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A Comparative Study on Region Growing Methodology and Zernike Moment Methodology for Brain Tumour Detection

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Abstract: In this paper a comparative study on two methodologies namely Region Growing method and Zernike Moments were done. Normally the diagnosing of brain tumour is carried out by examining the Magnetic Resonance Imaging (MRI) scans. The detection of tumour from MRI Images was carried out independently by the two methodologies and the performance were compared based on two criterions: Root Mean Square Error (RMSE) and Time Complexity. The Results Analysis shows that brain tumour detection carried out by Zernike Moments method is having better performance than Region Growing method.

Keywords: Brain Tumour, Magnetic Resonance Imaging (MRI), Zernike Moments, Region Growing method.

I. INTRODUCTION

One of the major cause for the increased death rate among the children and adults is the brain tumour. Nowadays many technologies are available for the detection of brain tumour such as Ultra Sound, Computed Tomography (CT) scans and Magnetic Resonance Imaging (MRI). Here MRI images of the patients are being taken for the brain tumour detection. In this paper a comparative study is made out between two methodologies namely Region grows method and Zernike moment method for the detection of brain tumours from the MRI images.

There are mainly two advantages for Magnetic Resonance Imaging. Firstly, it has the capability for changing the contrast of the images. As a result of different contrast settings the different types of tissues will get highlighted. Secondly the MRI has the ability to change the imaging plane without moving the patient's position. Computed Tomography do not have the ability to produce images in any plane whereas Magnetic Resonance Imaging can.

II. METHODOLOGY

The figure 2(a) shows the block diagram for the detection of brain tumour by Region Growing method. The figure 2(b) shows the block diagram for the detection of brain tumour by Zernike Moments method. The procedure carried out for both the methods are almost same except feature extraction.

There exist some shortcomings for using the region grows method. The computations which are performed in the region grows methodology is very time consuming in nature. Moreover, the presence of noise or any variations in the intensity will result in over segmentation.

There exist many advantages and applications for the Zernike moments. Since the Zernike moments have ideal shape descriptors and hence they are used in many mathematical applications. The Zernike moments have simple rotational invariance that is, even if the image is rotated to any degree the image will keeps its originality. The Zernike moments can represent the properties of an image with no redundancy or overlap of information between the moments.

III. EXPERIMENTAL RESULTS

Here 3 MRI Images are taken for analysing the performance of the two methodologies. The three images taken for performance analysis are shown in the figure 3(a). The tumour detection is carried out for Image 1, Image 2 and Image 3 using the Region Growing method and Zernike Moments method. Finally, a comparison between the two methodologies based on the Root Mean Square and Time Complexity is done. The values obtained for Root Mean Square Error and Time Complexity for the two methodologies tabulated. This is illustrated in the Table 3.1 and Table

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3.2 respectively. From the analysis it is very clear that the Root Mean Square Error and Time Complexity are very less for the Zernike Moments methodology and are comparatively high for the Region Growing methodology.

