Dayananda Sagar College of Engineering

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Brain Tumor Prediction Using Deep Learning Network

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Problem Statement

Brain tumor prediction on MR images with semantic segmentation by using deep learning network.

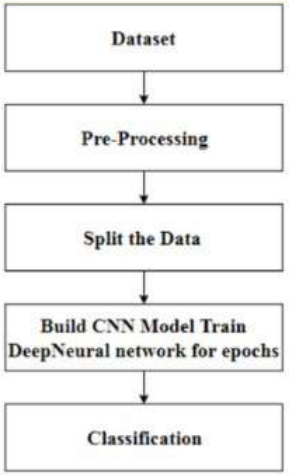
Abstract

Detection as well as segmentation of brain tumor is important in the healthcare domain. Since brain tumor can possibly lead to cancer, it is a crucial task to detect it early through Magnetic Resonance Imaging (MRI) or Computed Tomography (CT). These images obtained from the MRI makes it hard to locate the exact position of the tumor and hence it is a challenging task. Thus, computer-aided methods (segmentation, detection and classification processes) with better accuracy are required for early tumor diagnosis. The sematic segmentation method is applied to brain tumors which are automatically segmented with the aid of deep learning techniques (CNN, RNN, GAN, etc)

Literature Survey

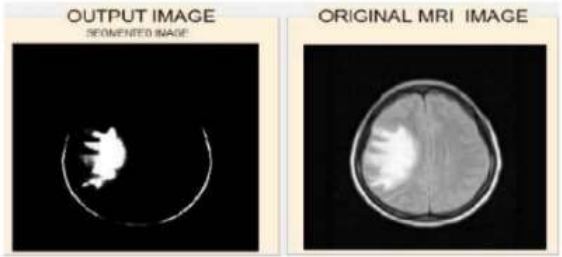
Sl. No.	Reference No.	Methodology/ Algorithm	Classifiers	Evaluation Metrics	Result
1	[1]	Birkeley Wavelet Transformation (BWT)	✓ SVM Classifier.	Sensitivity, Accuracy, Specificity, DSC	The results are: 94.2% - specificity, 96.51% - accuracy, 97.72% - sensitivity 0.82 - DSC
2	[2]	3D spatial fuzzy c-means (3DSpFCM) algorithm applied on two-stage fuzzy multi-objective framework (2sFMoF)	✗	Tissue Segmentation Accuracy (TSA), Segmentation Accuracy (SA), Cluster Validity Functions	The time complexity obtained from the 2sFMoF architecture is approximately: $O(3IC + 5IB_T + B_W)$
3	[5]	DCNN	✓ Support Vector Machine (SVM) Classifier	Dice ratio (DR), Modified Hausdorff Distance	Performance of CSN is better than other methods.
4	[12]	FCNN (densely-connected) along with the Skip Connections	✓ DenseNet for classification task	DSC, MHD (Modified_Hausdorff_Distance), ASD (Average_Surface_Distance)	The dice similarity coefficient (DSC) 90.37±1.30% - WM, 92.27 ± 0.81% - GM, 95.79 ± 0.54% - CSF
5	[13]	Novel Patch-Driven Level Set method	✗	Dice ratio	Accuracy of: (0.919±0.008 - WM, 0.980±0.003 - GM
6	[14]	Automated method for 2D deep segmentation	✓ Random Forest (RF)	Dice Overlap	For predicting survival rate, the overall accuracy is: 49% - test dataset, 52% - validation dataset
7	[10]	DL technique, CSN	✗	Mean Dice value	Mean Dice value observed: 0.9015 - EADC-ADNI HarP dataset 0.8835 - MICCAI dataset

Flow Chart



Expected Outcome

In the expected outcome, the brain tumors will be detected precisely which will be beneficial for both patients and doctors and tumor will be classified into respective categories. This model will be integrated with the web application, that makes it user friendly and displays the results for the user.



Conclusion

In comparison to other methods, our research demonstrates that the CNN algorithm achieved the highest accuracy and precision rate, which was approximately 99.74%. Hence, applying CNN model is observed to provide more accurate results in tumor detection. It was additionally brought to our observation that deep learning techniques have gained interest so as to enhance the accuracy and transparency of tumor prediction. Hence, the implementation will be carried forward with CNN technique.