EVALUATING PERFORMANCE AND ACCURACY OF EDGE DETECTION BASED BRAIN TUMOR DETECTION MODEL

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Abstract:

New studies have shown that using edge extraction with Deep Learning processes may greatly enhance performance while looking for brain tumours. Though deep learning and brain tumour detection have been the subject of some study, poor performance remains a major obstacle. The current deep learning approach to identifying brain tumours was sped up by adding edge detection. When a pre-trained network is used, tumour detection may be completed in half the time. The MRI scans have undergone a deep learning training process. The brain looks like a wall clock, at least according to a dataset used to train deep neural networks. If tumors take the shape of a dish, they may be easily detected. This research presents a discussion of the use of deep learning and reinforcement learning to identify brain cancers. The current states of the field, as well as its features and operational methodology, have been discussed. Given the present state of knowledge, finding brain tumours may be difficult. This evaluation will act as a jumping-off point for further research. It has been shown that edge detection is required to improve system performance. This has led to the introduction of edge detection and its extraction, along with its operational method and many types. The next steps for the study have been defined.

Keyword: Brain tumor Detection, image processing, edge detection, edge extraction

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1. INTRODUCTION

To keep up with the growing importance of AI, advancements must be made to deep learning-based medical imaging technologies. Brain tumours are difficult to diagnose since it is often difficult to determine the tumor's pattern in the patient's brain. The deep learning approach uses a neural network to identify peculiarities in MRI scans of the brain. You'll need a neural network specifically trained for tumour detection for this. In an RL setting, the neural network is the one doing the training. In differential graphic games, many agents are used to direct how the player interacts with the world. These games make advantage of reinforcement learning. It belongs to a class of abstraction techniques with varying levels of abstraction used to create robust AI mechanisms. The use of machine learning in this context is novel. However, deep learning systems are purpose-built for a certain set of circumstances. When talking about computers, the phrase "reinforcement learning" is often used. Machine learning in this sense. This use of machine learning is groundbreaking.

Edge Detection:

Edge detection in digital images is a fundamental component of image analysis [1, 2, 3] because it enables image segmentation, target area identification, and region shape selection. Edge detection is a crucial part of digital image processing as it serves as a border between the foreground item and the background. Also, they can't distinguish the target from the background unless we give them the advantage [4, 5, 6, 7].

Social Applications of Edge Detection

Looking at how this technique has been used in Macao culture might demonstrate its appeal in the public's desire. License plate recognition: Automobiles are widely used now across the world [8, 10, 13]. And therefore, it's safe to say that in the not-too-distant future, intelligent traffic management will be widely used. This means that they will discuss the process of licence plate identification utilising this detection approach. At the entrances of toll plazas and in parking lots, licence plate readers are a common sight. It has been found that this technology, with a few adjustments, may be useful. Sample grey-scale image detection using QDPA and hidden information extraction from medical images

Comparisons are made between phase-based detection approaches and standard edge detection techniques [15, 16]. Researchers found that the primary difference between the two approaches was that the new methodology could detect information throughout the whole object, while the old technique could only recognise information at the edges [13]. Common methods are ineffective due to the similarity in colour between these objects and their surroundings.

Brain Tumor Detection

It's generally agreed that the human brain is a complex and fascinating organ with many functions. Information is stored in the brain, from which it may later be retrieved and analysed [9]. Strangely, it's becoming bigger. There may be two broad types of brain cells. At the point when a single brain cell matures, all other units in the body undergo a similar transformation. Unchecked proliferation of brain cells may result in both positive and negative outcomes. Because of this, they go in the opposite direction of your body's regular cells. The cells keep wreaking havoc in other areas [14, 17]. The human mind has a limited ability to process information. The heavier something feels on the person carrying it grows in proportion to its actual weight. When a person has a heaviness in the head, it is due to damage in the brain. Multiple scanning modalities are used to detect and diagnose cancers in their earliest stages. Physicians utilise MRI findings for early diagnosis. Tissue evaluation is essential for separating and comprehending digital images when a computer programme is needed for analysis.

