A Survey on Image Segmentation Using Deep Learning

S. Prince Mary¹*, Ankayarkanni², Usha Nandini³, Sathyabama⁴ and S. Aravindhan⁵

¹ Associate Professor, Department of Computer Science and Technology, Sathyabama Institute of Science and Technology, Chennai.
², ³, ⁴ Assistant Professor, Department of Computer Science and Technology, Sathyabama Institute of Science and Technology, Chennai.
⁵ Student, Department of Computer Science and Technology, Sathyabama Institute of Science and Technology, Chennai.
* Corresponding author e-mail: princemary26@gmail.com

Abstract. Image segmentation is a critical process in computer vision. It involves dividing a visible input into segments to simplify image analysis. Segments represent objects or parts of objects and comprise sets of super-pixels. Image segmentation sorts pixels into larger components, eliminating the need to believe individual pixels as units of observation. Brain tumour segmentation is a crucial task in medical image segmentation. Early diagnosis of brain tumours plays a crucial role in improving treatment possibilities and increases the survival rate of the patients. Manual segmentation of the brain tumours for cancer diagnosis, from great deal of MRI images generated in clinical routine, may be a difficult and time-consuming task. There is a requirement for automatic brain tumour image segmentation. The method is proposed to segment normal tissues like substantial alba, grey matter, spinal fluid, and abnormal tissue like tumour part from a resonance Imaging (MRI) automatically. The system also uses to segment the tumour cells along the morphological filtering are going to be wont to remove background noises for smoothening of region. The project results will be presented as segmented tissues and classification using, Convolutional Neural Network (CNN) classifier.

1. Introduction

Image segmentation is a critical process in computer vision. It involves dividing a visible input into segments to simplify image analysis. Segments represent objects or parts of objects and comprise sets of super-pixels. Image segmentation sorts pixels into larger components, eliminating the need to believe individual pixels as units of observation. Brain tumour segmentation is a crucial task in medical image segmentation. Early diagnosis of brain tumours plays a crucial role in improving treatment possibilities and increases the survival rate of the patients. Manual segmentation of the brain tumours for cancer diagnosis, from great deal of MRI images generated in clinical routine, may be a difficult and time-consuming task. There is a requirement for automatic brain tumour image segmentation. The method is proposed to segment normal tissues like substantial alba, grey matter, spinal fluid, and abnormal tissue like tumour part from a resonance Imaging (MRI) automatically. The system also uses to segment the tumour cells along the morphological filtering are going to be wont to
remove background noises for smoothening of region. The project results will be presented as segmented tissues and classification using Convolutional Neural Network (CNN) classifier.

2. Survey of Existing Research

Nilakshi Devi and Kaustubh Bhattacharyya et al.[1] reveals the actual fact that considering the numerous disadvantages of manual detection of brain tumour, the researchers have now turned their attention toward using soft computing tools within the detection process to form the detection more robust and fewer time consuming. Too much of human interaction within the manual detection leads to chaotic results in the detection process which becomes a risk to the patient's life.

Shrutika Santosh Akshata Raut Swati Kulkarni et al.[2] The proposed work is based mainly on thresholding, application of morphological operations and extraction of the tumour region for further analysis. Thresholding technique is the application of 'T' which is a constant over an image. When we apply the threshold constant 'T' over an entire image, the process is called as global thresholding whereas when we change the value of 'T' over an image, that process is called as variable thresholding. The image of the brain is obtained from the MRI scanning.

Sergio Pereira et al. [3] had proposed a novel Convolutional Neural Network (CNN) based method for brain tumour segmentation in MR images. The 3*3-bit CNN is used as deep CNN architecture. High Grade Gliomas (HGG) & Low-Grade Gliomas (LGG) tumour samples are used for test. During training, the number of training patches is augmented artificially by rotating training patches and rare samples of LGG augmented by samples of HGG. Multi-site, multi-scanner acquisition of MRI images using intensity normalization had proposed by Nyul et.al. This achieved the good segmentation. Brain tumour cells are highly variable in their structural composition and spatial localization, so data augmentation need to overcome this variability.

