

Brain Tumour Detection System

A PROJECT SYNOPSIS

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A.Y. 2021-22

Project Details

Title

Brain Tumour Detection System

Introduction

The early detection and treatment of brain tumour helps in early diagnosis which aids in reducing mortality rate. Image processing has been widespread in recent years and it has been an inevitable part in the medical field also. The abnormal growth of cells in the brain causes brain tumour. Brain tumour is also referred to as intracranial neoplasm.

Brain tumor is broadly classified into two types: cancerous tumors, known as malignant tumors, and noncancerous tumors, known as benign tumors. Malignant tumors are further classified into grades I to IV by World Health Organization (WHO). A Grade-I tumor is called Pilocytic Astrocytoma, Grade-II tumor is Low-Grade Astrocytoma, Grade-III tumor is Anaplastic Astrocytoma and Grade-IV tumor is Glioblastoma. Grade-I tumors and Grade-II tumors are semi-malignant tumors with less aggressiveness. Grade-III and Grade-IV are malignant tumors and highly affect the health of the patient and may lead to the death of tumor patients.

Standard MRI sequences are generally used to differentiate between different types of brain tumours based on visual qualities and contrast texture analysis of the soft tissue. More than 120 classes of brain tumours are known to be classified in four levels according to the level malignancy by the World Health Organization (WHO).

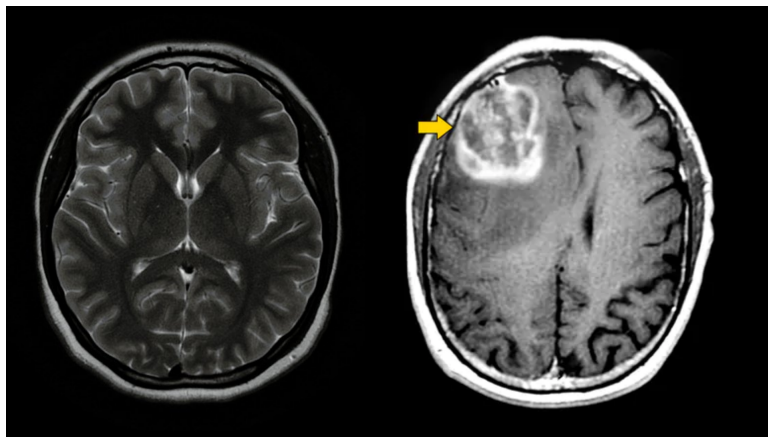


Figure 1: MRI Scan of brain without and with tumour

All types of brain tumours evoke some symptoms based on the affected region of the brain. The major symptoms may include headaches, seizures, vision problems, vomiting, mental changes, memory lapses, balance losing etc. Incidence of brain tumours are due to genetics, ionizing radiation mobile phones, extremely low frequency magnetic fields, chemicals, head trauma and injury, immune factors like viruses, allergies, infections, etc. The malignant tumours, also known as cancerous tumours, are of two types - primary tumours which start from the brain, and secondary tumours, which originate somewhere and spread to the brain. The risk factors for brain tumour are exposure to vinyl chloride, neurofibromatosis, ionising radiations and so on. The various diagnostic methods are computed tomography, magnetic resonance imaging, tissue biopsy etc.

Better treatments are now available for brain tumours. There is a chance of focal neurological deficits, such as motor deficit, aphasia or visual field defects in the treatment. Side effects can be avoided by measuring tumour size and time to tumour progression (TTP). Estimation of density of affected areas can give a better measurement in therapy.

The analysis of brain images is considered imperative because diseases of the brain called brain tumors are fatal and responsible for a large number of deaths in developed countries; for instance, according to the National Brain Tumor Foundation (NBTF), 29,000 people are diagnosed with brain tumor in the United States (US) with brain tumor and 13,000 of those patients die per annum. A number of advanced Magnetic Resonance Imaging (MRI) techniques that include Diffusion Tensor Imaging (DTI), MR Spectroscopy (MRS) and Perfusion MR are used for the analysis of brain tumor through MRI.

Deep learning is a machine learning technique that instructs computers what to do as a human think and do in a scenario. In deep learning, a computer model is able to do classification tasks from images, sound or text. Sometimes human level performance is being exceeded by deep learning techniques. One of the most popular neural networks is an artificial neural network that has a collection of simulated neurons. Each neuron

acts as a node and by links each node is connected to other nodes.