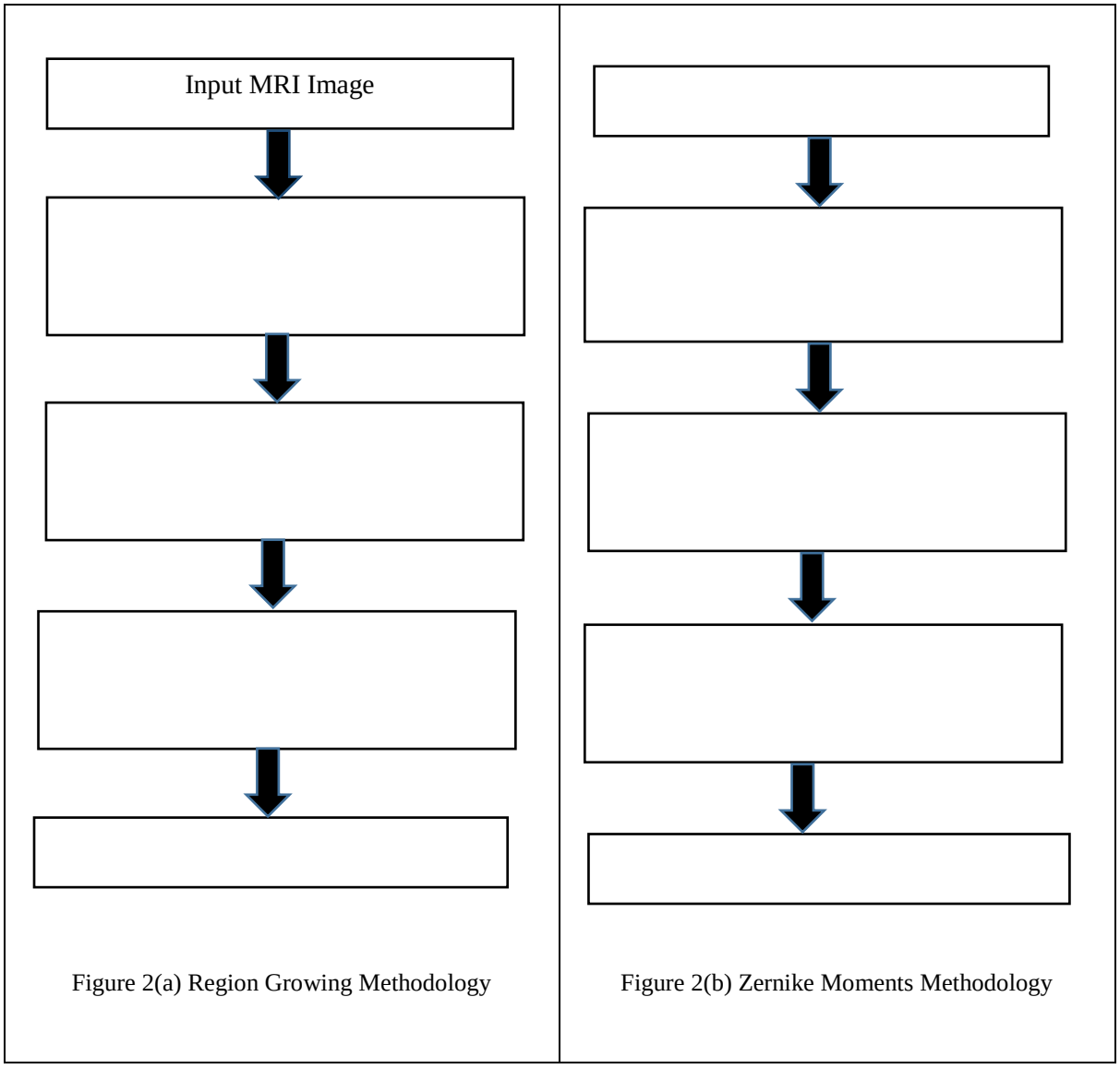

Figure 2(a) Region Growing Methodology

Figure 2(b) Zernike Moments Methodology

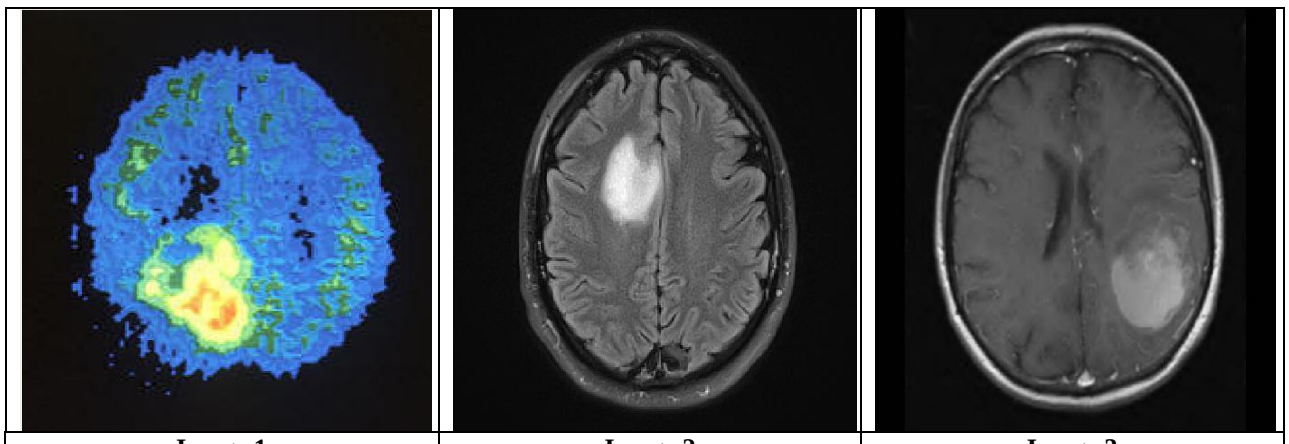

