Neural Network Analysis For The Detection Of Brain Tumors Using Orange Application

Prayitno Prayitno, Kurnianingsih, Ajeng Mutiara Charisma, Rizal Nugroho
Department of Electrical Engineering Politeknik Negeri Semarang
prayitno@polines.ac.id, kurnianingsih@polines.ac.id
ajengmutiarac@gmail.com, rizalnug2@gmail.com

Abstract. As digital imaging assumes crucial roles in the treatment of MRI images, X-ray images will be employed for evaluation and to detect tumor growth in the human body in the restorative field. As the tumor develops in the skull, it can cause extreme brain pressure and interfere with previously normal brain function. A hypostrained or isotense MRI occurs. In the image, the MRI calls the edge will fluctuate to gray. Depending on the back-propagation of neural system procedure describes an approach for the order of MRI images. Strategies are built using techniques such as image enrichment, segmentation, registration, character recognition, and segregation. The segmentation procedure considers morphological operations and threshold values. Using the backpropagation algorithm, the neural network technique is used to identify tumors in training and experimental images. Preparation and assessment are the two stages of CNN-based brain tumor categories. Based on median filtering techniques, the original preprocessed segment has a validation accuracy of 0.979. Accuracy will be improved with a low error rate in this upcoming work employing various classifier algorithms.

Keyword: Brain Tumor Classification, Neural Network, KNN, Deep Learning, Orange Data Mining

1. Introduction

One of the most complex organs in the human body that works in vast Numbers of cells is the brain. A brain tumor is a disease that attacks the brain, whether it attacks the brain itself, the central membrane system, or the membrane of the brain. The number two most significant cause of death was brain tumors of all cancers in people aged 20-39 [1]. The tumor that grows directly from the intracranial network is the primary brain tumor. Over the past decade, in some countries, brain tumors have steadily increased incidents. When a division cannot be managed by the cells that form so irregularly, the brain tumor increases. Cell groups will affect normal function in the behavior of brain activity and will destroy healthy cells. The life expectancy of those with brain tumors like glioma is

M. U. H. Al Rasyid and M. R. Mufid (eds.), *Proceedings of the International Conference on Applied Science and Technology on Engineering Science 2023 (iCAST-ES 2023)*, Advances in Engineering Research 230,
https://doi.org/10.2991/978-94-6463-364-1_100

affected by several factors - the age, stage, type of history, or lack of neurologic and therapeutic deficits.

Digital images assume essential tasks in the treatment of MRI images, so in the restorative field, X-ray images will be used for evaluation and identify tumor growth in the human body. A brain tumor can cause extreme brain pressure, as in the skull, the tumor will develop and interfere with previously normal brain function. In the world, the number of infected with cancer is increasing dynamically, making it a huge concern. In 2009, the National Cancer Institute (NCI) reported 22,070 new cases of brain cancer and other central neurons [2].

The brain tumor association has explained that there are 62,930 new cases of benign stage brain tumors. Currently, there is no identification to know the primary cause of brain tumors. Namu's brain tumor is caused by radiation contamination during MRI, CT scan, and X-ray. Severe seizures, loss of motor function, seizures, neurological and neurological problems with numbness, hormonal disorders, and personality changes, as well as bids into brain tumors, so they are the ones that have been confirmed for brain tumors as shown in Fig. 1.

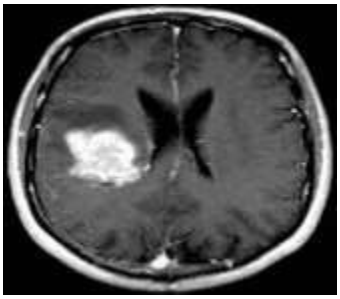

Fig. 1. The Presence of Brain Tumor

The traditional method of diagnosis relies on human perception as to the decision made in an MRI scan for scanning and the risk of a false diagnosis. Digital images can be used to identify tumors quickly and accurately. For an accurate result in brain disorders, advanced medical image segmentation is a complex and critical point of concern. CT scans and MRIs are used by radiologists to examine patients visually. The radiologists would examine the brain structure, the size of the tumor, and the location of the tumor. Digital images are important diagnostic tools for brain tumors. For example, a scientific journal article from the Radiology Journal titled “Brain Tumor Diagnosis Using Digital Image Segmentation” discusses the use of digital images to diagnose brain tumors and provides an example of how digital image segmentation can be used to accurately identify tumors [3].

