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Artificial Intelligence Recommendation System For Cancer Rehabilitation Scheme

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***Abstract*—Cancer is the most difficult problem in the field of medicine and its postoperative recovery has become the most concerned problem for cancer patients.In the field of medical image processing brain tumor detection and segmentation using MRI Scan has become one of the most important and challenging research areas.Magnetic Resonance Imaging(MRI) is a widely used imaging technique to assess these tumors,but the large amount of data produced by MRI needs manual segmentation in a reasonable time,limiting the use of precise quantitative measurements in the clinical practice.So,automatic and reliable segmentation methods are required.Automatic segmentation is a challenging problem in which manual detection and segmentation of brain tumors using brain MRI scan forms a large part of brain human intervention for detection and segmentation taken per patient,is both tedious and has huge internal and external observer detection and segmentation variability.Hence there is high demand for an efficient and automatic brain tumor detection and segmentation using brain MR images to overcome errors in manual segmentation.In practice,the system uses HSI(Hyperspectral Imaging) to detect cancer cells.It is difficult to eliminate the ambiguities of making spectral profiles with biological samples and therefore the presence of fundamental non-uniqueness is another limitation of HSI.To overcome this difficulty,we are developing a system which detects the location of cancer cells through MR images and also suggests effective treatment like medications,vaccines etc...to physicians.**

***Keywords*—MR images, Brain tumor, Segmentation, Classification, CNN, Machine Learning.**

1. INTRODUCTION

Cancer is a group of diseases characterized by the uncontrollable growth and rapid spread of abnormal cells which damages the nearby healthy tissues of the brain. If the spread is not controlled,it can result in death.And also,not all tumors are cancer but all cancers are tumors. Brain tumor was the most common cancer in worldwide,contributing 2,093,876 of the total number of new cases diagnosed in 2020.This can be made faster and more accurate.In this study we propose machine learning strategies to improve cancer characterization.Inspired by learning from CNN approaches.Only about 4 to 5 percent of all cancers are genetically inherited, or hereditary.It's rare for a brain tumor to be genetically inherited. Symptoms of brain tumors depend on the location and size of the tumor.Some tumors cause direct damage by invading brain tissue and some tumors cause pressure on the surrounding brain.You'll have noticeable symptoms when a growing tumor is putting pressure on your brain tissue.

Magnetic Resonance Imaging(MRI) scans play an essential role in the screening and diagnosis of brain tumor. The wide adoption of Brain tumor screening is expected to benefit millions of people. However,millions of MRI scan images obtained from patients constitute a heavy workload for radiologists. To stimulate the development of machine learning models for automated MRI diagnosis,the BRATS17 provided labeled MRI brain images from 1397 patients and awarded $1 million in prizes to the best algorithms for automated brain cancer diagnosis,which is the largest machine learning challenge on medical imaging to date.In response,1972 teams worldwide have participated and 394 teams have completed all phases of the competition,making it the largest health care-related brats17 contest. This provides a unique opportunity to study the robustness of medical machine learning models and compare the performance of various strategies for processing and classifying MR images at scale. Due to the improved performance of machine learning algorithms for radiology diagnosis, some developers have sought commercialization of their models. However, given the divergent software platforms, packages, and patches employed by different teams,their results were not easily reproducible. The difficulty in reusing the state-of-the-art models and reproducing the diagnostic performance markedly hindered further validation and applications. We implemented a Graphical user interface(GUI) which takes MRI Images as input and it preprocesses the data and detects the brain tumor whether it is present or not,if so it locates the tumor cell and the output will be the treatment suggestion for the detected tumor which will also be a benefit to the physician in charge. This project is developed as an interface which is very user-friendly.

2. RELATED WORK

There are various methods proposed by different authors for brain tumor detection. The work of the different authors are discussed below.

