

Brain tumor localization and segmentation using mask RCNN

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Problems & Ideas

- Brain tumor detection and segmentation from MRI images
 - Manual detection and segmentation of brain tumors is slow and suffer from a high error rate
 - Accurate brain tumor segmentation is still a challenge because of its structural complexity such as variations in location, size, shape, and overlapping tumor boundaries with normal brain tissues, etc.
- Ideas: Automated Brain tumor detection and segmentation from MRI images
 - Feature extraction using ResNet101 with a Feature Pyramid Network (FPN).
 - The Region of Interest (ROI) generation using RPN module.
 - For each of the proposed region the ROI classification and Bounding Box Regression network predicts bounding boxes and object class (tumor/non-tumor).
 - The segmentation network takes positive ROI as input and returns a segmentation mask

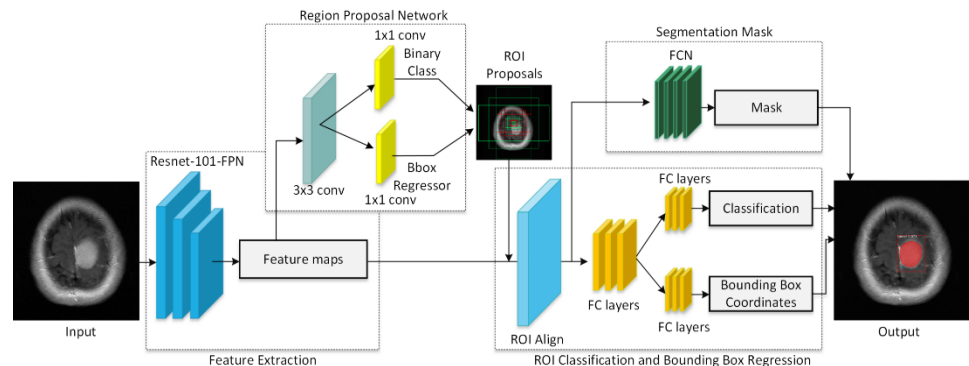


Fig. 1 Architecture of the Proposed Framework

Main Contributions

- Accurate localization and segmentation of brain tumor using the region proposal network and pixel-to-pixel accurate segmentation.
- A rigorous quantitative and qualitative comparison of the presented and latest techniques was performed on two online available datasets to exhibit the efficacy of our method.
- To the best of our knowledge, it is the first time Mask-RCNN has been employed for brain tumor segmentation.
- The proposed technique is robust to variations in size, shape, location, and overlapping tumor boundaries with normal brain tissues in the presence of MRI artifacts such as noise, bias field effect, and different acquisition angles.

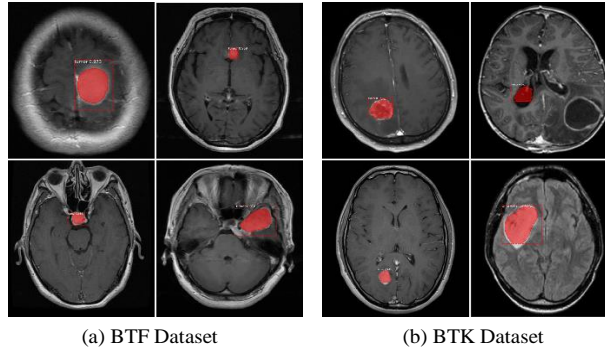


Fig. 2 Visualization of Tumor Segmentation Results in MRI Images

Table 1 Comparison of the Proposed Approach with other RCNN Methods.

Methods	accuracy	mAP	dice	sensitivity
RCNN	0.92	0.91	0.87	0.95
Faster-RCNN	0.94	0.94	0.91	0.94
Proposed (Mask RCNN)	0.95	0.94	0.95	0.95

Table 2 Comparison of the Proposed Method with Latest Techniques.

Techniques	mean IoU	dice	accuracy
Sultan et. al [2]	-	-	86.0
Arshia et. al [3]	0.76	0.93	93.4
Sobhaninia et. al [4]	-	0.79	-
FR-MRInet [5]	0.94	-	91.4
Proposed method (Mask RCNN)	0.95	0.95	95.1

Conclusion

- Mask RCNN can precisely segment the brain tumor by overcoming the challenges of variations in location, shape, and size. (Fig-2)
- Evaluation of the proposed method over BTF and BTK Datasets. (Fig-3)
- Mask RCNN perform better than other region-based segmentation methods i.e., RCNN and Faster-RCNN using the BTF dataset (Table 1).
- Compared the performance of our model with the existing latest approaches using the BTF dataset (Table 2)

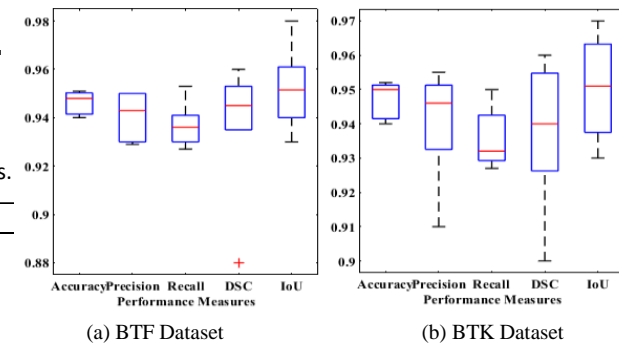


Fig. 3 Performance of the Proposed Method over BTF and BTK Datasets