The MRI becomes hypostrained or isotense as a result. In the image the MRI calls the edge, will fluctuate to gray. Converting images to edge pictures is used to shift gray tones in images with edge detection techniques. Segmentation images are obtained without any modification on the physical characteristics of the main picture. Radiologists, using MRI images that present details such as the location of the tumor, provide a simple way of diagnosing the tumor and preparing for surgical procedures.

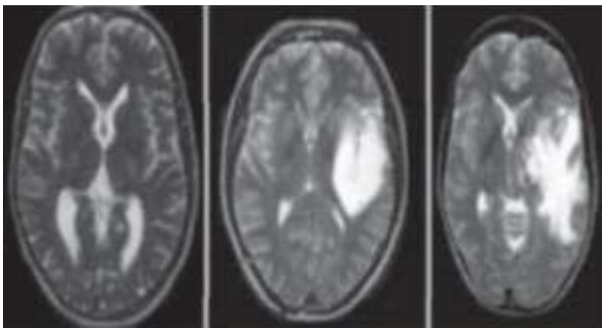

Fig. 2. a) Normal Brain, b) Benign Tumor, c) Malignant Tumor

The infected portion of the brain is shown in Fig. 2 from the tumor's location in the brain. In MRI, a strong magnetic field and radio waves are used to create three-dimensional images of the secret organ. The MRI method offers the advantage that there is no risk from ionizing radiation. The absence of ionizing radiation during MRI scans is a major benefit. The capacity of the MRI images to diagnose is enhanced by the use of image processing techniques.

Brain image processing is a crucial step in medical picture analysis. By revealing the inside workings of the body's invisible organs, medical photography enables medical diagnosis. The load on patients and doctors is lessened through the analysis of medical images. One of the primary optical image processing applications, it involves applying mathematical procedures to an image to improve its correctness [4]. The use of image processing to identify brain tumors has been around for a very long time. Many automatic image processing algorithms and semiautomatic methods for finding brain tumors have been proposed by researchers, but the majority of them lack effective and consistent results since medical images frequently contain noise and have weak contrast. Segmentation is challenging due to the complicated structural brain and brain tumors. However, early and accurate tumor identification is challenging. The diagnostic tool is crucial for tissues with malignancies, edema, and necrosis. Tumors can damage normal brain cells, and inflammation and increased pressure inside the skull can also put strain on some areas of the brain. Currently, partial differential equations, creative curate flows, and various mathematical trends are applied in the algorithms for processing medical images [5].

The organization of this paper's structure is as follows: first, a quick overview of brain tumors. Related work is covered in Section II, methodology is covered in Section III, Table 1 summarizes the classification accuracy attained using various methods, brain tumor data sets are covered in Section IV, and the conclusion and future directions are included in Section V.

2. Related Work

In this section, many existing brain tumor detection techniques we will discuss in the field. S, et al. Depending on the back-propagation of neural system procedure, describes

an approach for the order of MRI images. image enrichment, segmentation, registration, character recognition, and segregation techniques are the techniques used to build strategies. Morphological operations and threshold values are considered during the segmentation procedure. The neural network technique of the backpropagation algorithm is used to analyze the training and experimental images to identify the presence of tumors.

Nti, et al. [6] Data mining algorithms, such as a priori, k-means clustering, k-nearest neighbor classifier, fp tree-based association mining, and decision tree generation performed with inside and outside scoring techniques are used to investigate the techniques. Accompanied by the following techniques: such as various techniques for data mining algorithms, three separate methods. i) In most situations, the interface overhead is under 10 percent. ii) For each of the four data mining algorithms, strong parallel performance is achieved. iii) For phenomenal execution, a combination of different strategic swings is required if the decision tree construction algorithm happens to complete the Experiments presented in this paper.

Vadma, et al. [7] Modern-day development in the use of Magnetic Resonance images in biomedical photo processing. Imaging (MRI) allows for rapid analysis and localization of mind tumors. We plan to divide brain scans into eight categories, with seven categories indicating numerous kinds of tumors and one class for the normal brain. The use of the Leave2-Out cross-validation procedure, the cautioned category strategy, is tested.

Dabbas, et al. [8] Presented a review on numerous photograph preprocessing and segmentation strategies like picture filtration approach, Denoising method, Histogram primarily based segmentation, Watershed segmentation, SVM based segmentation, and MRF primarily based segmentation can be a module for a better result for accuracy and a lower fee of blunders.