In recent years, Prabhojot Kaur Chahal, Shreelekha Pandey and Shivani Goel in 2020.One of the most crucial tasks in any brain tumor detection system is the isolation of abnormal tissues from normal brain tissues. Interestingly, the domain of brain tumor analysis has effectively utilized the concepts of medical image processing, particularly on MR images, to automate the core steps, i.e. extraction, segmentation, classification for proximate detection of tumor. Research is more inclined towards MR for its non-invasive imaging properties. Computer aided diagnosis or detection systems are becoming challenging and are still an open problem due to variability in shapes, areas, and sizes of tumor detection techniques focusing segmentation as well as classification and their combinations. In the manuscript, various brain tumor detection techniques for MR images are reviewed along with the strengths and difficulties encountered in each to detect various brain tumor types. The current segmentation, classification and detection techniques are also conferred emphasizing on the pros and cons of the medical imaging approaches in each modality. The survey presented here aims to help the researchers to derive the essential characteristics of brain tumor types and identifies various segmentation/classification techniques which are successful for detection of a range of brain diseases. The manuscript covers most relevant strategies, methods, their working rules, preferences, constraints, and their future snags on MR image brain tumor detection. An attempt to summarize the current state-of-art with respect to different tumor types would help researchers in exploring future direction.

R.Tamilselvi, A.Nagaraj, M.Parisa Beham and M.Bhargavi Sandhiya in 2020. MRI is the most frequently used imaging technique to detect brain tumor. The brain is composed of nerve cells and supportive tissues such as glial cells and meninges. A brain tumor is a collection, or mass, of the brain in abnormal cells. Primary brain tumors can be either malignant or benign. A primary brain tumor is a tumor located in the brain tissue. New technologies in supplement to existing imaging modalities improve brain tumor screening. Most brain tumor databases are not publicly available. BRAMSIT is a resource for possible use by the MRI image analysis research community. The projected MRI database is a termed BRAMSIT, characterized by an attempt to offer a group of normal and malignant brain tumor images. The details such as age, and the MRI axial position (i.e., trans-axial, coronal and sagittal) of the patients are interpreted in the database.

T.M.Shahriar sazzad, K.M.Tanzibul Ahmmed, Misbah UI Hoque and Mahmuda Rahman in 2019.A tumor cell is a form of cell that develops out of control of the ordinary forces and standardizes growth. Brain tumor is one of the major reasons for human death every year. Around 50% of brain tumor diagnosed patients die with primary brain tumors. Among all electronic modalities, Magnetic Resonance Imaging (MRI) is one of the most used and popular for brain tumor diagnosis. In this research study, an automated approach has been proposed where MRI gray-scale images were incorporated for brain tumor detection. This study proposed an automated approach that includes enhancement at the initial stage to minimize gray-scale color variations. Filter operation was used to remove unwanted noises as much as possible to assist better segmentation. As this study tested grayscale images therefore, threshold based OTSU segmentation was used instead of color segmentation. Finally, pathology experts provided feature information that was used to identify the region of interests (brain tumor region). The experimental results showed that the proposed approach was able to perform better results compared to existing available approaches in terms of accuracy while maintaining the pathology experts' acceptable accuracy rate.

Mircea Gurbina, Mihaela Lascu and Dan Lascu în 2019. The brain is one of the most complex organs in the human body that works with billions of cells. A cerebral tumor occurs when there is an uncontrolled division of cells that form an abnormal group of cells around or within the brain. This cell group can affect the normal functioning of brain activity and can destroy healthy cells. Brain tumors are classified as benign or low-grade (grade 1 and 2) and malignant tumors or high-grade (grade 3 and 4). The proposed methodology aims to differentiate between normal brain and tumor brain (benign or malignant). The study of some types of brain tumor such as metastatic and bronchogenic carcinoma tumors, glioblastoma and sarcoma are performed using brain magnetic resonance imaging (MRI). The detection and classification of MRI brain tumors are implemented using different wavelet transforms and support vector machines. Accurate and automated classification of MRI brain images is extremely important for medical analysis and interpretation.

Annisa Wulandari, Riyanto Sigit and Mochamad Mobed Bachtiar in 2018. Brain tumor is one of disease types that attacks the brain in the form of clots. There is a way to see brain tumor in detail required by an MRI image. There is difficulty in distinguishing brain tumor tissue from normal tissue because of the similar color. Brain tumor must be analyzed accurately. The solution for analyzing brain tumor is doing segmentation. Brain tumor segmentation is done to separate brain tumor tissue from other tissues such as fat, edema, normal brain tissue and cerebrospinal fluid to overcome this difficulty. The MRI image must be maintained at the edge of the image first with the medium filtering. Then the tumor segmentation process requires a thresholding method which is then iterated to take the largest area. The brain segmentation is done by giving a mark on the area of the brain and areas outside the brain using watershed method then clearing skull with cropping method. In this study, 14 brain tumor MRI images are used. The segmentation results are compared brain tumor area and brain tissue area. This system obtained the calculation of tumor area has an average error of 10%.

