour segmentation strategy is that more often than not tumour boundaries will not be clearly defined from the other regions and tumours might have heterogeneous boundaries and will have invading nature. This boundary intrusions and protrusions are clearly visible after opening the fundamental disadvantage of morphological dilation is over segmentation. This can be reduced, by utilizing morphological opening (Fig. II (e)) operation with a circle shaped SE of suitable radius. The dimension and shape of the SE is chosen exactly and held consistent for the whole picture dataset. Opening operation (Fig. II (e)) is erosion trailed by dilation. The opening removes little subtle details of the outline of the segment without influencing the aggregate size of the relevant regions.

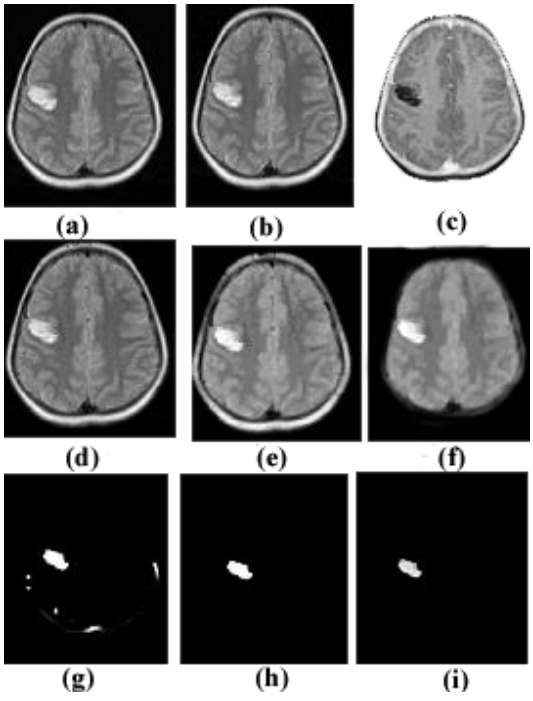

Fig II: Extraction technique for high grade tumour from T1 weighted MRI slice a) Original image b) Pre-processed image c) Complemented and dilated image d) Filtered image e) Image after opening f) Image after closing g) Threshold image h) Morphologically labelled image using connected component labelling i) Segmented gray level image

After the opening operation, the yield image experiences closing operation (Fig. II (f)) keeping in mind the end goal to revise the variation in small details. The tumour boundary and area of the resulting image is visually upgraded. The repeated morphological operations with organizing components of varied dimension and shape is for accomplishing precise segmentation. The resultant image is threshold (Fig. II (g)) to acquire a binary image. It is then morphologically labelled connected component labelling procedure to get the segmented ROI. The binary segmented tumour mask (Fig. II (h)) thus obtained is masked with the original standardized image to get the first gray level image of the corresponding ROI, as appeared in Fig. II (i).

III. TUMOUR SEGMENTATION

For Tumour segmentation we divide the brain part into two halves. One part is considered as a test image and other as a reference image part for perform comparison. The region of is detected on the test image. After perform partitioning on an axial MR slice, the left (or the right) half serves as the test image I, and the right (or the left) half supplies as the reference image R. The region of change D here is restricted to be a rectangle, which essentially aims to circumscribe the abnormality. Our method is different from most of the change detection methods proposed to date in that we view this change as a region-based global change that differs from most techniques, which view the change as a local pixel-to-pixel changes– here tumour or edema is considered as the "change" region in the test image and all other intracranial tissues except tumour or edema are considered as the "no change" region. We utilize a novel score function that can identify the region of change D with two very quick searches– one along the vertical direction of the image and the other along the horizontal direction.

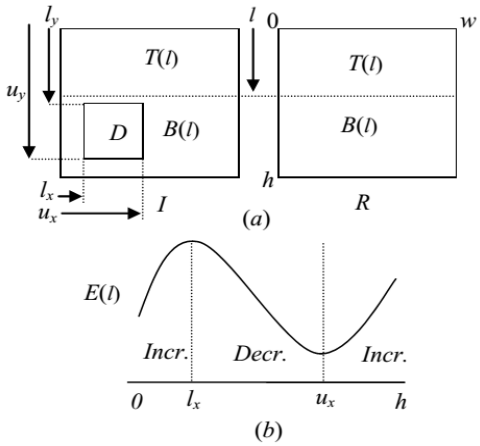

Fig III: (a): Finding anomaly D from test image I using reference image R. 1(b): Energy function plot.

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Fig. III illustrates the notations. I and R in Fig. III (a) represent the test and the reference images, respectively having same height h and same width w. The rectangular region D=[lx,ux] x [ly,uy] represents the region of change between images I and R.