3. Proposed Method

With the help of neural network design and implementation, the human brain is mimicked. These papers offer CNN-based brain tumor detection based on MRI image images of specific brain regions. The first level of the MRI picture extracts brain areas, and any slice in that region is segmented to acquire tumors. CNN architecture is employed to partition the tumor areas. To evaluate the patient images, CNN is employed.

This study's main objective is to find brain tumors. whether a patient has a benign or malignant tumor in their brain. A convolutional neural network-based brain tumor classification system is depicted in block diagram form in Fig 3. The CNN-based brain tumor category has two stages: preparation and assessment. The number of images is divided into different categories by identifying them with terms like a tumor and non-tumor brain imaging, etc. The training step makes use of preprocessing, feature extraction, and classification [6].

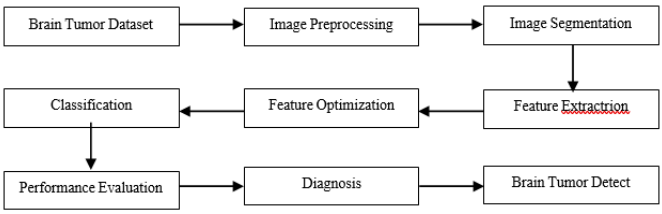

Fig. 3 Overall flow of the brain tumor detection system

The image preprocessing is illustrated in Fig. 3. Each image underwent the preprocessing processes listed below: (1) Cut off a portion of the brain that contains the images. (2) As soon as the photos are ready, transform them into the shape of (240, 240,3) from many sources. Considering that the photos in the collection arrive in various sizes, they can have distinct images. Therefore, all photos must be presented in the same format in order to feed information to the neural network. (3) The pixel values were scaled to the 0-1 range using the process of normalization.

The image preprocessing is illustrated in Fig. 4. Each image underwent the preprocessing processes listed below: (1) Cut off a portion of the brain that containsthe images. (2) As soon as the photos are ready, transform them into the shape of (240, 240,3) from many sources. Considering that the photos in the collection arrive in various sizes, they can have distinct images. Therefore, all photos must be presented in the same format in order to feed information to the neural network. (3) The pixel values were scaled to the 0-1 range using the process of normalization.

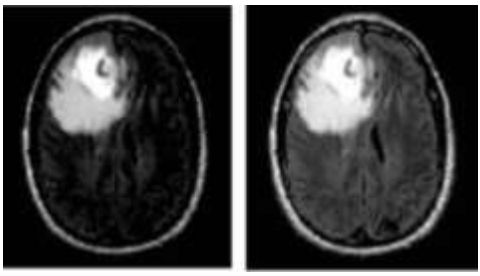

Fig. 4. Raw Image and Preprocessed Image

4. Image segmentation

The process within which an image is divided into areas with a range of tones, textures, brightness, contrast, and degrees of gray. A digital grayscale image serves as the operation's input. The operation's performance is an anomaly. Segmentation is used to collect more data than what is shown in medical images. To achieve the appropriate

performance data, a variety of processes are utilized, including Neural Networks, the decision tree, the algorithm based on rules, and Bayesian Networks in a segment. Other segmentation techniques abound.

1) Thresholding Method: As the name implies, voxels that are higherabove the threshold are thought to be tumor-related.
2) Region-growing technique: From a seed voxel, voxels that are identical are recognized as being part of the tumor by segmentation.
3) A technique for expanding regions: Tumor boundaries are defined byvariations in the density between voxel edges.

A NN-based brain tumor detection model was created using the Orange Application. The dataset consists of three categories: yes, no, and prediction files with 3060MRI images of the brain, and yes contains. This is a combination of the Br35H 2020 datasetand Central research UK. 60 brain MRI images were included in the prediction along with1500 tumor and nontumor brain MRI images.

A normal MRI cannot detect flowing fluids, such as blood in an artery, and as a result, flow cavities, which look like black holes in the images, are created. Because small tumors cannot be seen on an MRI, CT scan, or X-ray image, brain tumors are usually found in the malignant stage. Brain tumor segmentation using orange application can be shown in Fig. 5.

