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A Review of Brain Tumor Detection Techniques Using YOLOv8

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Abstract: Brain tumors, whether benign or malignant, pose significant risks, especially in children and young adults, impacting both life expectancy and quality of life. This review addresses the critical importance of early detection and treatment of brain tumors. With a focus on artificial intelligence, particularly object detection using the YOLOv8 model, the paper explores the potential for accurate and efficient brain tumor detection from magnetic resonance images (MRI). The YOLOv8 model is known for its real-time performance, efficiency, and high accuracy, making it a promising tool in the field of medical image analysis. The paper presents a method for brain cancer detection and localization, discusses experimental results, reviews the state-of-the-art literature, and outlines future research directions.[1-22]

Keywords: Brain tumor detection, MRI images, thresholding techniques ,YOLOv8, Faster R-CNN, deep learning, , medical imaging

I. INTRODUCTION

Brain cancer, including tumors, poses a substantial threat to individuals, particularly children and young adults. Its impact on life expectancy and the significant toll it takes on affected individuals underscore the urgency for comprehensive research and improved treatments. The YOLOv8 model, renowned for efficient object detection, is introduced as a potential solution to enhance brain tumor detection accuracy and speed.[1]

II. BACKGROUND

Brain tumors arise from uncontrolled and excessive cell growth, disrupting normal brain function and posing severe health risks, especially among children and adolescents. In recent years, brain tumors have become a leading cause of cancer-related deaths in various age groups. Timely and accurate diagnosis is crucial for effective management, with medical imaging, particularly Magnetic Resonance Imaging (MRI), being a key diagnostic tool.[5]

III. YOLOv8 ARCHITECTURE

Deep learning, specifically Convolutional Neural Networks (CNNs), has emerged as a powerful tool for accurate tumor detection. The paper emphasizes the effectiveness of CNNs, particularly the YOLOv8 architecture, for brain tumor detection. YOLOv8, known for its speed, ease of configuration, open-source nature, and compatibility with various frameworks, introduces significant enhancements for computer vision tasks such as object detection, classification, and segmentation.[12]

Advancements in YOLOv8: YOLOv8 incorporates features such as the Feature Pyramid Network (FPN) and Path Aggregation Network (PAN) into its neural network architecture. FPN facilitates the extraction of features at different scales, while PAN optimizes feature fusion, contributing to improved accuracy. Additionally, YOLOv8 introduces a new labeling tool to streamline the annotation prcess.

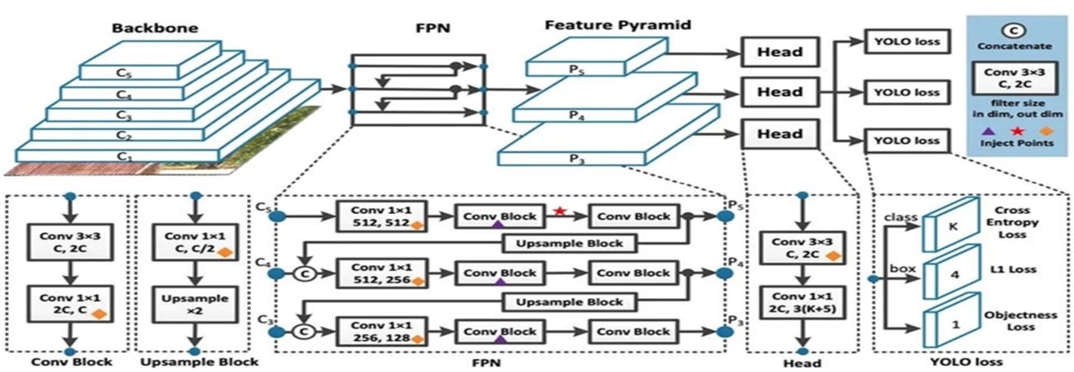

Figure 1: Yolov8 Architecture [17]