Carlos Arizmendi et al.[4] Author had proposed a binary classification of brain tumours using Energy criteria and Discrete Wavelet Transform (DWT). Based on pattern recognition techniques holds the assures of substantially improving the quality of medical practice in diagnostic and predictive tasks.

Roshan G. Selkar et al[5] had represented tumour segmentation and detection based on thresholding and watershed segmentation algorithm. Author had worked initially on MRI scan converted it into the grayscale image so that it becomes easy to process after that converted to the binary format using thresholding segmentation. Then applied watershed algorithm to group the same intensity pixels. Then morphological operations are applied to recognize the tumour.

Asra Aslam et al. [6] had proposed an enhanced edge detection algorithm for cerebrum tumour segmentation. The proposed strategy may be a mixture of Sobel technique with image independent Thresholding method. Close contour technique is utilized which decrease the rate of false edges. In the last, tumour extracted from the image based on intensity of pixels within closed contours. Brain tumour extracted from proposed method is better than the tumour extracted from Sobel Edge Detection.

3. Proposed System
The diagram of brain tumour classification supporting convolution neural network is shown in fig.1. The CNN based brain tumour classification is split into two phases like training and testing phases. The number of images is split into different category by using labels name like tumour and non-tumour brain image...etc. In the training phase, pre-processing, feature extraction and classification with Loss function is performed to make a prediction model. Initially, label the training image set. In the pre-processing image resizing is applied to change size of the image.

Another building block of a CNN is the pooling layer. It consequently reduces the spatial size of the representation to reduce the number of parameters and computation in the network. The most common way of pooling is max pooling. Accurate detection of size of the tumor and location of the tumor plays a crucial role in the diagnosis of tumor. The detection of tumor has two phases training and testing.

![Diagram](image)

**Figure 1. Proposed System Architecture**

4. Results and Discussion

In a computerized medical system, a classifier is required as part of a decision process to assist the physicians in diagnosing and monitoring a disease. Manual data analysis for diagnosis in medical practice has become inadequate as the number of patients is increasing. The need for automated classification system is necessary to speed up medical data analysis and to diagnose a disease accurately and consistently. Hence, development of classification techniques for effective computer based medical analysis helps the physicians in diagnosis.

In this work, efficient automatic brain tumour detection is performed by using convolution neural network. Simulation is performed by using python language. The accuracy is calculated and compared with all other state of the art methods. The training accuracy, validation accuracy and validation loss are calculated to seek out the efficiency of proposed brain tumour classification scheme. In the existing technique, the Support Vector Machine (SVM) based classification is performed for brain tumour detection. It needs feature extraction output. Using the feature value, the classification output is generated, and accuracy is calculated. The time of computation is high, and the accuracy is low in
SVM based tumour and non-tumour detection. The classification of images shown in Fig.2. The performance of the proposed system is shown in Table 1 and the Fig.3.

![Figure 2. Results after Classification](image)

![Figure 3. Results](image)

| Table 1. Comparison of Proposed work with Existing Methods |
|----------------------------------------------------------|
Performance | CNN Algorithm | SVM  
---|---|---  
Accuracy | >98% | 84.41%  
Computational time | Low | High  

5. Conclusion
Diagnosis of a problem plays an important role in all aspects. It is necessary to identify the future complication of tumor and take measures that are needed to minimize the amount of life loss. In our proposed work, we have proposed a model that could detect, any location where the classifier is trained with numerous previous information. The classification was performed using Neural Networks and the proposed model had good accuracy. The neural networks extracted the features of the dataset from the training set and were able to accurately detect the tumor. Various other parameters such as efficiency and computational time for the process was also considered which was found to be better than the traditional methods. The future works may include the use of other deep learning techniques, working on the security concerns of the Deep Learning, immediate detection of tumor which can save many lives.

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