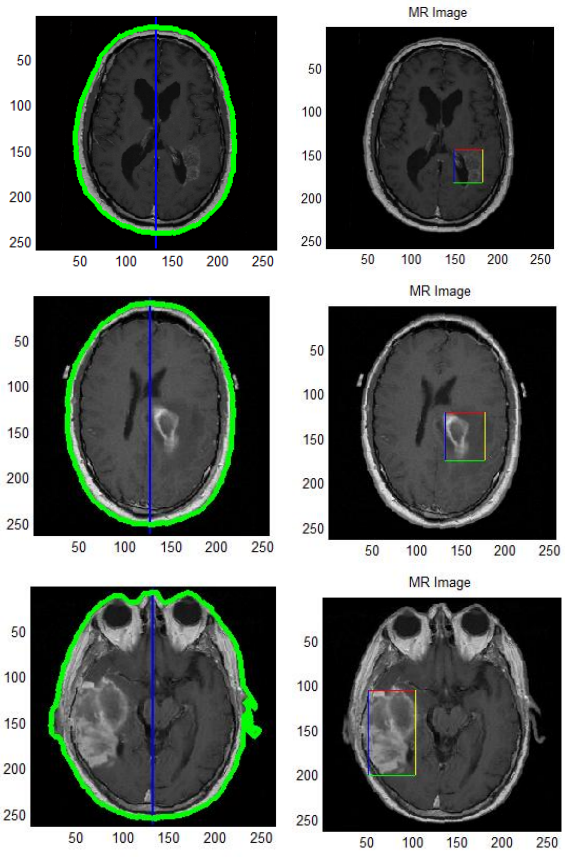
IV. SIMULATION RESULTS

The Proposed method is evaluated on the T1-weighted patient XNET dataset with low and high grade gliomas. The results have shown the good accuracy over other methods. To prove the effectiveness we have compare the output of our algorithm with other methods.

Table: I Properties of the input MR Image

No. of MRI Slice	20
Type of Slice section	Axial
Image Size	255 x 255
Image Type	Gray Scale

The proposed algorithm is applied on set of MR images some of them containing tumour. The output is compared with other methods. The proposed approach managed to detect and track the road lane in most of the sequence. In addition, false positives are reduced to a competent level. In order to validate the results, the proposed approach is compared with the hybrid clustering technique based brain tumour segmentation.



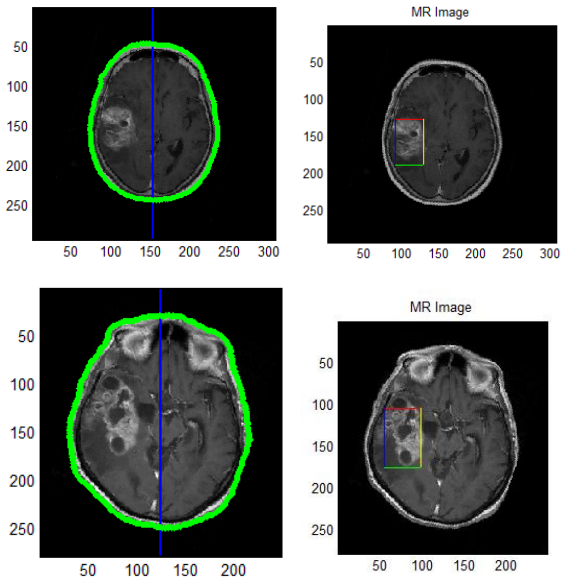


Fig IV: Partition of hemisphere of human brain and finally detected tumour and marked in rectangle box in different MRI images of different patient.

V. CONCLUSION& FUTURE SCOPE

Proposed HV Scan partition algorithm is a novel fast segmentation technique that uses symmetry to enclose an anomaly (typically, tumours or edema) by a rectangular mark within an axial brain MR image. We utilize a novel region based technique to compute local histogram similarity between test and reference (sub) images. We have analytically explained the behaviour of the proposed algorithm that effectively locates the brain tumours or edema quickly, showing how it exploits the symmetry of the axial brain MR image slices along the medial axis. Moreover, the algorithm does not need image registration. The method does not need any training images. It is also very efficient– i.e, it can be implemented in real time. As this method always generates a rectangular mark on a MR slice, even in the absence of the tumour or edema, we also present a heuristic scheme designed to separate relevant slices (slices having tumour or edema) from normal ones of a patient– using the mean shift clustering algorithm. Some standard segmentation algorithms (such as active contour without edges or normalized graph cut) can delineate exact tumour boundary or edema if these algorithms are applied only within the marked rectangular box. This region based approximate segmentation technique can explore new opportunities of effective MR database indexing system. The resulting method is very fast, robust and reliable for indexing tumour or edema images for both archival and retrieval purposes and it can use as a vehicle for further clinical investigations.

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