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IV. METHODOLOGIES

The research focuses on detecting meningioma, glioma, and pituitary brain tumors utilizing the YOLOv8 architecture with data augmentations. Initial data collection involves acquiring 3064 T1-weighted contrast-enhanced images from the Jung Cheng dataset, encompassing the three specified tumor types.[14]

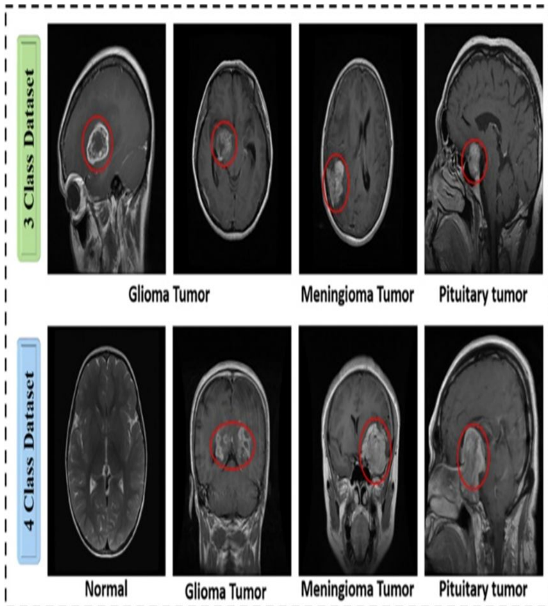


Figure 2 Methodology [19]

1) *Data Preprocessing:* Before utilizing the data, preprocessing is essential. The data undergoes conversion from .mat to .jpg format to facilitate the subsequent stages. Roboflow is employed for annotation, with the project team investing significant time and effort in the labeling process.[7]
2) *Data Augmentation:* Data augmentation techniques are employed to enhance the diversity of the training dataset and improve the generalization ability of the YOLOv8 model. Various augmentation operations, as detailed in Table 2, are applied using Roboflow.[13]
3) *Model Training:* With the preprocessed and augmented dataset in place, the YOLOv8s model is trained for the task of brain cancer detection and localization. The architecture of YOLOv8s serves as the foundation for this task.[8]
4) *Inference on Unseen Brain MRIs:* Once the YOLOv8s model is trained and optimized, it is applied to unseen brain MRIs for inference. The model performs classification, localization, and probability assignment tasks.[15]
5) *Literature Survey:* A comprehensive literature survey underscores the significance of employing deep learning techniques, particularly YOLOv8, in brain tumor detection.[22] Various studies have highlighted the efficacy of YOLOv8 in accurately localizing and classifying brain tumors from MRI scans, surpassing traditional methods in both speed and accuracy. Moreover, research endeavors have explored the integration of YOLOv8 with advanced preprocessing techniques and data augmentation strategies to further enhance its performance. These findings collectively validate the relevance and potential of YOLOv8 as a cutting-edge tool for early diagnosis and intervention in neuro-oncology, paving the way for future advancements in medical image analysis.
6) *Results and Analysis:* The analysis of YOLOv8's performance showcases its superiority in mean average precision (mAP) compared to previous versions and other models, with YOLOv8x achieving an impressive 53.9% on the COCO dataset. Despite its high accuracy, YOLOv8 maintains remarkable speed during inference, making it suitable for real-time applications while remaining efficient in computational resources. However, considerations must be made for medical imaging tasks like brain tumor detection from MRI scans, as YOLOv8 lacks support for 1280 resolution models.

Nevertheless, the robust YOLO community offers extensive resources for adoption and implementation across various applications. Future research endeavors should focus on addressing YOLOv8's limitations and optimizing its performance for specific domains, driving innovation in computer vision and enhancing outcomes in critical fields.[23]

