Journal of Autonomous Intelligence (2024) Volume 7 Issue 2
doi: 10.32629/jai.v7i2.653

ORIGINAL RESEARCH ARTICLE

Identification of meningioma tumor using recurrent neural networks

D. Anand[1], Osamah Ibrahim Khalaf[2,*], Ghaida Muttashar Abdulsahib[3], G. Rajesh Chandra[4]

[1] *Department of Computer Science and Engineering, Koneru Lakshmaiah Education Foundation, Green Fileds, Vaddeswaram, Andhra Pradesh 522302, India*

[2] *Department of Solar, Al-Nahrain Research Center for Renewable Energy, Al-Nahrain University, Jadriya, Baghdad 10072, Iraq*

[3] *Department of Computer Engineering, University of Technology, Baghdad 10066, Iraq*

[4] *Department of Computer Science and Engineering, KKR & KSR Institute of Technology & Sciences, Vinjanampadu, Guntur 522017, India*

*** Corresponding author:** Osamah Ibrahim Khalaf, usama81818@nahrainuniv.edu.iq

ABSTRACT

By the calculations of national center for biotechnology information from COVID 19 pandemic, number of meningioma tumor patients are increasing in world. Identifying the meningioma tumor and its position in brain is not easy task by using deep neural networking based medical imaging. But it is needed to identify meningioma tumors in brain by using AI based medical imaging for the purpose of medical artificial intelligence technology innovation. Comparing to neural network results with recurrent neural network results can give accurate results. For identifying the patients' present condition and prediction of future behavior by using recurrent neural network is need for us. Increase the accurate results for neural networking based medical imaging in health care is very expensive. By using recurrent neural networks (RNN) algorithm with many hidden layers for identification of tumor(s) in human brain with high accuracy by comparison of existing images in our data base with new unknown medical image with low cost. In this study first we are collecting the masks of skull from MRI image and dividing the masks to different types of datasets depending on age criteria like a child age, middle age and old age with two types male and female. Then we can get totally 6 types of datasets. All these masks of MRI images to binary imaging by using morphological erosion concept after that storing that masks in data sets then collect the new MRI image and comparing its mask part of skull with existing dataset in recurrent neural networks.

Keywords: meningioma; neural networks; tumor; brain cell

ARTICLE INFO

Received: 23 May 2023
Accepted: 10 August 2023
Available online: 12 December 2023

1. Introduction

A brain tumor is a growth of cells in the brain or near it[1]. Brain tumors can happen in the brain tissue. Brain tumors also can happen near the brain tissue[1]. Tumors can be cancerous. From the reports of national brain tumor society[2] of USA, seven lakhs' people are suffering with primary diseases of brain tumor and 88,970 citizens of USA[3] are diagnosed in 2022. This is very unfortunate thing that in entire world 78% of death rate for the year 2022 is because of brain tumors only[4]. Generally, we have two types of brain tumors in humans[5]. One is the primary[6] and another is metastatic brain tumor[7]. Primary tumor can start from the group of connected cells in brain and metastatic tumors can originate in another parts of human body[8] and pull up stakes to the brain[9]. these tumors are treated as a cancer[10]. Due to metastatic tumors only, human can get the lung cancer, breast

cancer, kindly and skin cancers[11]. The metastatic tumors can spread from one part of the human body to another part of the human body. The first tumors did not spread from one part to another part of the human body. The types of human brain tumors included 9 types of tumors those are gliomas and related brain tumors, choroid plexus tumors, embryonal tumors, germ cell tumors, pineal tumors, meningiomas, nerve tumors, pituitary tumors, and other brain tumors. By the symptoms like drowsiness, feeling very hungry and gaining weight. Trouble with balance, feeling very tired, speech problems, vomiting, fatigue, sleep problems, memory problems etc. with these only we can identify that, person is suffering from brain tumor. To identify brain tumors, we have so many methods. but no one method is not giving accurate results of brain tumors. Brain's main part is the cerebrum. Tumors in human brain can be originate in different parts of the human brain's cerebrum might cause different symptoms[12]. Those are the if tumor is originated at the front of the human brain then the patient will get the balancing problems and walking problems if the tumor is originated at middle of the brain then the patient will get sensing problems[13], vision problems and hearing problems, If the tumor is originated[14] at back part of the human brain, then the patient can lose the vision[15] if the tumor is originated at the lower part of the human brain then the patient[16] can get problems in smell and taste as shown in **Figure 1**.

