Reconstruction of Brain MRI Images

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Abstract— The field of medical visualization of organs are needed for accurate diagnosis and treatment of any disease. Brain tumour diagnosis and surgery also requires accurate 3D visualization of the brain. Detection and 3D visualization of the brain and possibly tumours from MRI is a computationally time consuming and error-prone task. The proposed system presents a 3D reconstruction model of the brain which greatly helps the radiologist to effectively diagnose and analyze brain. If the subject is in motion state or there occurs a movement while taking the scan, there might be distortions in the output scan image. In order to avoid such circumstances it is better to reconstruct the 2D image into a 3D space as it is more effective. Thus the quality of the scan image is much better. More than 200 images were used for the training and around 150 images were used for testing. Here the 2D image slices are undergone image pre-processing, image registration, and then reconstruction. For the image registration, the method used is discrete wavelet transform which is more suitable for medical imaging. The proposed system is applicable for the clinical practices.

Keywords: Image Processing, MRI, Reconstruction

I. INTRODUCTION

Magnetic resonance imaging (MRI) of the brain is a safe and painless test that uses a magnetic field and radio waves to produce detailed images of the brain and the brain stem. To get the high quality MRI results, the subject needs to lie still during the scan. For this reason, sedation may be needed, especially for babies and young kids, who often have trouble staying still for the test. Motion makes MRI data inconsistent By the proposed method even though the subject is moving, much better and clear scan be obtained. The scan images are undergone various steps and then a 3D visualization is obtained as the end result. More than 200 images were used for the training and around 150 images were used for testing. The process involves intensive pre-processing steps, Pre-processing is a necessary step to achieve acceptable input for intensity-based pose optimization for a volume reconstruction process. Image registration is also required for applications such as segmentation.

II. EXISTING METHODS

[1] propose a snapshot MRI methodology. This work was motivated by the challenge of fetal brain imaging. The proposed method can be for the subjects moving at high resolution and high SNR. The image registration method used here is SVR. After imaging the target volume, image registration method is used to align the image slices. The steps are achieving the slice data by a single shot technique. The second step is to determine the mapping. The last step is the interpolation of irregular sampled data.

[4] propose a fast multi GPU accelerated framework for the reconstruction. This method uses automatic outlier rejection and intensity bias correction. a fully automatic procedure is introduced to select the image slices. The movements more than 90° cannot be solved using this method.

[6] propose a learning based image registration method where it is used to predict the 3D rigid transformation of the 2D image slices. Only the image intensity information is needed. Here convolutional neural network (CNN) is used to predict the transformation.

[8] proposes an advanced form of SVR. Deformable SVR (DSVR) is the method which can be used for the non-rigid motion correction. In addition to this, it uses outliners to minimize the impact of registration errors

III. METHODOLOGY

To fully evaluate and assess the performance of reconstruction of brain, it is incorporated into a pipeline as shown in Fig. 1.
This features four modular components: (1) pre-processing, (2) Image registration using DWT, (3) Segmentation (4) 3D volume reconstruction.

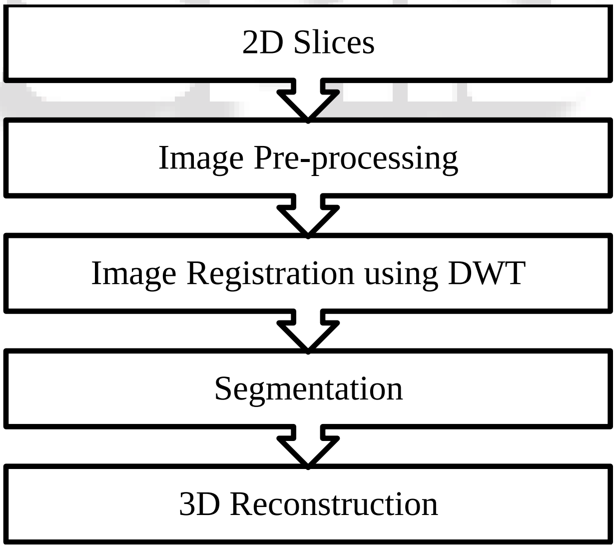

Fig. 1: Block diagram of image reconstruction

A. *Image Preprocessing*

Preprocessing is one the important steps in the image processing. The preprocessing steps used for the proposed system are resizing, Weiner filtering, image enhancement, contrast stretching. The images are changed into a size of 250× 250 standard size. Then it is followed by Weiner filtering of that image. The Weiner filtered image is undergone image enhancement and it is followed by the contrast stretching process. These steps are done as the preprocessing step for the proposed system.