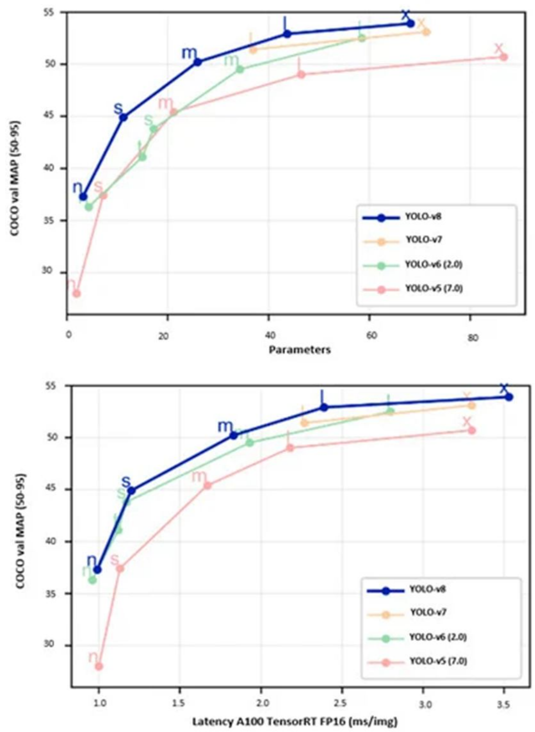


Figure 3 Results [22]

7) *Applications:* The proposed YOLO model for brain cancer detection and localization has broad applications in the field of medical imaging and healthcare. Beyond its immediate application to brain MRIs, the model can be extended to analyze other types of bioimages, enabling early detection and localization of abnormalities in various organs.[7]
8) *Future Scope:* The presented work on brain tumor detection from MRI using the BGF-YOLO model lays a strong foundation for future advancements in medical imaging and deep learning. Several avenues can be explored to further enhance the capabilities and applicability of the proposed model.[4]

