International open access journal

Journal of Medical Pharmaceutical and Allied Sciences

Journal homepage: www.jmpas.com

Research article

MRI brain image segmentation by using a deep spectrum image translation network

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ABSTRACT

Now a days medical image processing is challenging task. Because of its structure, flexibility in place, and irregular borders, manual identification and segmentation of brain tumours is difficult. The proposed work uses the super pixel technique to identify and segment brain tumours based on transfer learning. This process is called as dense prediction because we are predicting for each pixel in the image. It is important to identify these tumours early to provide better treatment to patients. Early detection improves the patient's chances of survival. The primary goal of this study is to use deep learning to segment brain tumours in MRI images. The suggested technique is tested using data from Kaggle data sets for Brain Tumour Segmentation. In the first step we are pre-processing the required data sets, after getting required manner we are applying the data to VGG-19 transfer learning network to identify the disorder of the brain tumours. And then we are using UNet model for tumour detection process. Due to these processes, we are getting better improvement in terms of quality metrics.

Keywords: Magnetic Resonance Images, transfer learning, segmentation, VGG-19 network

Received - 18/05/2021, Reviewed - 16/06/2021, Revised/ Accepted- 10/07/2021

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INTRODUCTION

Magnetic Resonance Images (MRI) are the most popular for tumour analysis, growth detection, and position identification of tumours. Many algorithms are implemented to identify and analysis brain tumours. The implementation of automated systems for disease prediction in medicine is critical. Hence, we must develop new techniques for diagnosis of brain tumours. Several techniques are implemented to determine brain disorders, but it will give low accuracy in tumour identification process.

MATERIALS AND METHODS

Related work

MRI Images are mainly used to identifying the disorders in brain tissues. In region-based segmentation and classification [1]. To get initial features of the image we are using object recognition image exploration and segmentation [2]. Different algorithms are proposed on that help full techniques are CBIR such as support vector machine (SVM) [3,4]. To separate approximate nearest neighbours, we are using 2 level segmentation and the automatic algorithm configuration is discussed in [5, 6]. To perform multilevel optimization of MRI brain images we are using genetic algorithm [7, 8] to get fast and stable results. Shen et al. [9] developed traditional fuzzy C-means (FCM) clustering algorithm. Kalavathi and Ilakkiya muthu [10] implemented FCM clustering algorithm. To detect the brain disorders par meet Knur and Harish Kundra proposed the intelligent water drops algorithm [11]. For machine learning methods, Tustison et al. [12] Zikic et al. [13], and Gooya et al. [14], are proposed some work to perform brain tumour segmentation.

Proposed methodology

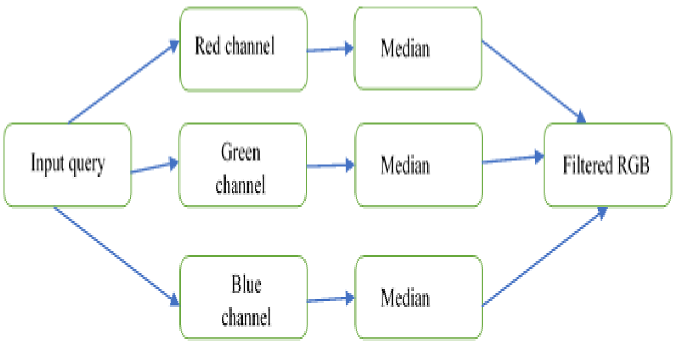
Initially we are performing some pre-processing operations on MRI image. If Pre-processing is not performed, then it will result poor performance. To perform filtering operations, we are using median filter it will eliminates noise by maintaining sharp edges.

Here the image is divided into R, G, B components, and these are filtered by using median filter as shown in figure.

