

Synopsis

Classification of Brain Lesion and Grade Using MRI Texture and Shape in Machine Learning Scheme

1. Introduction :-

The number of persons infected by brain lesion increases every year. Lesions are caused by abnormal growth of cells. Brain lesions can be benign (noncancerous lesions) or malignant (cancerous). They are also classified as primary and secondary. Primary lesions start in the brain or Central Nervous Systems whereas the secondary lesions spread from other body parts into the brain. Depending on the degree of abnormality of brain tissue, the lesions are typecast into four grading lesions: high-grade lesions that are highly susceptible to cancer.

Classifying brain lesions using machine learning techniques have become an essential due to its importance in people's life. The correct and fast diagnosis are the keys to reduce the percentage of deaths that have raised recently to significant numbers. The available techniques such as CT scan and MRI imaging are widely used nowadays and the latter is more common as it provides high resolution images from different angles for brain tissues. Determining the right type of brain lesion manually requires an expert who has a good knowledge in brain diseases. Also, it is time consuming and tedious for a lot of images. Moreover, human errors are possible and consequently false detection may cause a wrong procedure and treatment. Therefore, the scientists and researchers introduced different approaches for classifying lesion types automatically and efficiently without needing to human knowledge.

2. Need of work :-

1. Determining the right type of brain lesion manually requires an expert who has a good knowledge in brain diseases. Instead of going to doctor in physical mode we can go through online mode and save our time.
2. Determining and Detection is time consuming and tedious for a lot of images on manually.
3. Lesion will predict in initial stage so it will easy for treatment.
4. Human errors are possible and consequently false detection may cause a wrong procedure and treatment.
5. Minor abnormalities.

3. Problem Statement :-

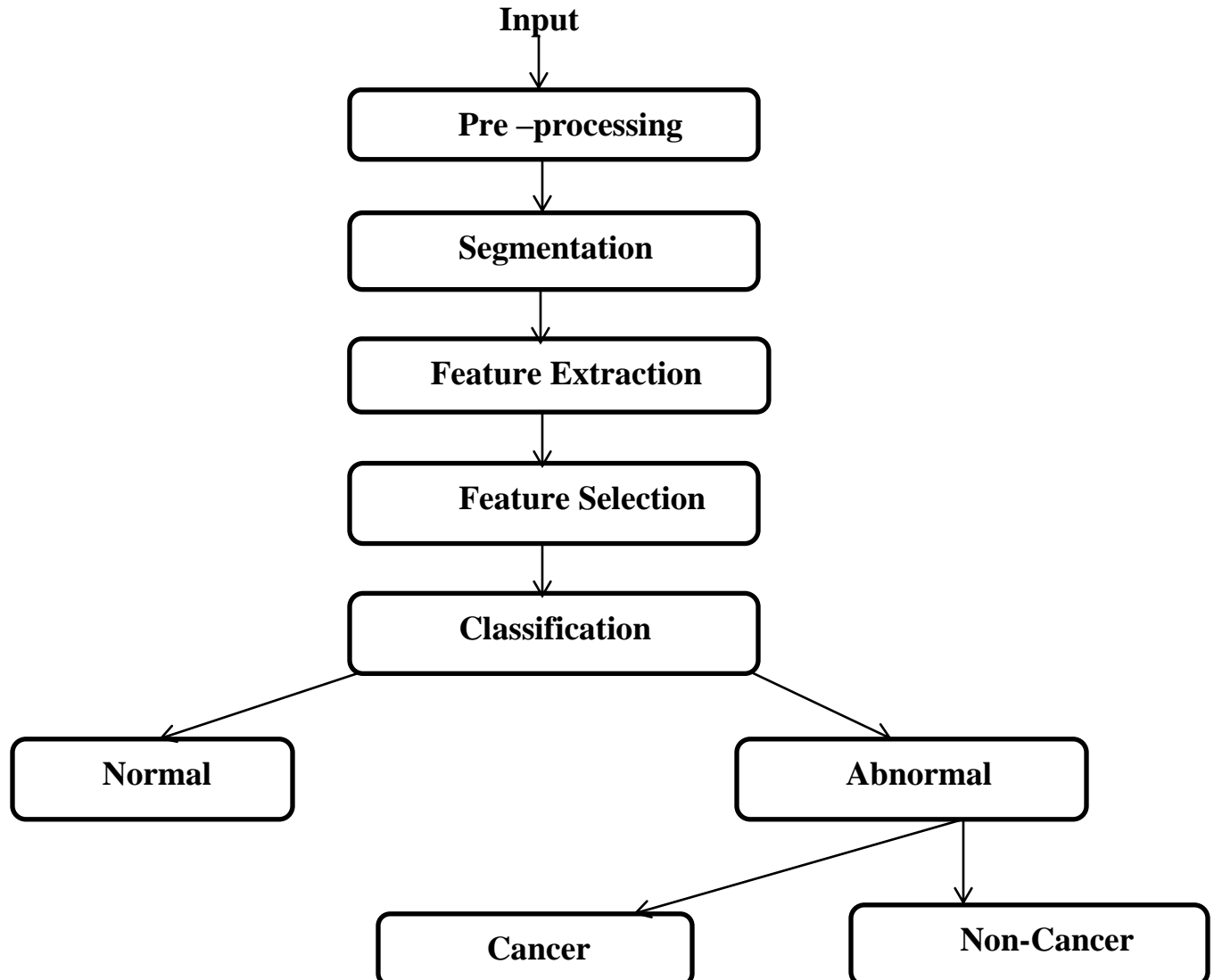
To design and implement system which will predict Brain Abnormalities using MRI images and Detection and Classify through Machine Learning Techniques.