Edge Extraction

As part of the edge extraction process, the edge pattern identified by the edge detection technique is saved in a distinct matrix. The matrix has been recorded digitally. Edge extraction in the proposed study decreases the amount of data stored and speeds up the training and testing processes.

Deep Learning

DL is an AI function that seeks to mimic the way the human brain analyses data and builds patterns in order to draw inferences [11, 12]. Deep learning (DL), a subfield of artificial intelligence's ML, makes use of neural networks to learn unsupervised from data that has not been organised or labelled [18–20]. This method is also known as DL [21].

2. LITERATURE REVIEW

A literature survey or literature review is a section of an academic publication that summarises what is already known about a certain topic. All significant discoveries and theoretical and methodological advancements count. You may discover a wide range of previously published studies and research here. There are a lot of articles on our topic that have appeared in print and online. There is a brief synopsis of some of the articles below.

Sobel edge detection operator was employed by Guowei et al. (2011) in image processing. This operator transforms the image by taking the logarithm of the brightness. It has a fast processing speed and is well suited for online detection. More importantly, the detection result is unaffected by illumination level. Online detection also makes advantage of this method. Compared to its forerunners, the Roberts algorithm, the Prewitt algorithm, and the Sobel algorithm, the Log Sobel operator has less of an impact on the final image, as shown in experiments. [1]

A comparative performance study of several edge detection operators in image processing was given by Pinaki et al. in 2012. Based on the findings of this study, it has been concluded that the canny edge detection operator outperforms Sobel, Roberts, Prewitt, Zero crossing, and LoG in terms of picture quality and boundary localization precision, respectively. The most popular programme used is MATLAB. [2]

The prewitt, robert, sobel, marr hildrith, and canny operators were among the various edge detection approaches explored by Rashmi et al. in 2013. The researchers compared their findings and concluded that the shrewd edge detector was the most effective overall. To separate facial characteristics, edge detection approaches such as the canny edge detection method and the Sobel edge detection algorithm were utilised by Vijayarani Mohan et al. in 2013. Facial identification was one use of the technologies. A number of metrics are used to evaluate the efficiency of each algorithm and make comparisons. Results from trials show that the cunning edge detection approach is superior than Sobel edge detection methods. [4]

The most effective compression techniques presently utilised in the area of medical image processing were analysed by Suma et al. in 2014. An analysis of the current literature revealed that, despite the growing need, medical image compression confronts increasing degrees of difficulties in order to fulfil the growing demands of the medical sciences. [5]

Ekta Gupta et al. (2015) developed a method that uses GLCM for feature extraction and HDWT for segmenting a picture into horizontal, vertical, and diagonal areas. The study here used SVM for the classification process. The experimental results are conclusive when contrasted to the status quo. This study suggests a calculation that combines the advantages of several current approaches to improve the accuracy and efficiency of recovery. [6]

Sobel, Roberts, Prewitt, Laplacian (Zero Cross), Canny, and LOG were used to identify edges in various document images and then used in a 2016 presentation by Vijayarani Mohan et al. The relationship between processing speed and accuracy in terms of total performance was analysed using structural similarity (SSIM). The results of the studies showed that the Laplacian and Roberts edge detection approach was superior than the others. The Prewitt, Roberts, Sobel, and Laplacian of the Gaussian approaches, among others, were subjected to a comprehensive examination by Mohd. Aquib Ansari et al. in 2017. Experiments have revealed that the canny variation of edge detectors works quite effectively. The latest version of Matlab (R2015a) was utilised for this task. [8]