3. PROPOSED METHOD

Awareness of cancer patients and their families , health care providers, and specialized cancer centers is achieved through access to up-to-date information about various items. Today, intelligent information technology systems have an important role in the awareness of people.Therefore, a type of technology is required that is capable of learning people's needs, interests and suggesting appropriate information accordingly. The emergence of information technology systems, like recommender systems, is a step towards selecting appropriate information. With modelling the preferences , interests, needs, requests, and behaviours of the users, recommender systems seek to predict the future preferences, needs and behaviours of the users to recommend appropriate and helpful services accordingly. Recommender systems can be a suitable tool for the information management of cancer-related screenings, diagnoses,treatments, operations, and rehabilitation programs. Access to treatment and health recommendations from valid sources is an important component of the natural processes of human decision making. The aim of this collection is to introduce recommender systems to use in cancer-related issues.

In this study, we propose machine learning strategies as a recommender system to improve cancer characterization. Inspired by learning from CNN (Convolution Neural Network) approach which is a deep learning algorithm comes under the machine learning category. So, here we used the CNN algorithm in the recommender system to detect and classify brain tumor as benign and malignant, and give treatment suggestions based on needs. Before we get into the goal, firstly we need to analyze and process the input MR images using Image processing techniques. The image processing techniques will make the MR images more clear and enhanced so that accurate diagnosis can be performed.The image processing techniques consist of data pre-processing, segmentation, feature extraction and classification. The input MR images will undergo various stages of image processing techniques which can be summarized as our system modules.

3.1 SYSTEM MODULES

Our System modules are the following.

- Data Pre-processing
- Segmentation
- Feature Extraction
- Classification
- Training and Testing
- Treatment Suggestion

3.1.1 DATA PRE-PROCESSING

Collecting the data is one task and making that data useful is another vital task. Data collected from various means will be in an unorganized format and there may be a lot of null values, in-valid and unwanted data. cleaning all these data and replacing them with appropriate or approximate data and removing null and missing data and replacing them with some fixed alternate values are the basic steps in pre-processing of data. Even data collected may contain completely garbage values. It may not be in the exact format or way that is meant to be. All such cases must be verified and replaced with alternative values to make data meaningful and useful for further processing. Data must be kept in an organized format.

3.1.2 SEGMENTATION

Segmentation technique is to separate out tumor region from MRI images. Using segmentation, it is possible to identify objects, boundaries, location in an image. A lot of research has been carried out in the area of segmentation. In computer science, it is used for the dividing of digital images into multiple segments. It is used to achieve the goal to obtain the more meaningful and easier to analyze the image as it simply or change the image representation. There are many applications of segmentation in the medical field like identifying the diseases in MRI or CT scan images, to locate tumor.

3.1.3 FEATURE EXTRACTION

Feature extraction comes after the segmentation process to point us to the exact tumor. It is the process of extracting the features of segmented brain tumor. It is a crucial task in case of brain tumor because of the structure of the brain. Certain parameters are taken into account for feature extraction as size, shape, composition, location of affected parts in the brain. As per the result obtained from the feature extraction, the classification will be done as the next step.

3.1.4 CLASSIFICATION

Image classification is a process of classifying the items according to its type and pattern from the image in the dataset.It performs on image using CNN algorithm. This CNN algorithm used to classify the input MR images into benign or malignant. For example, if we have a MRI brain image and we want to train our CNN on that image to classify it into “benign” or “malignant”.

3.1.5 TRAINING AND TESTING

Finally after processing of data and training, the very next task is obviously testing. This is where performance of the algorithm, quality of data, and required output all appears out. From the huge data set collected 90% of the data is reserved for testing. Training as discussed before is the process of making the machine to learn and giving it the capability to make further predictions based on the training it took whereas testing means already having a predefined data set with output also previously labeled and the model is tested whether it is working properly or not and is giving the right prediction or not. If the maximum number of predictions are right then the model will have a good accuracy percentage and is reliable to continue with. Otherwise it is better to change the model.