Image 1	Image 2	Image 3

Figure 3(a) MRI Images taken for comparison

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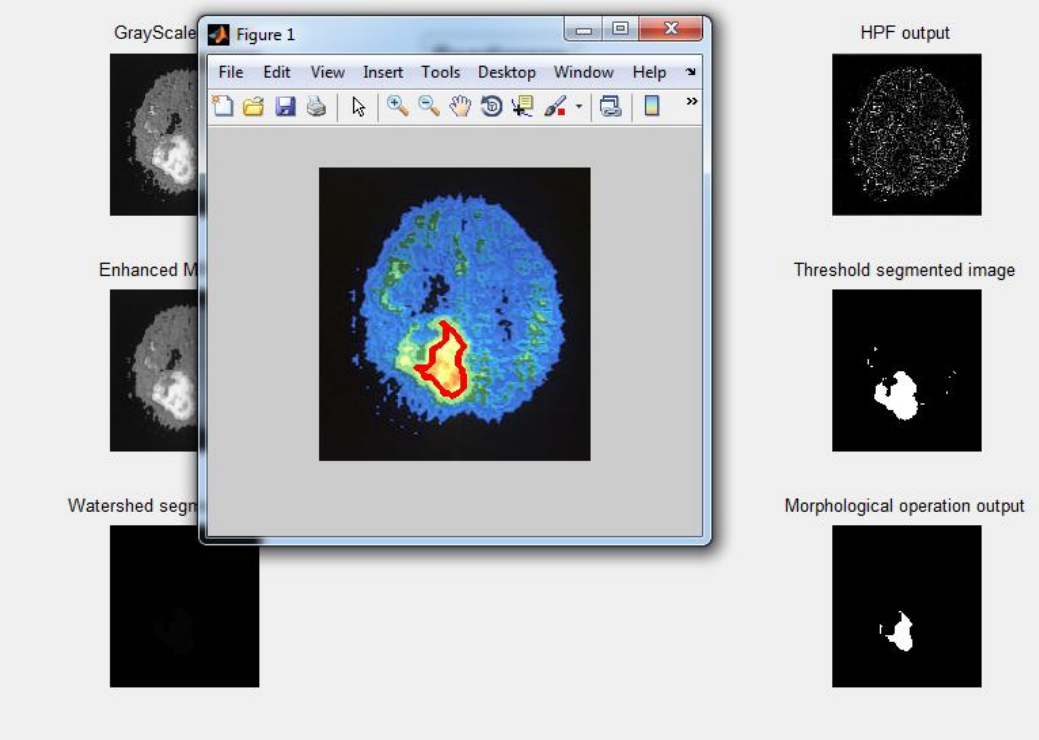