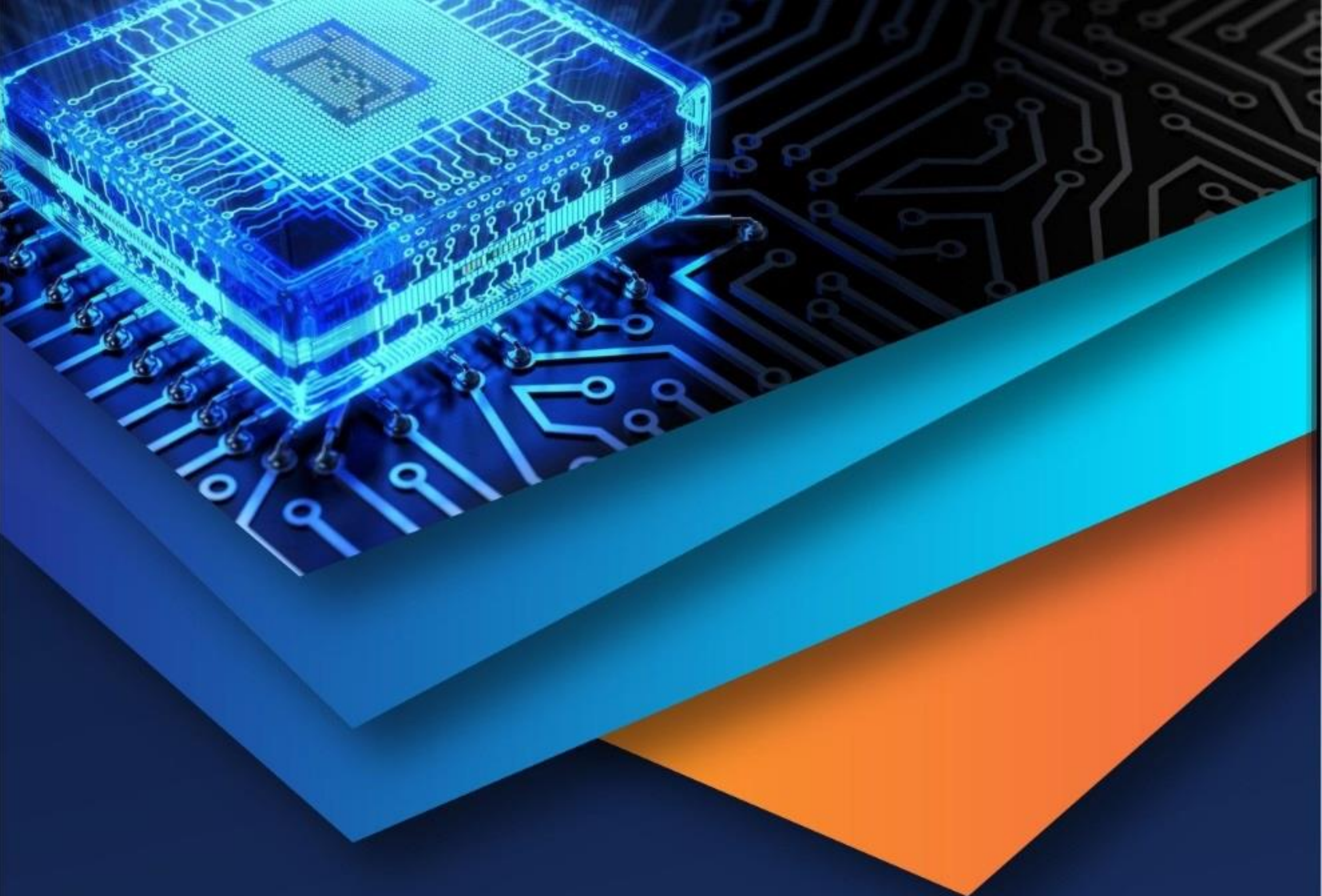
V. CONCLUSION

In conclusion, the implementation of YOLOv8 for brain tumor detection from MRI scans showcases significant advancements in medical imaging. The model's robust performance, coupled with efficient object localization and real-time capabilities, underscores its potential for revolutionizing early diagnosis and treatment planning in neuro-oncology. As a versatile tool, YOLOv8 offers promising prospects for seamlessly integrating into clinical practice, enhancing decision-making processes, and ultimately improving patient outcomes. Continued research and refinement of such deep learning models hold the key to further innovations in medical image analysis, paving the way for personalized medicine and improved healthcare delivery in the field of neurology.

REFERENCES

[1] B. Selcuk and T. Serif, "Brain Tumor Detection and Localization with YOLOv8," 2023 8th International Conference on Computer Science and Engineering (UBMK), Burdur, Turkiye, 2023, pp. 477-481,doi:10.1109/UBMK59864.2023.10286729 .keywords:{Locationawareness;Computerscience; Magneticresonanceimaging;Computationalmodeling;Magneticresonance;Medicaservices;Brainmodeling;deeplearning;brain tumors;object detection},
[2] G. Jocher, A. Chaurasia, and J. Qiu, "Yolo by ultralytics (version 8.0.190)," GitHub, 2023, https://github.com/ultralytics/ultralytics.
[3] R. King, "Brief summary of yolov8 model structure," GitHub, 2023, https://github.com/ultralytics/ultralytics/issues/189.
[4] G. Jocher, "Yolo by ultralytics (version 5.7.0)," GitHub, 2022, https://github.com/ultralytics/yolov5.
[5] Z. Wu, "Yolov5 (6.0/6.1) brief summary," GitHub, 2022, https://github.com/ultralytics/yolov5/issues/6998.
[6] T.-Y. Lin, P. Dollar, R. Girshick, K. He, B. Hariharan, and S. Belongie, "Feature pyramid networks for object detection," in Proc. IEEE Conf. Comput. Vis. Pattern Recognit. (CVPR), 2017, pp. 2117–2125.
[7] S. Liu, L. Qi, H. Qin, J. Shi, and J. Jia, "Path aggregation network for instance segmentation," in Proc. IEEE/CVF Conf. Comput. Vis. Pattern Recognit. (CVPR), 2018, pp. 8759–8768.