$f(x,) = median\{g(s,t)\}$ ……………………………...…………… (1)

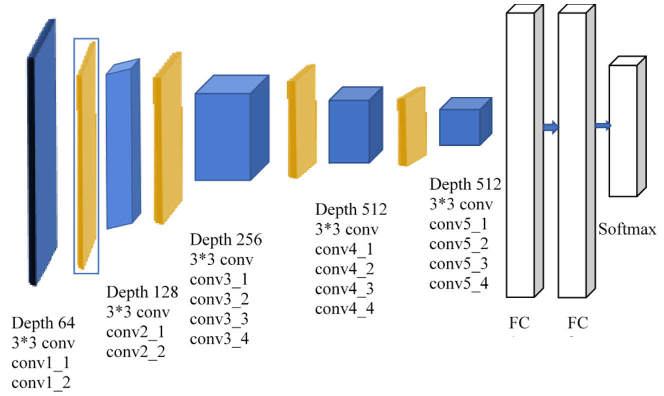
The VGG-19 model, developed by Simonyan and Zisserman of the University of Oxford, is a 19-layer (16 conv., 3 fully connected) CNN that strictly uses 3×3 filters with pad of 1 and stride, as well as 2×2 max-pooling layers with stride [15]. The VGG-19 (see Fig. 2) is a deeper CNN with more layers than other network.

Figure 1. Flow of Pre-processing



Last few decades VGG-19 plays an important role in object categorization. Here we are performing some basic pre-processing operations and after this these images are transferred to VGG-19 network. This network classifies images into number categories. If we want to recognize images in large scale, you are using VGG-19 network.

Figure 2. The Block-Wise VGG19 architecture



The VGG 19-Unet depends up on the results that we are getting in the previous step. Linear activation function is used to get the enhanced spectrum of the given image. U-Net well known conventional network for image segmentation and deionizing. In encoder block VGG19 is embedded with U-Net architecture that was trained with images. In this paper TCGA data set is used, it is available from Kaggle. Here the analysis is goes with determination of tumour and identification of effected area.

RESULTS AND DISCUSSION

In this paper mainly we are concentrating on disorder detection and segmentation.by using this model we have worked up to 70 epochs. With this network were acquiring good accuracy results as well as disordered identification. With this analysis we have achieved and accuracy of 97%.