4. Objectives :-

1. The objective of this study is to investigate the use of pattern classification methods for distinguishing different types of brain abnormalities, such as primary gliomas from metastases, and also for grading of gliomas.
2. A computer-assisted classification method combining conventional MRI and perfusion MRI is developed and used for differential diagnosis.
3. The proposed scheme consists of several steps including region-of-interest definition, feature extraction, feature selection, and classification.

4. The extracted features include lesion shape and intensity characteristics, as well as rotation invariant texture features.
5. Feature subset selection is performed using support vector machines with recursive feature elimination.
6. The binary support vector machine classification accuracy, sensitivity, and specificity

5. Proposed System Architecture :-



6. Modules :-

1. Pre-processing

Image pre-processing is the first step of detection that a researcher or an inspector spend more time on dealing with as the following steps rely on it. The purpose of this step is to remove any noise or labels such as time and date, and enhance the quality of the image preparing for the next step of segmentation . There are different techniques that are used to implement this process for example: cropping, image resizing, histogram equalization, filtering, and image normalization.

2. Segmentation

The next step of detection is a segmentation that represents the most essential part of image processing. This process contains a procedure to extract the area that is valuable in determining whether a region is infected or not. Segmenting brain lesion based on MRI images is facing several difficulties such as noise in the image, low contrast, loss boundaries, the changing in the intensities within tissues, and also the varying in tissue types.

3. Feature extraction techniques

Feature extraction is a process of reduction in number of features by creating new set of them that have the same information of the original ones, but they are completely different. The advantages of this technique are improving accuracy of the classifier, minimizing risk of overfitting, ability to visualize data, and increasing the speed of training.

4. Feature selection techniques

This technique is also applied to minimize the volume of features in the dataset with keeping the same features. The technique is trying to order the features regarding their importance from top features to bottom features.

selecting the best features is done by employing supervised machine learning such as C5 algorithm. Examining the whole features and searching for the optimal ones manually is time consuming and prone to errors as each feature could affect with another one.

5. Classification

Classification methods can be classified into two main parts, cancer methods and non-cancer methods. Introduced two approaches for classification- The first approach classified glioma type for various grades Grade1, Grade 2, and Grade 3, whereas the second one classified the grades for low and high. The study utilized SVM and KNN algorithms for classification and achieved accuracies 85% for multi-classification and 88% for binary classification.

CNN algorithm to classify gliomas disease into two grades (low Grade or high Grade) and different grades (Grade 2, Grade 3, and Grade 4). The classifier was achieved accuracies 71% and 96% respectively.

7. Requirements :-

1- Hardware Requirements :

Number	Description
1	PC with 250 GB or more Hard disk.
2	PC with 4 GB RAM.

2- Software Requirements :

Number	Description	Type
1	Operating System	Windows XP / Windows 7,10
2	Language	Python
3	Database	MySQL
4	IDE	Jupyter notebook.
5	Browser	Google Chrome

8. Project Plan :-

Sr. No.	Activity	Completion Date/Month
1	Information Search About Project	August
2	Finalization of Project Topics	September
3	Literature Survey	October
4	Planning	October
5	Implementation (Initial Setup)	November
6	Implementation of module 1	December
7	Implementation of module 2	January
8	Configuration	February
9	Deployment	March
10	Project Report	April

9. Conclusion :-

The main steps to analysis datasets starting with dealing MRI medical images that support a reader with information to develop this field and help for better diagnosis. Finally, it has been noticed from reviewing various methods that using K-NN, SVM, and CNN classifiers are achieved high results.

The benefit of the system is to assist the physician to make the final decision without hesitation. According to the experimental results, the proposed method is efficient for the classification of the human brain into normal and abnormal. The proposed algorithm achieves the classification percentage is more than 95%. Also the performances if this study shows the advantages of this technique: it is rapid, easy to operate, non-invasive and inexpensive.

10. References :-

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