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Application of Tessellation Technique to T1-Weighted Images for Extraction of Brain

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Abstract: **This is a method of extraction of brain from the T1 weighted MR images. This work is a combination of the both stochastic model and geometric model. This method is fast from which the brain will be extracted accurately, without losing any brain parts and without adding any non brain parts. The main parts of brain extraction method are a) Bias correction of the given brain MR image b) Skull stripping using the tessellation process for this using BET algorithm. In BET algorithm there are four steps. A)Initially it estimates the imge parameters b) Finds the centroid of the brain c) Estimate radius and form a brain layer d)Finally extract the brain, and generate the iso-surface.`**

Keywords: **Brain, skull stripping, Brain extraction tool, MR images**

I. INTRODUCTION

Brain extraction is a method of removing the external parts like eyes, dura, scalp skull which are present around the brain. It also contains the cerebrospinal fluid (CSF) with white matter and gray matter. Brain extraction is a preprocessing step for many brain analyses. Finding the irregularities which is present in MR brain image is called bias field, bias correction helps to remove the noises and any irregularities present in the brain MR images. Next step is skull stripping using the tessellation, this avoids the losing of brain tissues. In the BET method first step is to normalize the intensity values like upper values and the lower values of the input MR images and find "robust" values. Robust means taking the required values and rejecting the minimum values the smaller values are different than the required values those are calculated by bias corrected image .Then find the centre-of-gravity of the brain then brain image and brain will be tessellated and slowly deform and reach the edge, finally brain image get extracted. And the extracted brain will be moved to form the iso-surface generation[5][6].

II. EXISTING SYSTEM

Many approaches are developed to extract the brain from MR images those are deformable model, atlas-based method and label fusion. Some method give good results but while removing non brain tissues it removes brain tissues also and someone add non brain tissue to the brain tissues. And atlas based technique is very time consuming.

III. PROPOSED SYSTEM

This method is a hybrid framework , by using this method the brain will be extracted accurately from the brain MR images.It supports both the stochastic model and geometric model methods. In the extraction process mainly four steps are using. Bias correction helps to detect the irregularities present in the brain MR images after the bias correction stripping of the skull in this apply the Brain Extraction Tool, in the brain extraction tool again three steps are there[5][6].

Estimating the image parameters like finding the upper and lower values. means selecting the required values and rejecting the smaller voxel values these are calculated by seeing the bias corrected image. find the centroid of the brain MR image after this roughly estimate the radius of the brain image then the brain will tessellate slowly like triangles, then the brain will be deform slowly and extracted brain accurately without losing any brain parts and adding any non-brain parts. This method is very fast and accurately extracts the brain. Architecture for this framework as shown below.

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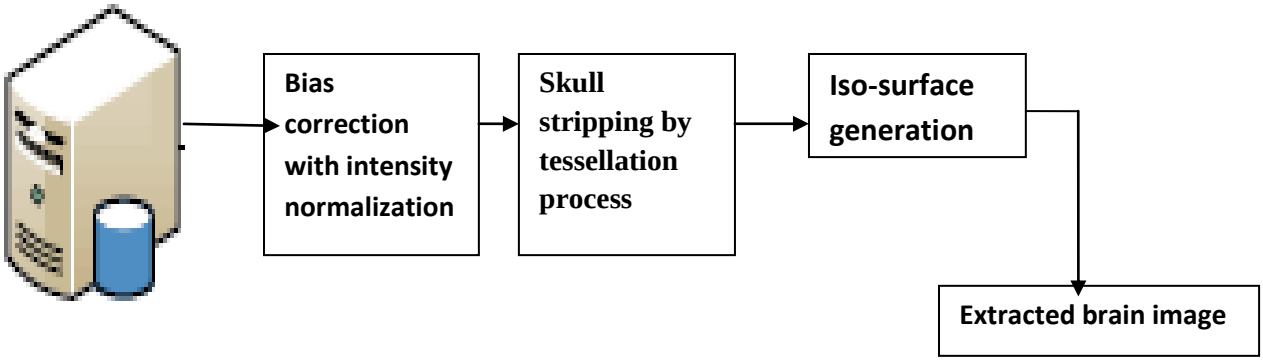

Magnetic Resonance Imaging (MRI)

MRI is a procedure which is used in hospitals to scan the patients and to determine the injuries. MRI machine uses a magnetic field and radio waves to creating the images of the body. The common reasons people use an MRI for sprained ankle or back pain. Magnetic resonance imaging (MRI) is a relatively new and painless technique that allows doctors to look at the soft tissues of the body. It is different from regular x-rays because it does not expose the body to radiation.