An MRI scan of the brain revealed a tumour in 2017, as disclosed by Priya Patil et al. Brain tumours and blocked blood vessels are two conditions that MRIs may help diagnose. Brain symmetry and asymmetry are checked for first in the process of identifying a brain tumour. Next comes segmentation based on a couple of techniques. One, a Fuzzy Transform. The process of morphology. These two techniques are used to build an image in magnetic resonance imaging. This layout allows clinicians to locate the boundaries of a brain tumour and calculate its actual surface area. The f-transform is used to offer information useful for tasks like edge extraction and reconstruction. [9] Research conducted in 2018 by Rehan Mehmiod et al. compared and contrasted a number of cutting-edge methods for detecting edges. The feature vector is only a description of a handful of key spots that provide crucial data about the edges. Using an edge detector of some kind was essential to accomplishing the goal. [10] In 2018, Giang et al. suggested this novel deep learning-based approach for rendering high-detail low-resolution point clouds. In particular, they propose utilising co-registered high-quality photographs as the ground truth data while training a deep neural network for point-based rendering. The proposed method can quickly produce high-quality point rendering images, making it suitable for interactively traversing large-scale 3D environments and image-based localisation. Extensive quantitative evaluations on real and simulated datasets shown that the proposed approach outperformed state-of-the-art techniques. [11]

Review by Zeynep Batmaz et al. from 2018 with the intention of informing and orienting newcomers to the area of deep learning based recommendation systems. The study was analysed in four dimensions: the DL models used in recommender systems; the issues with recommender systems; the recommendation domain's expertise and prevalence; and the attributes that make recommenders successful. They conclude by discussing the insights they've gained and the likely directions they'll go in developing solutions to the problem. [12]

To automate the classification of MRI images, Sheetal S. Shirke et al. published a hybrid method in 2018. The suggested method primarily consists of two parts: feature extraction and classification. At first, PCA and GLCM are used to the task of feature extraction from images. We next sent the collected features into a PNN-RBF classifier. Differentiated

between normal, benign, and malignant examples of imaging In 2018, R. Ashraf et al. conducted study on the topic of content-based image retrieval [13]. They used Discrete Wavelet Transform and Color Descriptor to accomplish their objective. The complexity of various forms of communication grows with the ever-expanding capabilities of modern technology. In 2019, Chenxing Xue et al. presented a gradient-based edge detection method [14], although it can only recognise edges in a subset of directions and ignores edge data in the other directions. For this goal, they introduce a convolutional neural network (CNN) edge detection method in this study. The formula went as follows: In the first place, the convolutional network can immediately extract features from photos. The purpose of this article is to show how to construct a CNN in the tensor flow architecture to perform the edge detection operator. After the dataset was created, it was used to train the network, and the subsequent results were captured in matlab for analysis. In addition, the experiment had dual independent trials for evaluation. In the first set of tests, the network is trained using six different optimizers in order to generate the corresponding edge detection operators. They are tasked with extracting edges from a test set image. Based on a comparison of their processing outcomes, Adam and Gradient Descent optimizers were selected as the most effective optimizers for this task. The edge
detection operator in Adam Optimizer was evaluated against a conventional operator in a second set of experiments. [15]

A. Sadiq et al. measured the level associated with Blind photos in 2020. The specifications were derived using data from a typical image of a constant wavelet transform. A human being is a photograph's ultimate audience. Therefore, evaluating the visual quality from a human's point of view is essential. Urine Raman spectroscopy was the subject of a research by C. Chen et al. in the year 2020 [16]. The goal of these efforts was to create a cost-effective means of diagnosing CRF. In order to get the necessary information, they have used several different kinds of categorization systems. To put an end to assaults, S. Hosseini et al. [17] introduced a hybrid of support vector machine (SVM) and convolutional neural network (CNN) in 2020. In 2020, D. B. Renita et al. took into account a combined model for image extraction, support vector machine, and grey wolf optimization [18]. After this paper is published, the GWO-SVM method becomes available. Beginning with a query image, this method established a correlation to a predetermined class. [19]

FT-IR spectroscopy's use to support vector machines was shown by J. Liu et al. in 2020. Here, it plays the role of a transmitter. The goal of the study was to identify breast cancer patients who had developed a kind of carcinoma called continuous canalicular. [20]

Computer-aided design was developed by A. Shakarami et al. in the year 2020. This design improvement was made primarily with the intention of spotting Alzheimer's disease. A more sophisticated AlexNet-SVM method and two-dimensional slices were employed to solve the problem. [21]

This study built on previous studies involving edge detection and picture processing. The authors employed a variety of methods for detecting edges, including the Log Sobel operator, Prewitt and Robert's Hildrith, Sobel and Marr's, Canny operators, the Laplacian, and the LOG. Several authors presented new image processing methods, including HDWT and GLCM. Picture categorization for content-based image retrieval was performed using deep learning methods. The research of several of these scientists relied on the utilisation of photographs processed using conventional wavelet transformations. There has been considerable thought given to investigating what may happen if SVM and CNN were combined. A grey wolf, support vector machine, and picture extraction hybrid model was explored by one writer.