The aim of this project is to develop a web application that would help in cancer detection from MRI images through the convolution neural network.

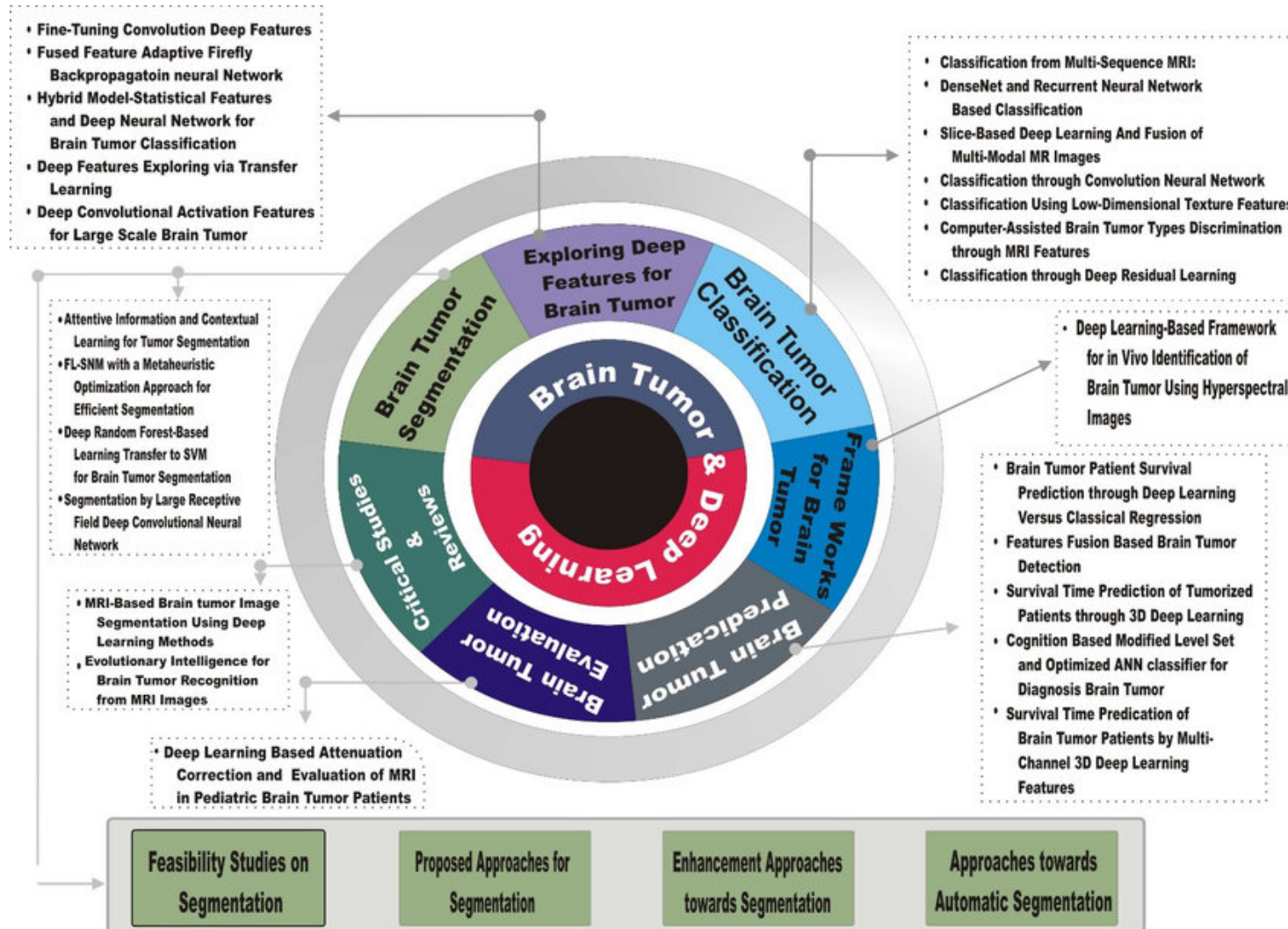


Figure 2: Literature Taxonomy of brain tumor using deep learning.

Objective and Scope

- To develop a deep learning model for detection of brain tumour from MRI images.
- To develop a web application that uses the trained model, which will act as an interface to end users for determining whether the input MRI image has any sort of tumour present in it or not.
- To further train the model to classify the type of tumour.
- To learn more about Data form analysis and dive into Aritifical intelligence.