Weighted MRI images

Mainly there are two types of weighted MR images. Namely

i. T1 – weighted
ii. T2 – weighted and
iii. STIR and FLAIR sequence MRI

Table.1 Difference between T1 weighted and T2 weighted images

Colour	T1 weighted	T2 weighted
Dark	CSF: Increased water, edema, tumour, low proton density flow, void.	Low proton density, protein rich fluid.
Bright	Fat, melanin, slowly flowing blood.	Increased water, edema, Tumour

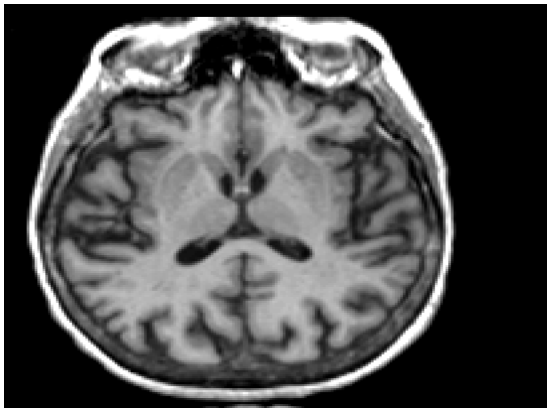

Fig.1 T1 weighted image

Short TR+ Short TE=T1 weighted image

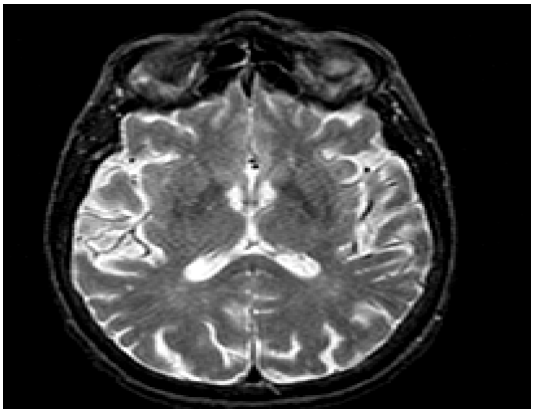

Fig.2 T2 weighted image

Long TR+ Long TE=T2 weighted image

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IV. PRINCIPLES OF BRAIN EXTRACTION BY TESSELLATION METHOD

a) Remove noise and inconsistency.

This step is used to remove the noises and inconsistencies of MRI data. To accurately extract the brain it is important to account for the low frequency intensity non-uniformity or inhomogeneity. The determination of inhomogeneity is called bias field[5].

b) Remove non brain Tissue.

The second phase of is to remove the non-brain tissue from the MR images. To achieve this, a small factor to minimize the loss of brain tissues, this uses a deformable model-based approach to remove the skull from brain MRIs. In the stripping method some important steps are there to segment of brain.

Step-1 Estimation of image parameters

The first processing is the estimation of a few simple image parameters, to be used at various steps in this analysis. Here, the robust image intensity minimum and maximum are found. Robust means the effective intensity extrema, calculated by ignoring small numbers of voxels and that have different values from the rest of the image[6].

Fig 3. Input of brain image

Step: 2-Radius of the brain/head in the image is estimated

Next step is "radius" of the brain/head in the image is estimated. There is no distinction made between estimating the radius of the brain and the head, this estimation is very rough, and simply used to get an idea of the size of the brain in the image[6]. It is used for initializing the brain surface model.

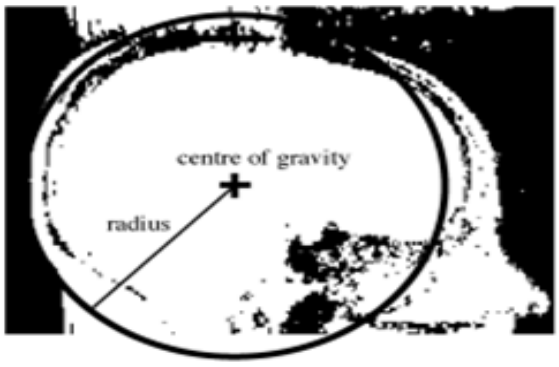

Fig 3.finding centroid of brain

Step:3 -Brain surface is modeled by a surface tessellation process

The brain surface is modeled by a surface tessellation using connected triangles. The initial model is a tessellated sphere, generated by starting with an icosahedrons and iteratively subdividing each triangle into four smaller triangles, while adjusting each vertex's distance from the centre to form as spherical a surface as possible[6].

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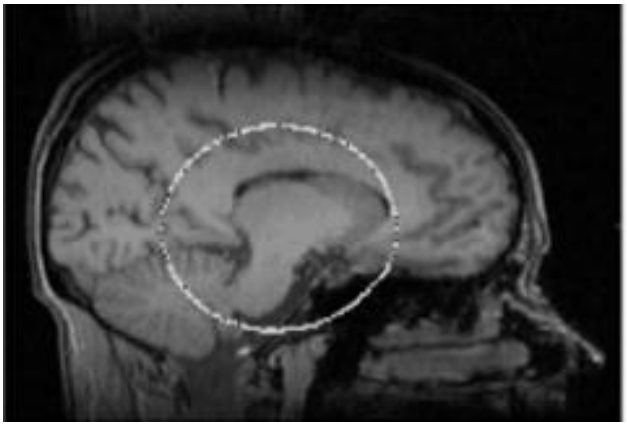


Fig.5 Tessellation of brain

Step.4: Updation of image

Each vertex in the tessellated surface is updated by estimating where best that vertex should move to improve the surface[6].

