

Project Pipeline

3D Brain Vessels Extraction

Group Members:

Danish Sikander K132061

Kashif Sikander K132062

Step 1 - Skull Removal :

To remove the skull, we use various mathematical morphological operations, the idea was taken from a paper which implemented a similar technique. The algorithm is as follows:

1. Binarize the image using standard deviation of the image.
2. Take the complement of the image.
3. Perform a 2D Wavelet Decomposition of level 2 by db2 using matlab function `wavedec2()`.
4. Re-compose the image using approximation coefficient.
5. Label the image using `bwlabeln()`
6. Resize the image to its original dimensions, using bilinear interpolation.
7. Take the largest connected component, that's the brain, using `bwareafilt()`
8. Take the complement of the image.
9. Apply `convexhull`, to get a complete and smooth shape.
10. Multiply this image with the original, element by element, the obtained image is the one without skull.

Step 2 - Applying Local Intensity Rejection Filtering :

After the skull was removed from each slice of the image. Each slice was then pass through local intensity rejection. The algorithm had the following steps:

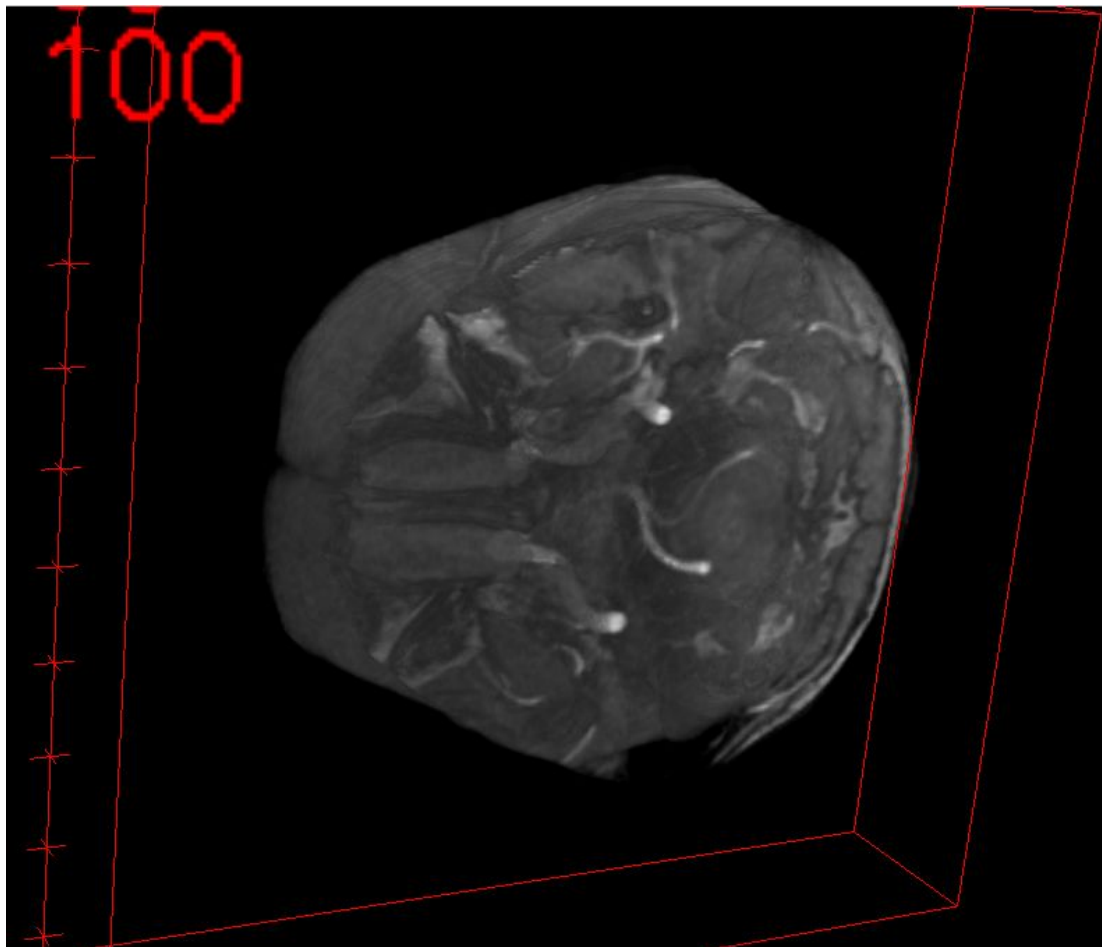
1. Take a Window of size 32x32.
2. Take the mean of the window.
3. Put "0" intensity value whenever a pixel has value lower than mean.
4. Move the window in a brute force manner and and apply the above three steps.
5. Do the above steps for rest of the slices.