Figure 3(b)Tumour detected for Image 1 using Region grows method

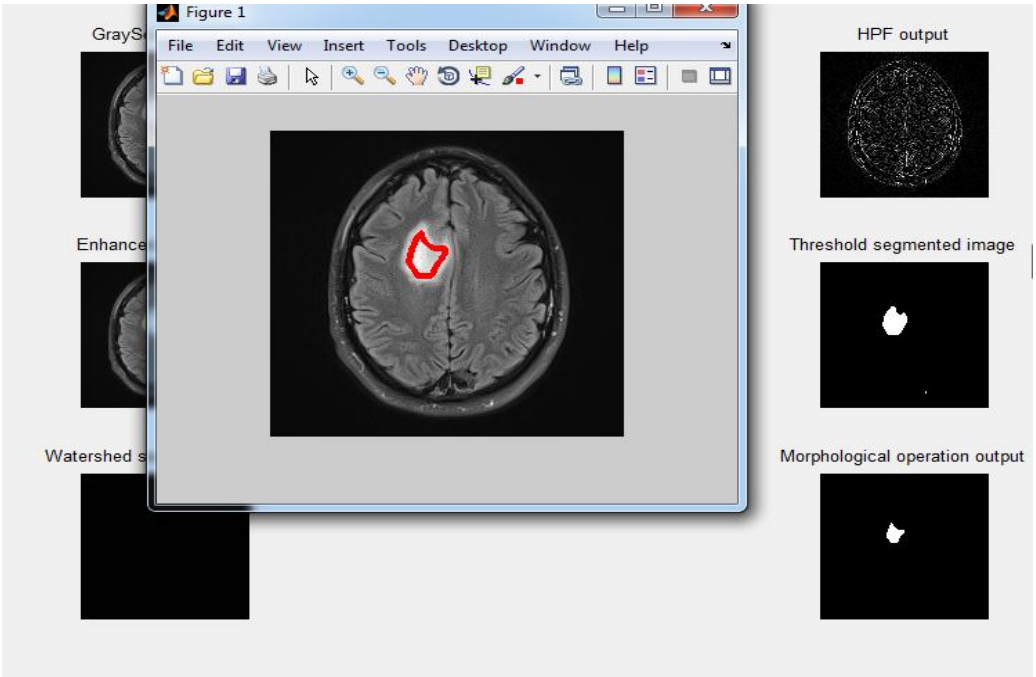

Figure 3(c) Tumour detected for Image 2 using Region grows method

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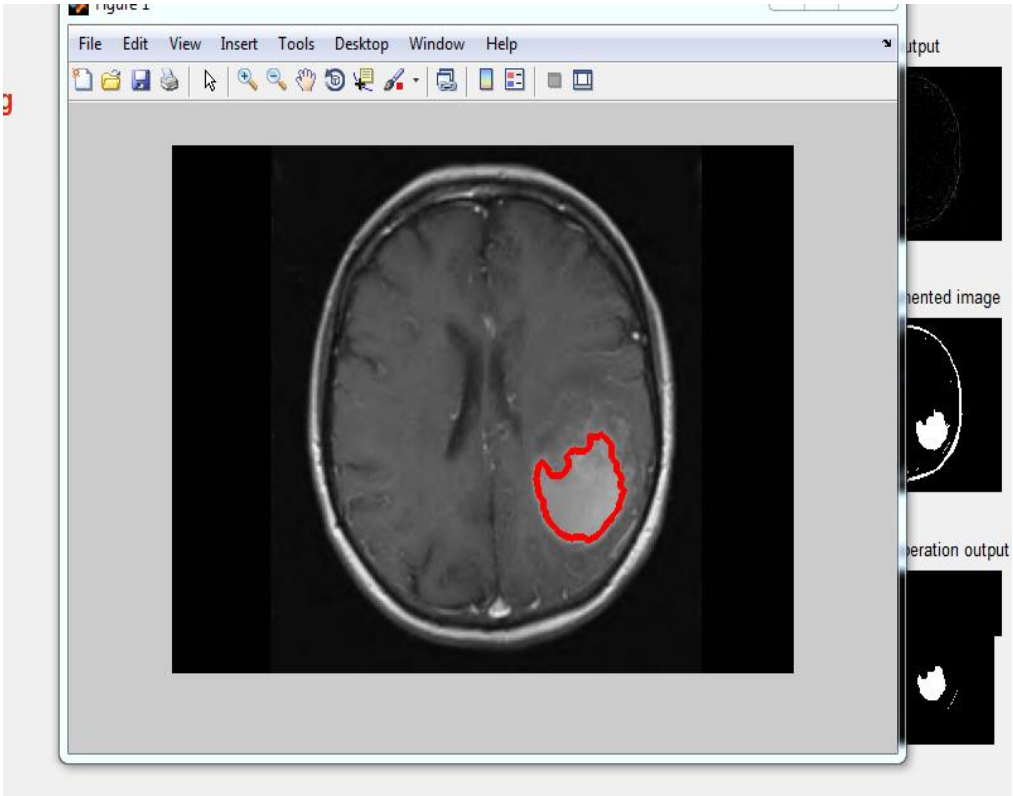