3.1.6 TREATMENT SUGGESTION

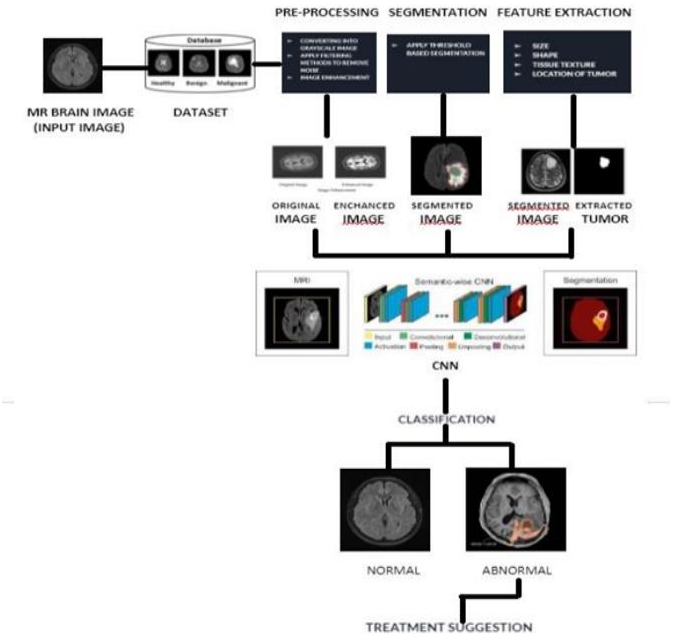
Treatment suggestions include types of treatment that are the standard of care for a brain tumor. “Standard of Care” means the best treatments known. Treatment options and recommendations depending on several factors are the following.

- The size, type and grade of the tumor
- Whether the tumor is putting pressure on vital parts of the brain
- If the tumor has spread to other parts of the CNS or body
- Possible side effects
- The patient’s side effects
- The patient’s preferences and overall health

Based on these factors the suggestions will be given to the doctor.

3.2 PROPOSED SYSTEM ARCHITECTURE

Based on the above six modules, we build a system architecture using the proposed CNN layers. System architecture is the conceptual model that defines the structure, behaviour, and more views of a system. An architecture description is a formal description and representation of a system, organized in a way that supports reasoning about the structures and behaviours of the system.



SYSTEM ARCHITECTURE

MR brain image is the input image which is taken from the dataset (database) for image processing. The image processing has three major steps are Data Pre-processing, Segmentation, Feature Extraction and Classification. Data Preprocessing is the process of taking only the necessary data from the input MRI by removing unwanted data present in the MRI image and data pre-processing involves the functions like converting into grayscale image, applying different filtering methods to remove noise, image enhancement to improve the image quality. This will be converted into a suitable form on which further work can be performed. Next move to the segmentation process. This process will separate out the tumor region from the MRI image and segmentation involves the function of threshold-based segmentation. The threshold-based segmentation is the technique used by the segmentation process. This technique will detect and highlight the tumor region based on pixel intensity (high impression). And then moves to the feature extraction process. This process will extract the features of the segmented part like size, shape, tissue texture and location of the affected part in the brain. After the basic operations of image processing on MRI image, the CNN algorithm will perform a processed image to classify the brain into benign (healthy brain) or malignant (tumor brain). This classification is done by using an algorithm called CNN (Convolution Neural Network). The purpose of using CNN is the best algorithm for image recognition. And finally, treatment suggestions will be given to physicians if the tumor is identified in the brain.

3.3 ADVANTAGES OF PROPOSED SYSTEM

- Accuracy is high in image recognition.
- Highly efficient than the existing system.
- Generalize well across problem domain.
- Has security and privacy protection.

4. CONCLUSION

In this paper, we have proposed a recommender system of machine learning which is obviously AI. In the recommender system, we used a deep learning algorithm called CNN which is the best algorithm for image recognition since our project is an image based project and also needs to process large amounts of data present in the project. Firstly, we do image processing techniques on input MR image for enhancement of image quality to do further work on it and then to detect and classify MR image into benign and malignant using a proposed CNN algorithm for accurate detection of brain tumor and giving treatment suggestions based on needs. By using this methodology, we improve the efficiency of detection and classification of brain tumors. There is no need for any technical knowledge to work this application since this project is a user interface and it is easily accessible. For physicians, it works like an add on, which reduces their work and time of access. Therefore, it can be seen that detection of brain tumor from MRI images is done by various methods, also in future work different automatic methods achieve more accuracy and more efficient.

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