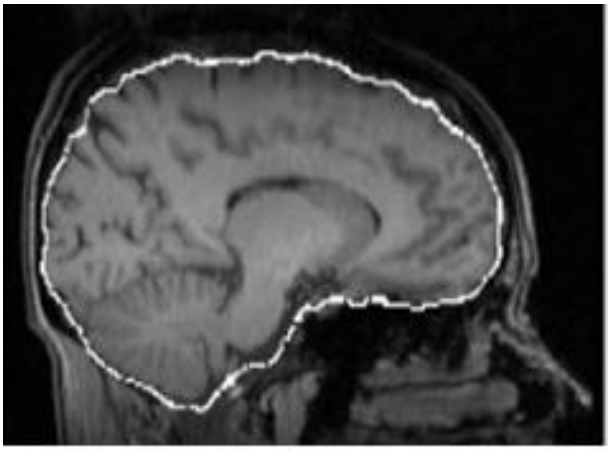


Fig 6.Segmentation of brain

a) Generation of brain surfaces:

To obtain more accurate brain segmentation results, we need propose a processing step that is based on the geometric features of the brain to account for error from the proposed method skull stripping.Here the non-brain tissues are brighter than brain tissue, the step shows the visual appearance features of the MR brain data[6].

Algorithm-Brain extraction:

1) Correct the bias of the MR brain data.

a) Brain intensity normalization.

b) GGMRF edge preservation.

2) Strip the skull using BET [2].

3) Estimate the models for brain and non-brain tissues using Step 2 results.

4) Form an initial m by voxel-wise classification using models found in Step 3.

5) Calculate the distance map inside the binary mask obtained from BET.

6) Generate a set of N iso-surfaces using the distance map calculated in Step 5.

7) while j <N

a) Select the jth iso-surface and classify its voxels by combining the first and second-order visual appearance features.

b) Are all the voxels on the selected iso-surfaces classified only as brain tissue?

No! Go to Step 7 (a).

Yes! Break

V. DESIGN

Algorithm:

Step 1: Input the Brain MR image.

Step 2: Estimation of the parameters based on the histogram analysis.

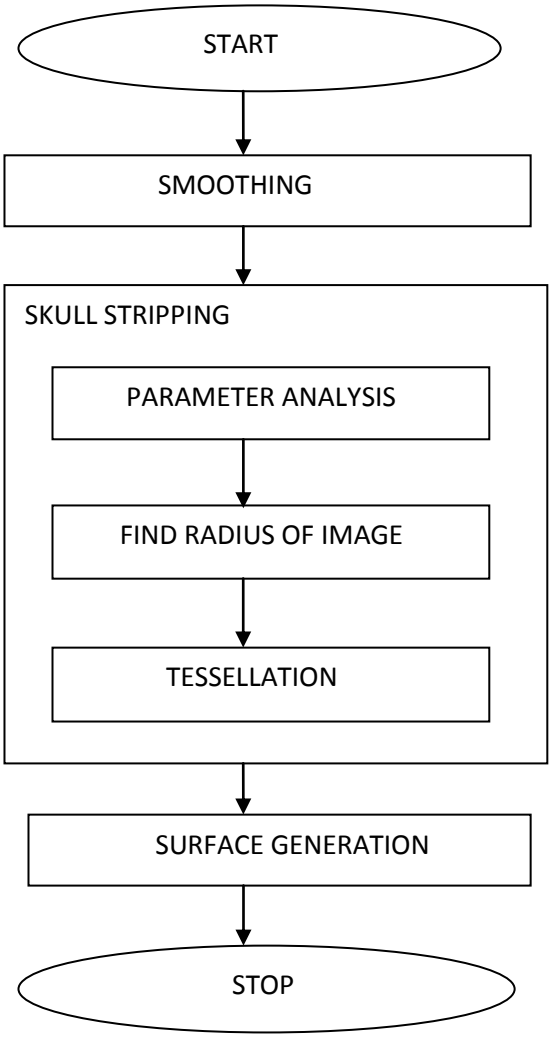
Step 3: Binarising the image to find the centroid and radius of image.

Step 4: Start the tessellation process on the brain image.

Step 5: Repeat the updates to surface.

Step 6: Final tessellated surface here brain gets extracted.

Framework for brain segmentation from MRI Brain slices



V. CONCLUSION

A method for segmentation of brain from MRI images, This is the method result the brain segmented accurately.The usage of the histogram analysis and tessellation process, makes the result of the segmentation of brain very accurate for the further medical analysis.

VI. FUTURE WORK

The proposed work is segmentation of the brain from the MRI scanned image. This is a very important step before the doctors could go for the identification of any injuries to the brain like brain tumours and any other brain diseases. The accurate segmentation of brain helps in the detection of these injuries at easily.

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