Step 3 - 3D view :

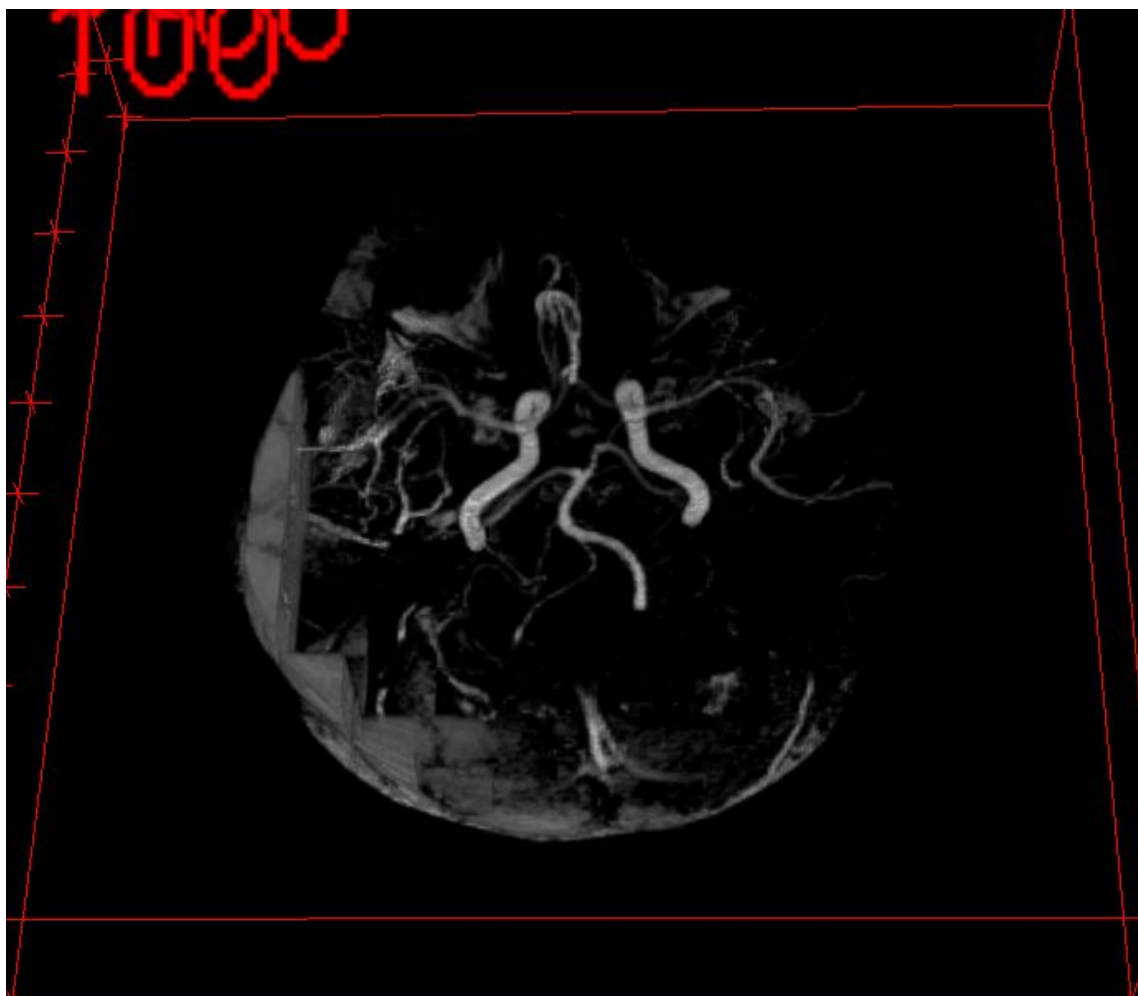
To achieve the 3d view of these vessels, we use FIJI ImageJ application since we had limited knowledge of computer graphics and the project was for the course of Digital Image Processing.

Results

Obtained by applying skull removal



Obtained after applying Local Intensity Rejection Filter



The results achieved through step 2 are not too accurate because image was bright from one side but vessels appear prominent after this step..