3. RESEARCH GAPS

Several researches in area of image processing, edge detection have been studied that did work on image edge detection & did comparison of various edge detectors. The scope of those research works was limited because they ignored performance.Despite the emergence of new algorithms and approaches, such as those based on the canny and sobel edge detection mechanisms for performance analysis, the necessity to add a compression mechanism to cut down on processing time and picture size remains. Existing research that focused on image compression did not integrate them with edge detection to build real life application. On other hand research work that reviewed the brain tumor segmentation and detection ignored edge detection mechanism and compression mechanism. It has been observed that previous researches in field of brain tumor were unable to resolve the issue of time consumption and space consumption. Moreover there was need to increase the accuracy during pattern detection. There remain need of research that should make use of compressed and edge detected image with conventional Neural Network in order to build efficient brain tumor detection mechanism.

4. PROBLEM STATEMENT

However, there have been a number of studies in this sector, but they have a number of flaws. Performance, storage capacity, and accuracy are all issues. The training of a deep neural network takes a long time and a lot of resources. A method that improves training speed while also improving feature detection performance is required. To boost performance when learning and detecting patterns, canny edge detection must be included.

5. PROCESS FLOW OF WORK

Below is a breakdown of the many methods used in research:

1. To begin, get the MRI picture collection.
2. Gray conversion is used to alter the size of previously processed images.
3. A method based on edge detection may be used here.
4. For each photo, the chance of cancer may be computed by removing certain features from the image.
5. Artificial neural networks are employed to identify tumors.
6. There is a comparison of the outcomes.

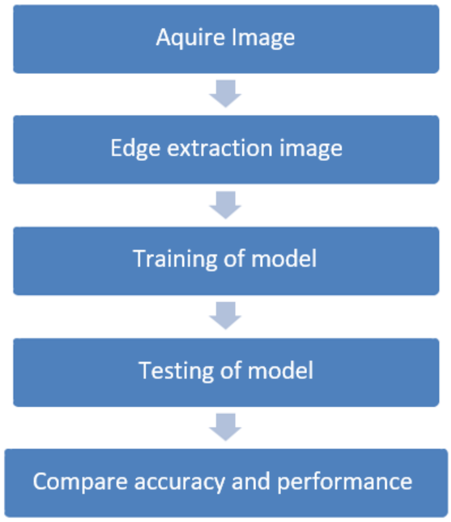

Fig 1 Research methodology

6. RESULT AND DISCUSSION

Time Comparison

Table 1 Time Comparison of Conventional and Proposed Work

No of Images	Conventional Work	Proposed Work
10	10.65	3.56
20	20.75	14.41
30	30.87	25.15
40	40.80	36.18
50	50.98	45.62
60	60.58	56.48
70	70.14	66.13
80	80.95	72.86
90	90.72	81.77
100	100.57	94.00