Figure 3(d)Tumour detected for Image 3 using Region grows method

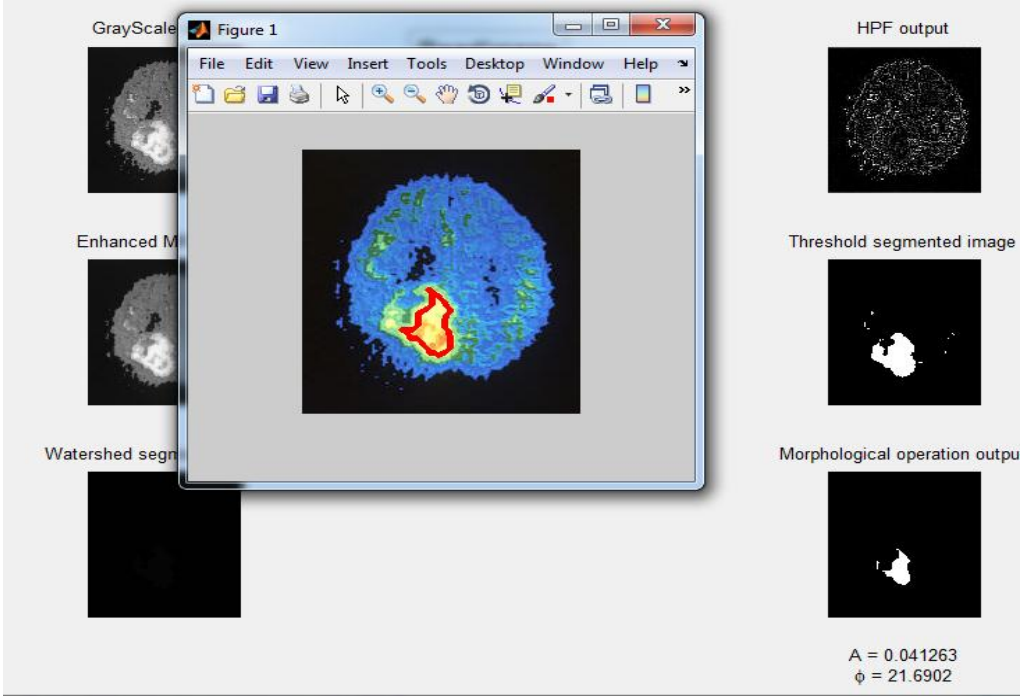

Figure 3(e) Tumour detected for Image 1 using Zernike moments

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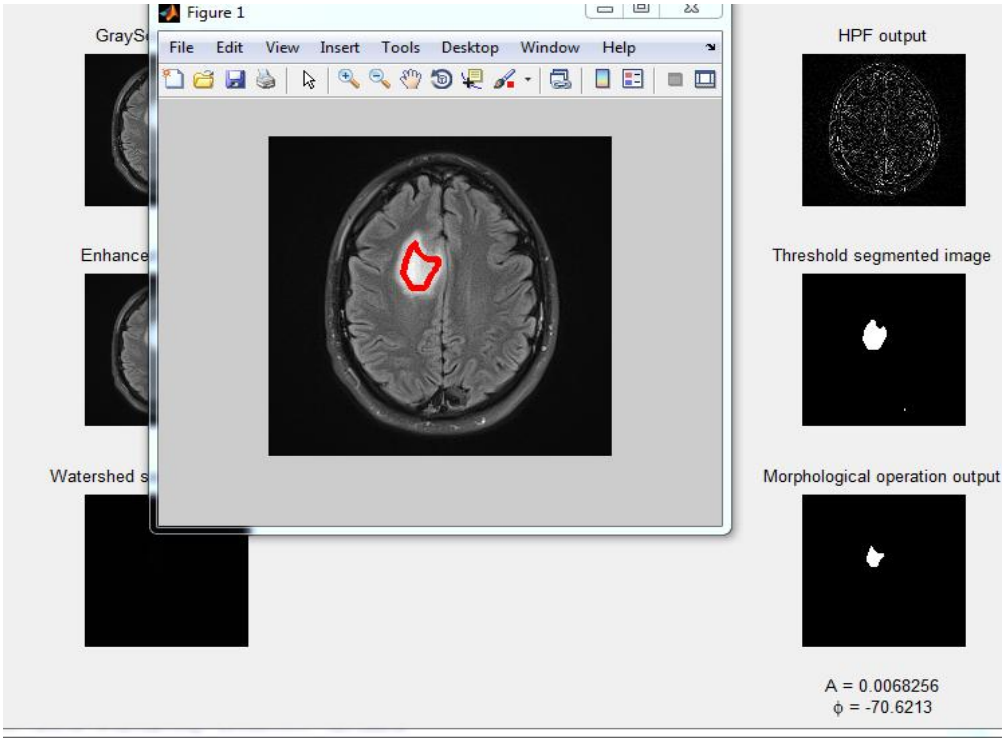