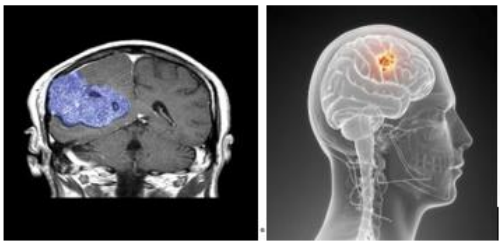

Figure 1. Brain tumor and meningioma tumor[14].

2. RNN of AI

RNN plays important role in deep learning. the following figure shows the recurrent neural network. The below figure illustrates the concept of recurrent neural networks[15] this figure contains x, y, h, x is the input layer and y is the output layer and h is the hidden layer. In hidden layer only multiple tasks are running. In recurrent neural networks only we can get accurate results comparing to conceptual neural networks.as shown in **Figure 2**.

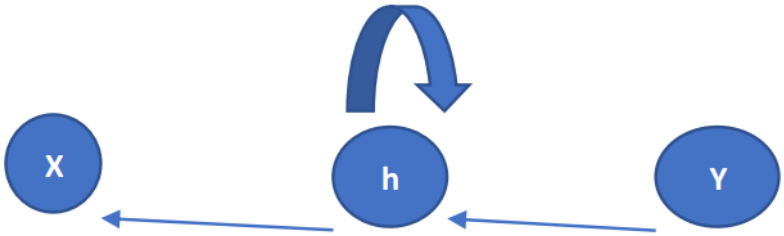

Figure 2. Concept of recurrent neural networks.

In modern research, we have many methodologies[17] to find out the position of the tumor in human bran. But we are not getting accurate results for the brain tumors by using the modern research. In this study we are increasing the accuracy of the results for the brain tumors by using RNN algorithm in the stage of object detection of MRI images of brain tumor from DICOM format. After identifying the tumor in MRI images, we have to apply data extraction algorithms on that object of a images after then we have to compare that object's position with existing images of our data base then only by comparing with it all existing images, we have to predict that tumor position.

3. Literature review

The literature survey of this papers presented in **Table 1** as follows:

Table 1. previous studies for the current researches.

SNO	Title	Reference	Methodology	Pros	Cons
1	MRI-based brain tumor detection using convolutional deep learning methods and chosen machine learning techniques.	[1]	Pre-processing MRI images, feature extraction, and classifcation by various classifers.	Precision, recall, and F-measure of 2D CNN.	Classification accuracy rates of machine learning classifiers.
2	Identification of meningioma patients at high risk of tumor recurrence using MicroRNA profiling.	[2]	Novel 2D CNN architecture, meningioma; prognosis; recurrence; miRNA.	Convolutional auto-encoder neural network.	Convolutional auto-encoder network.
3	Falling and drowning detection framework using smartphone sensors.	[3]	FaDD framework.	Machine learning model and parameter tuning.	Logistic model trees.
4	A novel method for classifying liver and brain tumors using convolutional neural networks, discrete wavelet transform and long short-term memory networks.	[4]	A CNN-DWT-LSTM method.	Biomedical image processing.	Classification of brain tumor.

Issues in existing methodology

In our literature review we observed many research articles, but no one is not got the accurate results for identifying the tumor in exact position of human brain. And medical imaging complications are very serious and it causing a illness.