[8] H. Zhang, Y. Wang, F. Dayoub, and N. Su¨nderhauf, “Varifocalnet: An iou-aware dense object detector,” in Proc. IEEE/CVF Conf. Comput. Vis. Pattern Recognit. (CVPR), 2021, pp. 8510–8519.
[9] X. Li et al., “Generalized focal loss: Learning qualified and distributed bounding boxes for dense object detection,” in Proc. Annu. Conf. Neural Inf. Process. Syst. (NeurIPS), 2020, vol. 33, pp. 21002–21012.
[10] X. Li, W. Wang, X. Hu, J. Li, J. Tang, and J. Yang, “Generalized focal loss: Learning qualified and distributed bounding boxes for dense object detection,” in Proc. IEEE Conf. Comput. Vis. Pattern Recognit. (CVPR), 2021, pp. 11632–11641.
[11] X. Li, C. Lv, W. Wang, G. Li, L. Yang, and J. Yang, “Generalized focal loss: Towards efficient representation learning for dense object detection,” IEEE Trans. Pattern Anal. Mach. Intell., vol. 45, no. 3, pp. 3139–3153, Mar. 2023.
[12] Z. Zheng, P. Wang, W. Liu, J. Li, R. Ye, and D. Ren, “Distanceiou loss: Faster and better learning for bounding box regression,” in Proc. AAAI Conf. Artif. Intell. (AAAI), 2020, vol. 34, pp. 12993–13000.
[13] P. Li, J. Zheng, P. Li, H. Long, M. Li, and L. Gao, “Tomato maturity detection and counting model based on mhsa-yolov8,” Sens., vol. 23, no. 15, Jul. 2023, p. 6701.
[14] G. Yang, J. Wang, Z. Nie, H. Yang, and S. Yu, “A lightweight yolov8 tomato detection algorithm combining feature enhancement and attention,” Agron., vol. 13, no. 7, Jul. 2023, p. 1824.
[15] G. Yang, J. Lei, Z. Zhu, S. Cheng, Z. Feng, and R. Liang, “Afpn: Asymptotic feature pyramid network for object detection,” arXiv:2306.15988 [cs.CV], Jun. 2023.
[16] Z. Huang, L. Li, G. C. Krizek, and L. Sun, “Research on traffic sign detection based on improved yolov8,” J. Comput. Commun., vol. 11, no. 7, pp. 226–232, Jul. 2023.
[17] G. Wang, Y. Chen, P. An, H. Hong, J. Hu, and T. Huang, “Uavyolov8: A small-object-detection model based on improved yolov8 for uav aerial photography scenarios,” Sens., vol. 23, no. 16, Aug. 2023, p. 7190.
[18] G. Jocher et al., “Ultralytics/yolov5: v7. 0-yolov5 Sota Realtime Instance Segmentation,” Zenodo, 2022, doi: 10.5281/zenodo.7347926.
[19] C. Li et al., “YOLOv6: A Single-Stage Object Detection Framework for Industrial Applications,” arXiv Prepr., 2022, [Online]. Available: http://arxiv.org/abs/2209.02976.
[20] C.-Y. Wang, A. Bochkovskiy, and H.-Y. M. Liao, “YOLOv7: Trainable bag-of-freebies sets new state-of-the-art for real-time object detectors,” in Proc. IEEE/CVF Conf. Comput. Vis. Pattern Recognit., 2023, pp. 7464–7475.
[21] Y. Li, Q. Fan, H. Huang, Z. Han, and Q. Gu, “A Modified YOLOv8 Detection Network for UAV Aerial Image Recognition,” Drones, vol. 7, no. 5, pp. 304, 2023, doi: 10.3390/drones7050304.
[22] D. Reis, J. Kupec, J. Hong, and A. Daoudi, “Real-Time Flying Object Detection with YOLOv8,” arXiv Prepr., 2023, doi: 10.48550/arXiv.2305.09972.
[23] Hussain, M. YOLO-v1 to YOLO-v8, the Rise of YOLO and Its Complementary Nature toward Digital Manufacturing and Industrial Defect Detection. Machines 2023,11,677.https://doi.org/10.3390/machines11070677



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