Figure 3(f) Tumour detected for Image 2 using Zernike moments

Figure 3(g) Tumour detected for Image 3 using Zernike moments

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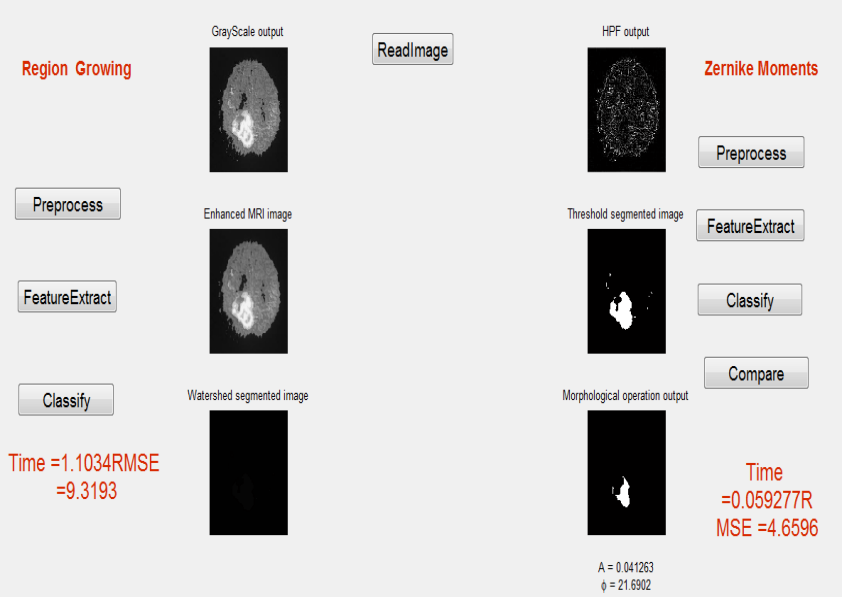