Abstract

Brain tumours are a life-threatening problem and hamper the conventional functioning of the shape. For correct diagnosis and efficient treatment planning, it's necessary to detect the brain tumour in the early stages. The tumour within the brain is one of the most dangerous diseases and might be diagnosed easily and reliably with the assistance of detection of the tumour using automated techniques on MRI Images. Positron Emission Tomography, Cerebral Arteriogram, spinal tap, Molecular testing are used for tumour detection. Digital image processing plays an important role in the analysis of medical images. Segmentation of tumours involves the separation of abnormal brain tissues from normal tissues of the brain. Within the past, various researchers have proposed semi and fully automatic methods for the detection and segmentation of tumours . The motivation behind this project is to detect neoplasm and supply better treatment for the suffering. The project uses MRI Scans as the base image for detection purposes.

Project Category

Digital Image Processing, Deep Learning.

Process Description

The web application will use the trained model for detection of brain tumour. This detection model work on pre trained models that are able to analyze the input images provided by the end users. Once the system has input images, it performs pre-processing operations on it. Pre-processing is the name for operations on images at

the lowest level of abstraction whose aim is an improvement of the image data that suppress undesired distortions or enhances some image features important for further processing. Some of the steps in the Pre-processing include converting the image to grayscale, detecting the skull and brain part in the MRI image and so on. Once the Pre-processing is done, the system determines whether the input MRI image contains any tumour or not and will intimate the same to the end users.

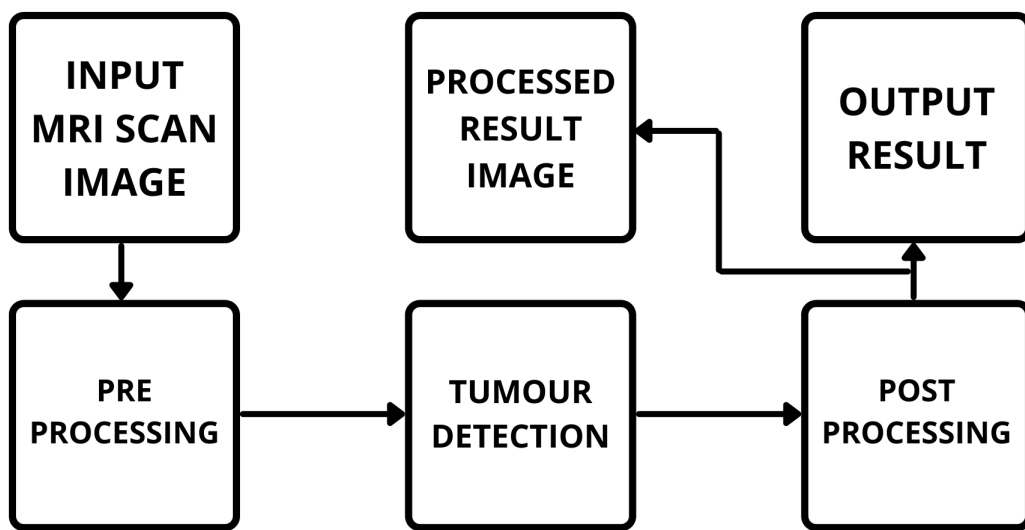


Figure 3: Proposed Block Diagram

Requirement of Resources and Limitations

Requirement:

- Software Requirement
 1. OS Requirement:
 - Windows 8/10(Can be used both for Training and at User End)
 - Linux(Only at User End)
 2. Training of the model:
 - Python ide(Anaconda Jupyter Notebook/Jupyter Lab)
 - Dataset for Training

3. Web Application

- Hardware Requirement

1. Basic Hardware for Training Purpose:

- RAM : 8 GB
- ROM : 2 GB
- Processor : i5 Processor

Limitations: Limited detection due to less datasets being used in training.

Impact analysis

1. Impact of project on society:

Positive Impact of project on society:

- Early detection of tumour can reduce the cost required to treat the tumour.
- Early detection can overall improve the lifespan of humans.

Negative Impact of project on society:

- It has a risk of errors and wrong detection due to less training.
- It has a risk of not detecting Initial stages of tumour due to small size.

2. Impact of project on environment

Positive Impact of project on environment:

- Less Bio Medical waste is generated due to early detection and treatment.