4. Materials and method

In this study we collected meningioma MRI scanned images. These meningioma MRI scanned images datasets are collected from national library of medicine and created six types of meningioma MRI scanned images' datasets those are the child male, child women, middle-aged male, middle-aged women, old age male, old age women. Every data set contains minimum 250 meningioma MRI scanned images of meningioma patients. All images are categorized in 6 categories. And every MRI image is converted to binary image and collected skull part of all binary images and stored in that datasets only. Based on image properties we can compare the skull part of new image with existing images if any skull part of binary image in any data set is matching with new image's skull part, then we can identify the position of new image's patient's health condition in this paper we used recurrent neural networking algorithm for identification of meningioma tumor. To identify it we have so many techniques belongs to neural network only. But up-to now no one is giving accurate results with exact position of tumor in brain by using recurrent neural network. In this paper we used recurrent neural network concept to identify the tumor by comparing it existing MRI images with new image.

4.1. Process

Our process is to identify the brain tumor can contains the following steps.

Step 1: giving MRI image as an input.

Step 2: converting input image to gray scale image[10].

Step 3: converting gray scale image to binary image.

Step 4: selecting skull part of binary image by morphological erosion[12,13].

Step 5: comparing the skull part of binary image with existing skull part of binary images of meningioma data sets those are available in our datasets.

Step 6: after completion of comparison, if any image is matched with our new image, then based on existing image data, we can identify the person's tumor position[18]. As shown in **Figure 3**.

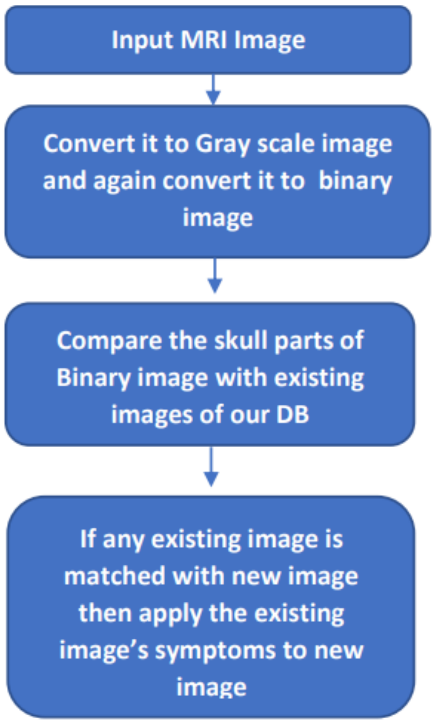

Figure 3. Process diagram of model.

5. Results and discussion

5.1. Grayscale image

Converting the color MRI image to gray scale by using MAT lab then get the gray scale image. The following figure shows the MRI image and gray scaled image (**Figure 4**).

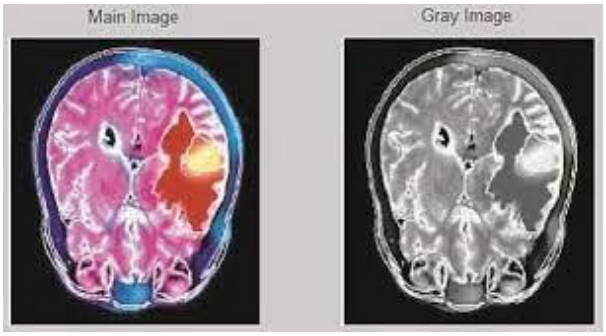

Figure 4. Difference between MRI scan image and grayscale image.

5.2. Binary image

Converting the gray scale image to binary image by using MAT lab. The following figure shows the gray image and binary image. As shown in **Figures 5** and **6**.