Figure 3(h) Comparison of Zernike moment with Region growing for Brain Tumour 1

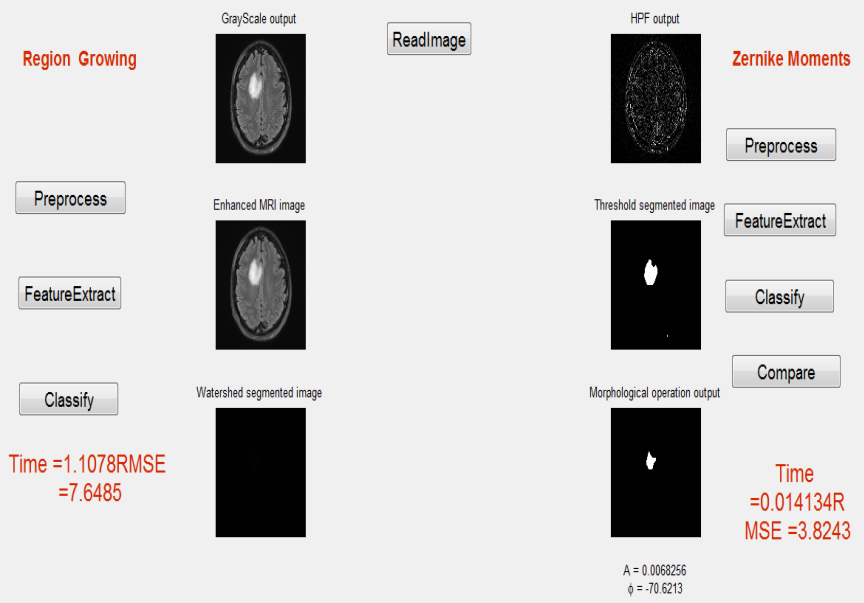

Figure 3(i) Comparison of Zernike moment with Region growing of Brain Tumour 2

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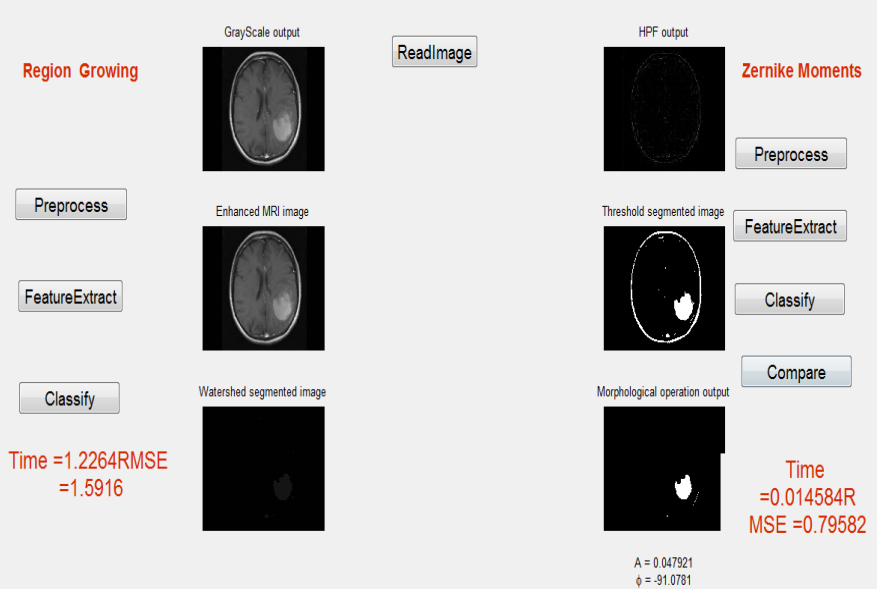

Figure 3(j) Comparison of Zernike moment with Region growing of Brain Tumour 2

Table 3.1 Comparison of Zernike moment with Region growing in terms of Time complexity

Image	Region Grows	Zernike Moments
Image 1	1.1034 s	0.059277 s
Image 2	1.1078 s	0.014134 s
Image 3	1.2264 s	0.014584 s

Table 3.2 Comparison of Zernike moment with Region growing in terms of RMSE

Image	Region Grows	Zernike Moments
Image 1	9.3193	4.6596
Image 2	7.6485	3.8243
Image 3	1.5916	0.79582

IV. CONCLSION

The detection of brain tumour is carried out by using two methods: Region Growing method and Zernike Moments method. The comparison of performances is made for both methods based on the Root Mean Square Error (RMSE) and the Time Complexity of the two methods. From the values obtained for both the methods, it is very clear that the Zernike Moments method has maintained better performance when compared with Region Growing method. With the combination of mean values from the low and high order Zernike moments it is possible to extract the tumour regions from the different kinds of brain tumour images.

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