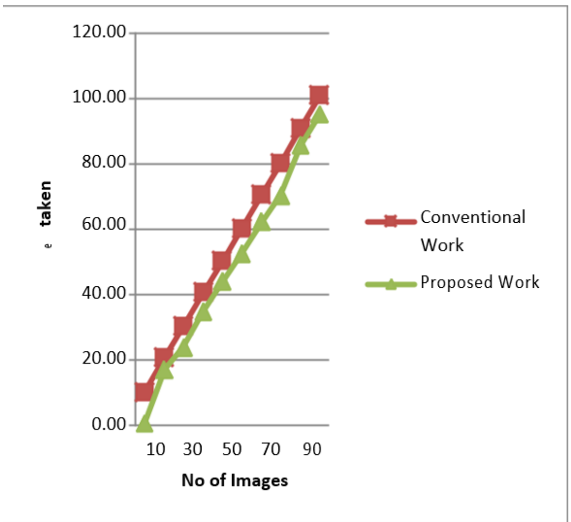

Fig 2 Time Comparison of Conventional and Proposed Work

Size Comparison

Table 2 Size Comparison of Conventional and Proposed Work

No of Images	Conventional Work	Proposed Work
10	10.46	6.38
20	20.52	13.56
30	30.73	22.28
40	40.30	31.57
50	50.56	41.30
60	60.15	51.30
70	70.55	66.86
80	80.68	75.18
90	90.37	89.42
100	100.24	94.79

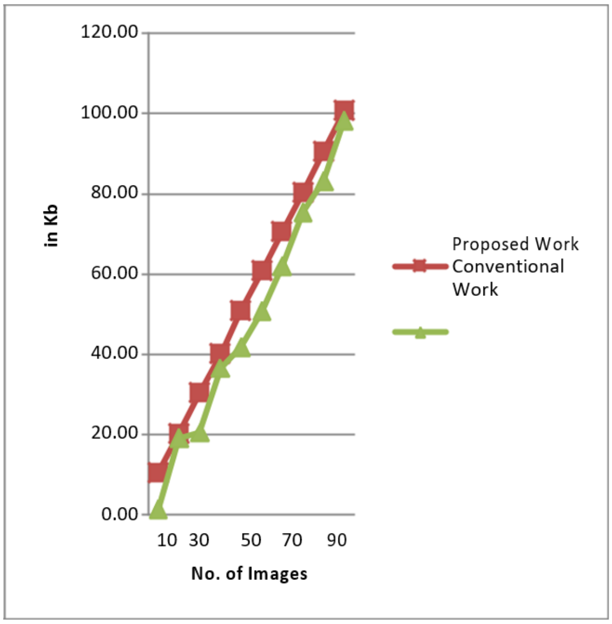

Fig 3 Size Comparison of Conventional and Proposed Work

Accuracy Comparison

Table 3 Accuracy Comparison of Conventional and Proposed Work

Cases	Conventional Work	Proposed Work
1	91.27%	94.72%
2	91.65%	94.08%
3	91.44%	94.85%
4	91.18%	94.38%
5	91.74%	94.92%
6	91.91%	94.68%
7	91.61%	94.04%
8	91.56%	94.13%
9	91.40%	94.18%
10	91.21%	94.49%

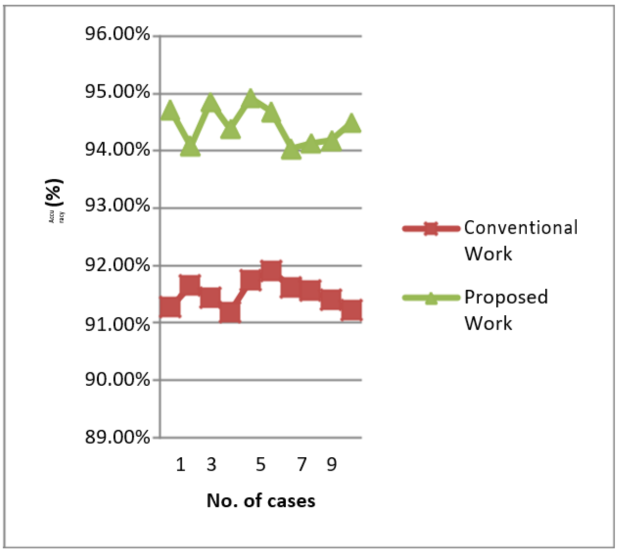

Fig 4 Accuracy Comparison of Conventional and Proposed Work

7. SCOPE OF RESEARCH

Need of brain tumor detection is growing day by day. There is need to introduce mechanism that should be capable to provide brain during detection solution with more accuracy and performance. Such research might play significant role in building better solutions.

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