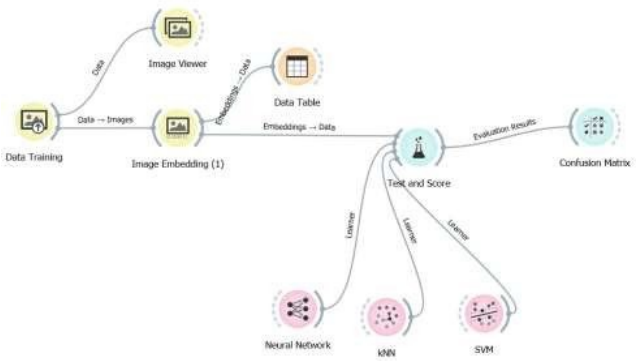

Fig. 5. model using orange

The results using the kNN, SVM, and Neural Network methods in the orange applicationshow that the highest Accuracy uses the CNN method, which is equal to 0.979.

Model	AUC	CA	F1	Precision	Recall
kNN	0.988	0.956	0.956	0.956	0.956
SVM	0.934	0.857	0.857	0.857	0.857
Neural Network	0.996	0.979	0.979	0.979	0.979

CONCLUSION

In this article, we look at a variety of cutting-edge, cutting-edge methods for identifying brain tumors. The original preprocessed segment uses median filtering techniques to preprocess MRI pictures, and its validation accuracy is 0.979. These learned traits served as feedback for three thousand. These classifier performances in terms of accuracy, validity testing, and sensitive feeling. For accuracy levels with a reduced rate of error, NN approaches work well. As a result, the target area is segmented, and the technique presented here enables clinicians to determine the presence of a tumor and determine the terms of the tumor surveillance during diagnosis. The advantages of this approach are that it improves performance in comparison to the alternative system by increasing the segmentation level and spatial localization of the image. Compared to networks with fewer parameters, it is faster to train and to compute. NN is the most common method used for accuracy. The accuracy will be improved with a low rate of error in this upcoming work employing various classifier algorithms. In the future work, we would like to employ federated learning to enhance user data privacy [9].

REFERENCES

[1] M. A. Naser and M. J. Deen, "Brain tumor segmentation and grading of lower-grade glioma using deep learning in MRI images," *Comput. Biol. Med.*, vol. 121, p. 103758, Jun. 2020, doi: 10.1016/j.compbiomed.2020.103758.

[2] M. B. Barton and J. G. Elmore, "Pointing the Way to Informed Medical Decision Making: Test Characteristics of Clinical Breast Examination," *JNCI J. Natl. Cancer Inst.*, vol. 101, no. 18, pp. 1223–1225, Sep. 2009, doi: 10.1093/jnci/djp279.

[3] D. Kontos *et al.*, "Radiomic Phenotypes of Mammographic Parenchymal Complexity: Toward Augmenting Breast Density in Breast Cancer Risk Assessment," *Radiology*, vol. 290, no. 1, pp. 41–49, Jan. 2019, doi: 10.1148/radiol.2018180179.

[4] S. Song, Y. Zheng, and Y. He, "A review of Methods for Bias Correction in Medical Images," *Biomed. Eng. Rev.*, vol. 1, no. 1, Sep. 2017, doi: 10.18103/bme.v3i1.1550.

[5] M. Puttagunta and S. Ravi, "Medical image analysis based on deep learning approach," *Multimed. Tools Appl.*, vol. 80, no. 16, pp. 24365–24398, Jul. 2021, doi: 10.1007/s11042-021-10707-4.

[6] I. K. Nti, J. A. Quarcoo, J. Aning, and G. K. Fosu, "A mini-review of machine learning in big data analytics: Applications, challenges, and prospects," *Big Data Min. Anal.*, vol. 5, no. 2, pp. 81–97, Jun. 2022, doi: 10.26599/BDMA.2021.9020028.

[7] V. Vadmal, G. Junno, C. Badve, W. Huang, K. A. Waite, and J. S. Barnholtz-Sloan, "MRI image analysis methods and applications: an algorithmic perspective using brain tumors as an exemplar," *Neuro-Oncol. Adv.*, vol. 2, no. 1, p. vdaa049, Apr. 2020, doi: 10.1093/noajnl/vdaa049.

[8] J. Dabass, S. Arora, R. Vig, and M. Hanmandlu, "Segmentation Techniques for Breast Cancer Imaging Modalities-A Review," in *2019 9th International Conference on Cloud Computing, Data Science & Engineering (Confluence)*, Jan. 2019, pp. 658–663. doi: 10.1109/CONFLUENCE.2019.8776937.

[9] Prayitno *et al.*, "A Systematic Review of Federated Learning in the Healthcare Area: From the Perspective of Data Properties and Applications," *Appl. Sci.*, vol. 11, no. 23, Art. no. 23, Nov. 2021, doi: 10.3390/app112311191.