Negative Impact of project on environment:

- Bio Medical waste generated during treatment after the detection of tumour is done through this system, if not treated properly can pose environmental risks.

Professional ethical practices to be followed

1. Giving credits.

2. Keeping technical guidelines in mind.
3. Following the norms of engineering Practices.
4. Liability for outcome caused by one's actions or decisions.

Project Planning (Timeline analysis and Finance management

Table 1: PROJECT PLANNING: (Timeline Analysis)

Parameters	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10
Formation of group	Y									
Identification of problem statement		Y								
Literature survey		Y	Y							
Objectives and outcomes			Y							
Proposed system (methodology)				Y						
Simulation/ Testing)					Y	Y	Y			
Developing final product								Y	Y	

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Future scope and further enhancement

1. The entire Web Application can be further developed to understand more types of human body scans such as X-ray, CT - Scans etc. So as to become a full fledged health assessment portal.
2. Such web application could be installed at hospitals which will then connect patients and the hospital staff virtually.
3. The system in it's base form can be trained further to detect the tumour even more efficiently.
4. The system can be upgraded to detect more types of tumours such as ovarian, breast, skin, lung tumours etc.

Expected Outcome

A web application that uses trained models to detect whether a patients or test MRI Scan Image has any signs of tumour. If there is any tumour detected, the system is to alert the user for the same.

References

- [1] Avigyan Sinha, Aneesh R P, Malavika Suresh, Nitha Mohan R, Abinaya D, Ashwin G Singerji “Brain Tumour Detection Using Deep Learning“ *Seventh International conference on Bio Signals, Images, and Instrumentation (ICBSII)*, 2021
- [2] Pr Salander, A Tommy Bergenheim, Katarina Hamberg, Roger Henriksson , “Pathways from symptoms to medical care: a descriptive study of symptom development and obstacles to early diagnosis in brain tumour patients“ *Family Practice, Volume 16, Issue 2, April 1999, Pages 143148*
- [3] McKinney PA, “Brain tumours: incidence, survival, and aetiology,“ *Journal of Neurology, Neurosurgery & Psychiatry 2004*
- [4] Muhammad Waqas Nadeem, Mohammed A. Al Ghamdi, Muzammil Hussain, Muhammad Adnan Khan, Khalid Masood Khan, Sultan H. Almotiri and Suhail Ashfaq Butt, “Brain Tumor Analysis Empowered with Deep Learning: A Review, Taxonomy, and Future Challenges“ *Brain Sci.*2020
- [5] Logeswari, T.; Karnan, M. “An improved implementation of brain tumor detection using segmentation based on hierarchical self organizing map.“ *Int. J. Comput. Theory Eng. 2010, 2, 591.*
- [6] Yang, G.; Raschke, F.; Barrick, T.R.; Howe, F.A. “Manifold Learning in MR spectroscopy using nonlinear dimensionality reduction and unsupervised clustering.“ *Magn. Reson. Med. 2015, 74, 868878.*

- [7] Mansi Lathera, Dr. Parvinder Singh “Investigating Brain Tumor Segmentation and Detection Techniques “ *International Conference on Computational Intelligence and Data Science (ICCIDS 2019)*
- [8] Nandita Goyal and Dr. Bharti Sharma “Image Processing Techniques for Brain Tumor Identification“ *IOP Conf. Ser.: Mater. Sci. Eng. 1022 012011*
- [9] Isselmou Abd El Kader, Guizhi Xu, Zhang Shuai, Sani Saminu, Imran Javaid, Isah Salim Ahmad and Souha Kamhi “Brain Tumor Detection and Classification on MR Images by a Deep Wavelet Auto-Encoder Model“ *Diagnostics 2021*
- [10] Saurabh Kumar, Iram Abid, Shubhi Garg, Anand Kumar Singh and Vivek Jain “BRAIN TUMOR DETECTION USING IMAGE PROCESSING“ *International Journal of Information Sciences and Application (IJISA). ISSN 0974-2255, Vol.11, No.1, 2019, (Special Issue)*
- [11] Ramin Ranjbarzadeh, Abbas Bagherian Kasgari, Saeid JafarzadehGhoushchi, ShokofehAnari, Maryam Naseri & Malika Bendeache “Brain tumor segmentation based on deep learning and an attention mechanism using MRI multimodalities brain images“