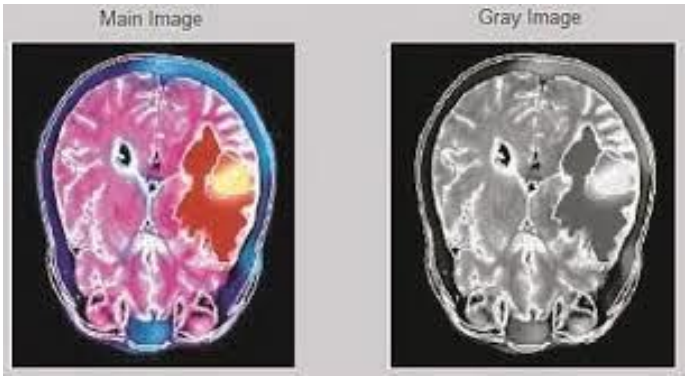

Figure 5. MRI image to gray scale image.

Figure 6. Gray scale image to binary image.

5.3. Morphological erosion

If we want to remove the floating points and thin lines of images, then we can use this method. By using this we can select sub area of an image and removes the unwanted area of the image. In our study of work, we are applying the morphological erosion technique on input MRI image for selecting the skull region of it.as shown in **Figure 7**.

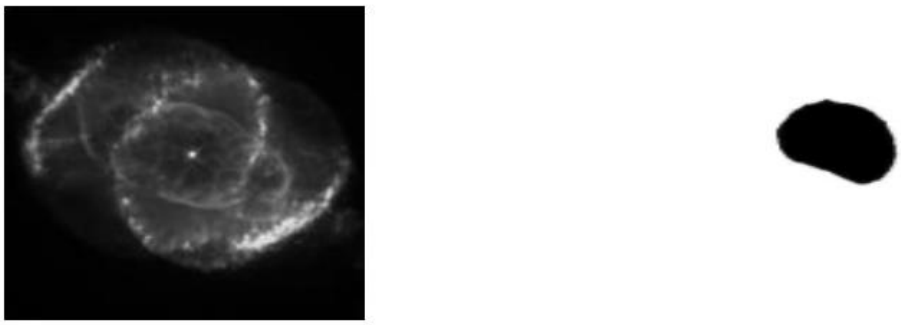

Figure 7. Before erosion of the image and after erosion of the MRI image.

By getting the tumor from the morphological erosion concept we have to compare with all images of all datasets. if any image is matching with current image. Then we can identify the current image's patient's tumor position.

6. Conclusion and future work

In this study we collected meningioma diseased images from different locations. And every meningioma diseased MRI scanned image is converting to grayscale image and after only it will be converted as a binary image and then select the skull part of each binary image through morphological erosion and store in our data sets. And select any new MRI scan image and convert it to gray scale image and then convert it to binary image then compare with all images of our data set. If any image is matching with the new image, then we can identify the position of tumor based on matching image.

Author contributions

Conceptualization, OIK and DA; methodology, OIK and GMA; formal analysis, OIK; funding acquisition, software, validation, DA; writing—review & editing, investigation, GMA and GRC. All authors have read and agreed to the published version of the manuscript.

Conflict of interest

The authors declare no conflict of interest.