Figure. 3. Tumour activation in deepest layer

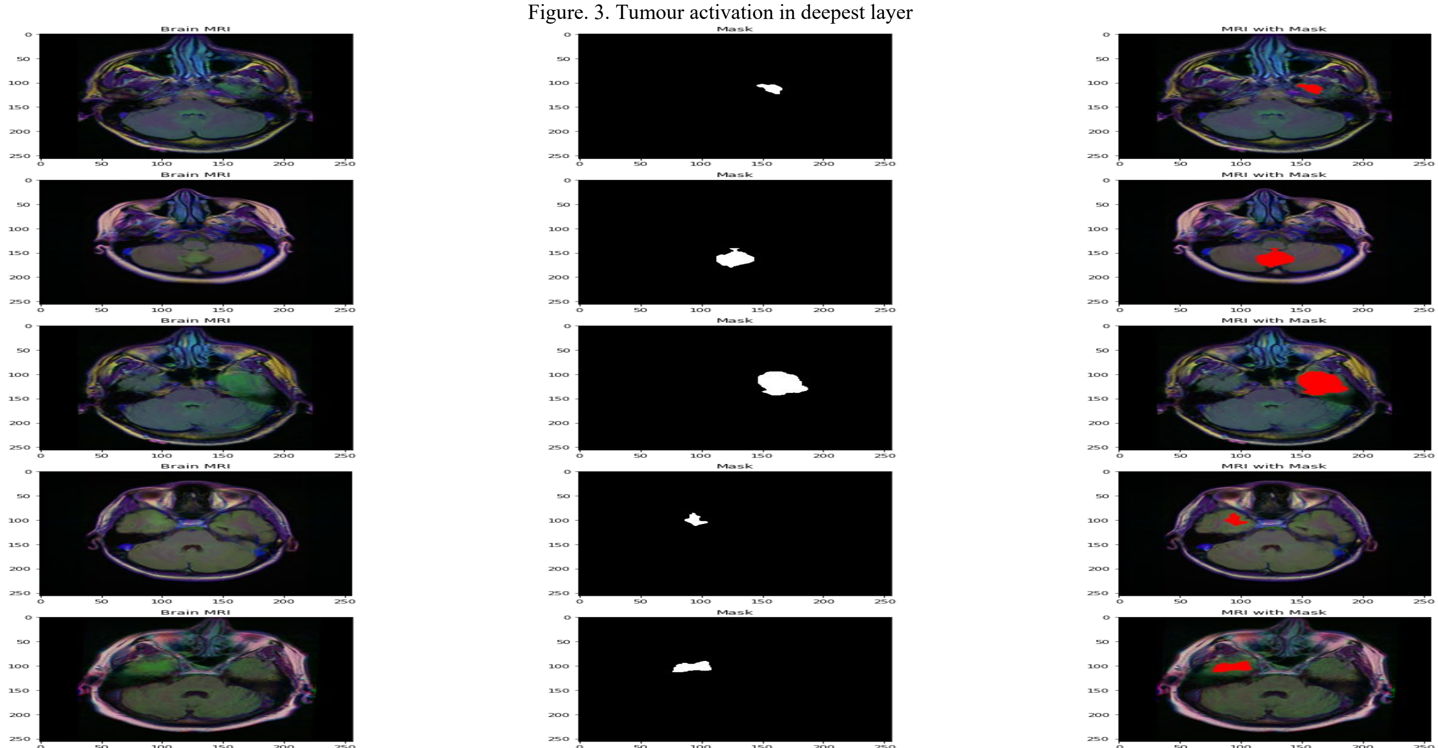


Figure. 4. Loss and Accuracy curve for 70 epochs

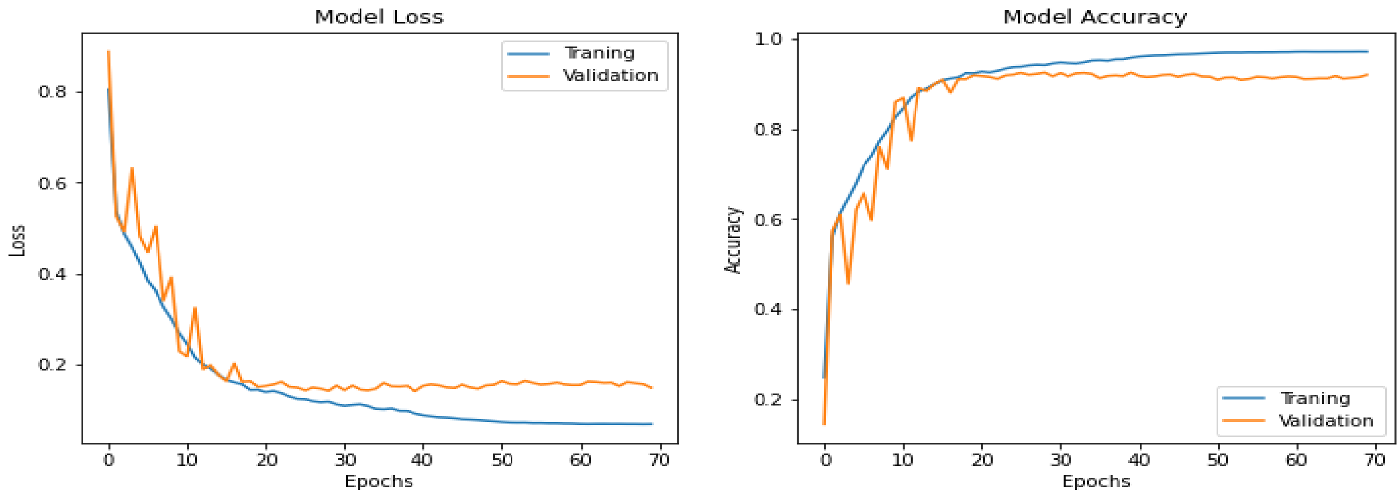


Figure. 5. Visualization of prediction for brain tumour

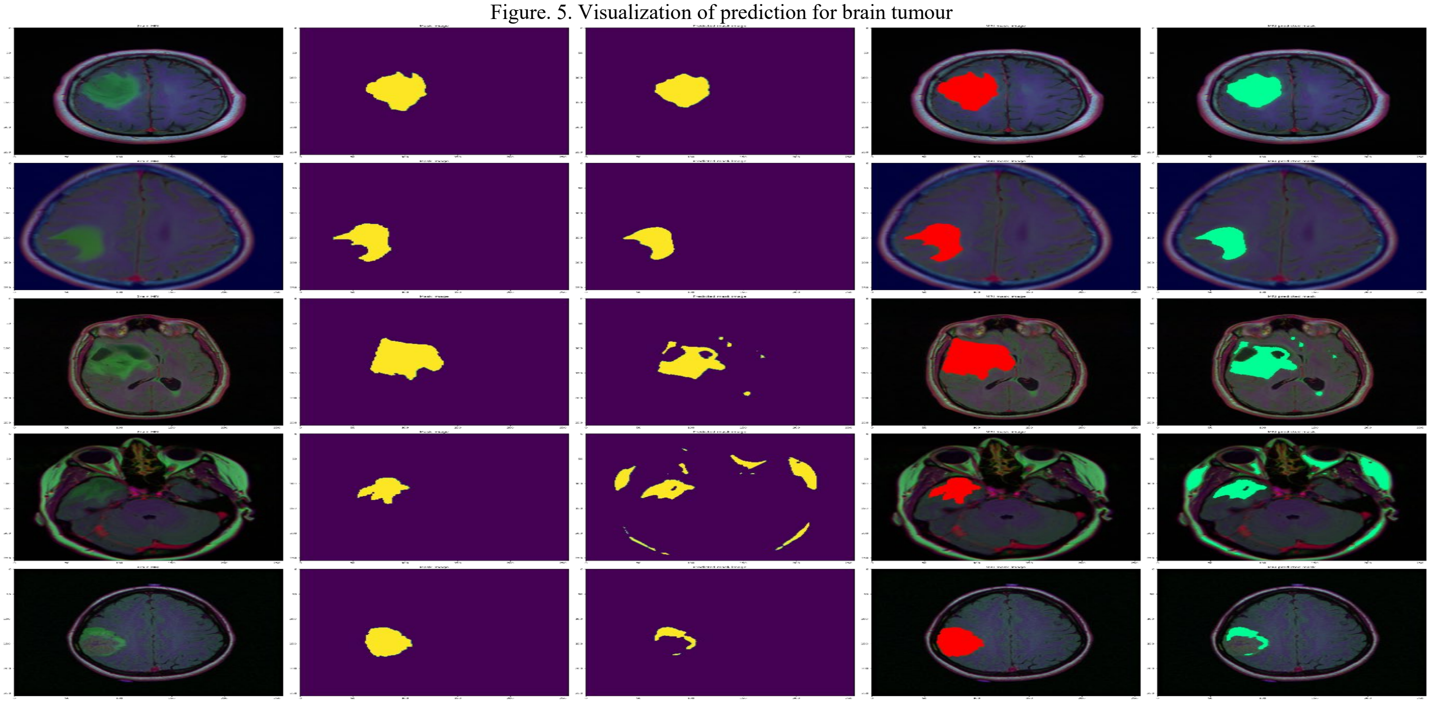


Table 1. Comparison of proposed with Existing techniques

	pixel accuracy	mean accuracy	mean IU	frequency weighted	geom. accuracy
Liu [16]	76.7				
Tighe [17]					90.8
Tighe [18]	75.6	41.1			
Farabet	72.3	50.8			
Pinheiro	77.7	29.8			
FCN-16s	85.2	51.7	39.5	76.1	94.3
Proposed	91.9	53.9	42.8	77.2	97.1

Where the quality parameters are

Pixel accuracy is $\sum_i P_{ii}/\sum_i t_i$………………………………………………………...………… (2)

Mean accuracy is $(1/P_{cl})\ \sum_i P_{ii}/t_i$…………....………………………………………….…. (3)

Mean IU is $(1/P_{cl})\ \sum_i P_{ii}/(t_i + \sum_j P_{ji} - P_{ii})$…………………………………….…..…… (4)

Frequency weighted is $(\sum_k t_k)^{-1}\ \sum_i t_i\, P_{ii}/(t_i + \sum_j P_{ji} - P_{ii})$...……………...…………..…… (5)

We present four metrics based on accuracy and region intersection. Let P_{ij} be the number of total pixels belong to class j from class i, P_{cl} various classes, $t_j = \sum_j P_{ij}$ total number of pixels belongs to class i.

CONCLUSION

A fully conventional network is mainly used to transform image pixel to pixel classes. The combination of VGG and UNet gives better results in terms of classification and segmentation point of view. At the same time the speeding process of the neural network is also improved. due to this technique, we are getting better results and we are getting better accuracy of 97%. The future work is goes with implementation of different networks to perform operations on real time data base.

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How to cite this article

Srinivasarao Gajula, V. Rajesh, 2021. "MRI brain image segmentation by using a deep spectrum image translation network". Jour. of Med. P'ceutical & Alli. Sci. V 10 - I 4, 1103, P-3097-3100. doi: 10.22270/jmpas.V10I4.1103