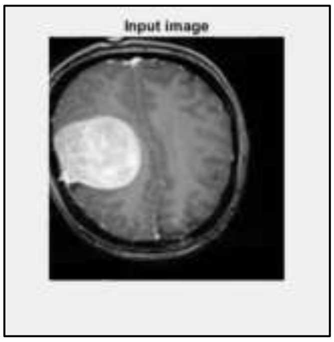

Fig. 2: Input image

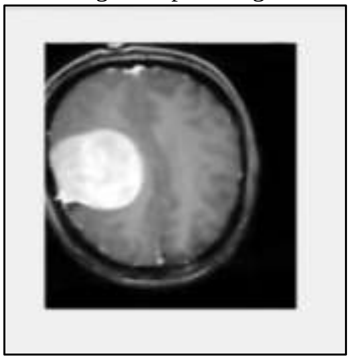

Fig. 3: Resized image

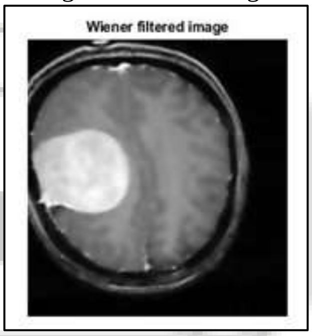

Fig. 4: Weiner filtered image

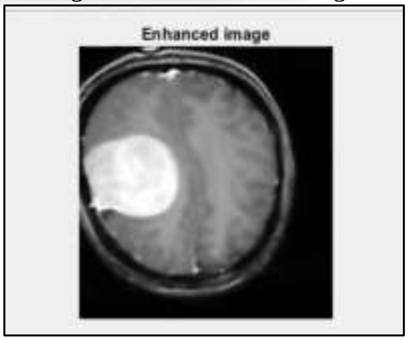

Fig. 5: Enhanced image

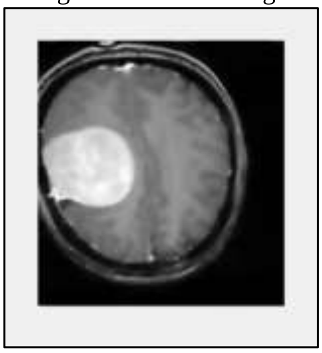

Fig. 6: Contrast stretched image

B. Image registration

Image registration is the process in which the different image or data sets are transformed into one coordinate system. Here the data refers to multiple photos,data from different sensors etc. There are several methods for image registration.Popular image registration techniques are SVR PVR DWT etc. For the proposed system DWT is used as it is more effective for the medical images.By using DWT, the horizontal, vertical, diagonal views of the image is obtained.

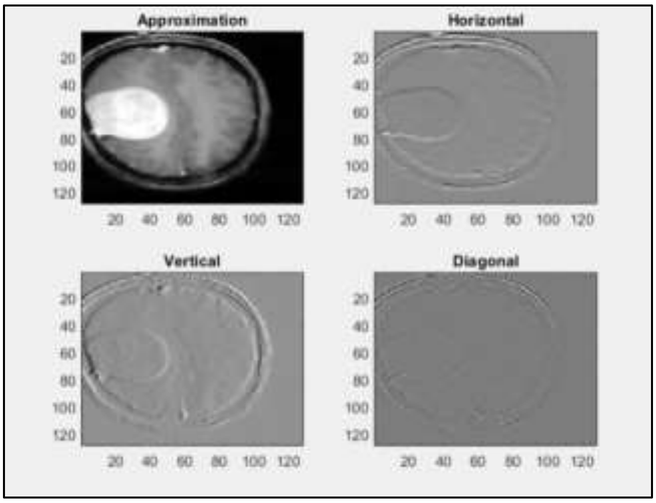

Fig. 7: Image registration using DWT

C. Segmentation

To find the abnormalities in the brain MRI image segmentation is done.segmentation is assigning data points tonthe cluster.such clusters are found using similarity measures.here fuzzy c means clustering algorithm is used to find the clusters.the fuzzy c means algorithm has been proposed as a more applicable algorithm in the performance. For the classification artificial neural network is used.

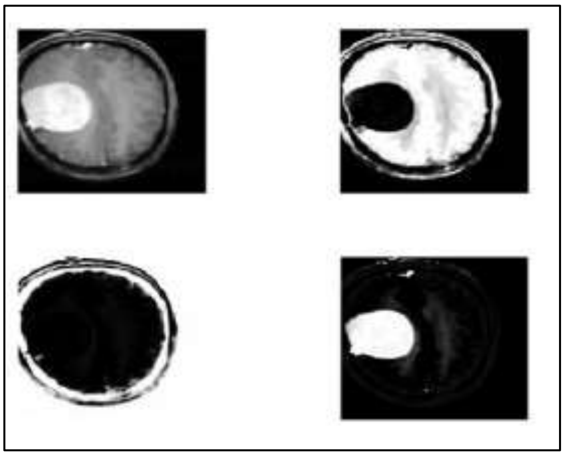

Fig. 8: Segmented image

IV. CONCLUSION

Both fetal and neonatal motion is unpredictable, characterized by unique patterns. Motion compensation holds a very important role. This method allows the reconstruction of the brain MRI image. Motion corrupted scan images can be reconstructed using the proposed method. From the further proceeding of this project, detection of tumours in the brain can be found from the reconstructed image.

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