References

1. Tang Z, Xie H, Du C, et al. Machine learning assisted energy optimization in smart grid for smart city applications. *Journal of Interconnection Networks* 2022; 22: 2144006. doi: 10.1142/S0219265921440060
2. Goswami S, Sagar AK, Nand P, Khalaf OI. Time series analysis using stacked LSTM model for Indian stock market. In: Proceedings of the 2022 IEEE IAS Global Conference on Emerging Technologies (GlobConET); 20–22 May 2022; Arad, Romania. pp. 399–405.
3. Hussain S, Rahman H, Abdulsaheb GM, et al. A blockchain-based approach for healthcare data interoperability. *International Journal of Advances in Soft Computing & Its Applications* 2023; 15(2): 85–98. doi: 10.15849/IJASCA.230720.06
4. Mangalampalli S, Karri GR, Kumar M, et al. DRLBTSA: Deep reinforcement learning based task-scheduling algorithm in cloud computing. *Multimedia Tools and Applications* 2023. doi: 10.1007/s11042-023-16008-2
5. Jebril I, Dhanaraj P, Abdulsahib GM, et al. Analysis of electrically couple SRR EBG structure for sub 6 GHZ wireless applications. *Advances in Decision Sciences* 2022; 26(5): 102–123. doi: 10.47654/v26y2022i5p102-123
6. Xue X, Poonia M, Abdulsahib GM, et al. On cohesive fuzzy sets, operations and properties with applications in electromagnetic signals and solar activities. *Symmetry* 2023; 15(3): 595. doi: 10.3390/sym15030595
7. Dash S, Parida P, Sahu G, et al. Artificial intelligence models for blockchain-based intelligent networks systems: Concepts, methodologies, tools, and applications. In: Handbook of Research on Quantum Computing for Smart Environments. IGI Global; 2023. pp. 343–363.
8. Xue X, Marappan R, Raju SK, et al. Modelling and analysis of hybrid transformation for lossless big medical image compression. *Bioengineering* 2023; 10(3): 333. doi: 10.3390/bioengineering10030333
9. Xue X, Chinnaperumal S, Abdulsahib GM, et al. Design and analysis of a deep learning ensemble framework model for the detection of COVID-19 and pneumonia using large-scale CT scan and x-ray image datasets. *Bioengineering* 2023; 10(3): 363. doi: 10.3390/bioengineering10030363
10. Xue X, Shanmugam R, Palanisamy S, et al. A hybrid cross layer with harris-hawk-optimization-based efficient routing for wireless sensor networks. *Symmetry* 2023; 15(2): 438. doi: 10.3390/sym15020438
11. Agrawal R, Kumar A, AlQahtani SA, et al. Cache memory design for single bit architecture with different sense amplifiers. *Computers, Materials & Continua* 2022; 73(2): 2313–2331. doi: 10.32604/cmc.2022.029019
12. Rana SK, Rana AK, Rana SK, et al. Decentralized model to protect digital evidence via smart contracts using layer 2 polygon blockchain. *IEEE Access* 2023; 11: 83289–83300. doi: 10.1109/ACCESS.2023.330277
13. Khalaf OI, Ashokkumar SR, Dhanasekaran S, et al. A decision science approach using hybrid EEG feature extraction and GAN-based emotion classification. *Advances in Decision Sciences* 2023; 27(1): 172–191. doi: 10.47654/v27y2023i1p172-191

14. Xue X, Palanisamy SK, Manikandan A, et al. A Novel partial sequence technique based Chaotic biogeography optimization for PAPR reduction in eneralized frequency division multiplexing waveform. *Heliyon* 2023; 9(9): e19451. doi: 10.1016/j.heliyon.2023.e19451
15. Homod RZ, Mohammed HI, Abderrahmane A, et al. Deep clustering of Lagrangian trajectory for multi-task learning to energy saving in intelligent buildings using cooperative multi-agent. *Applied Energy* 2023; 351: 121843. doi: 10.1016/j.apenergy.2023.121843
16. Anand D, Arulselvi G, Balaji GN, Chandra GR. A deep convolutional extreme machine learning classification method to detect bone cancer from histopathological images. *International Journal of Intelligent Systems and Applications in Engineering* 2022; 10(4): 39–47.
17. Anand D, Arulselvi G, Balaji GN. Detection of tumor affected part from histopathological bone images using morphological classification and recurrent convoluted neural networks. *Journal of Pharmaceutical Negative Results* 2022; 13: 4992–5008. doi: 10.47750/pnr.2022.13.S09.617
18. Anand D, Arulselvi G, Balaji GN. An assessment on bone cancer detection using various techniques in image processing. In: Editor Deepak BBVL, Editor Parhi D, Editor Biswal B, et al. (editors). *Applications of Computational Methods in Manufacturing and Product Design*. Springer; 2022.