DUAL FILTER PIPELINE MECHANISM FOR DETECTION OF CEREBRAL MICROBLEEDS(CMB'S)

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CATEGORY- OPEN INNOVATION

PROBLEM- Cerebral microbleeds are one of the leading causes of brain hemorrhages and its detection using magnetic resonance imaging is not effective in detecting these hypointense lesions of size as small as 5 mm.

SOLUTION- Devising an algorithm having two algorithmic**(SUPPORT VECTOR MACHINE(RBF METHOD) AND CONFUSION MATRIX)** checkpoints termed as filters and the parent algorithm is termed as the pipeline where the filters are present and the relevant datasets are passed to through it, where the end result will be a prediction of different biological parameters related to the cerebral microbleeds and its status inside the patient.
DETECTION OF CEREBRAL MICROBLEEDS FROM MRI DATA USING SUPPORT VECTOR MACHINE ALGORITHM USING RADIAL BASIS FUNCTION AND CONFUSION MATRIX

THESIS

AIM :- Detection of cerebral microbleeds from MRI data using support vector machine algorithms with the help of radial basis function(RBF) and confusion matrix.

PREREQUISITE KNOWLEDGE :-
WHAT ARE CEREBRAL MICROBLEEDS ?
Cerebral microbleeds (CMBs) are small, round or ovoid lesions that can be seen on brain imaging studies, such as magnetic resonance imaging (MRI) or

computed tomography (CT) scans. These tiny hemorrhages occur within the brain's small blood vessels, particularly in the cerebral white matter and deep gray matter. CMBs are typically less than 5 millimeters in size and are often associated with underlying vascular and neurological conditions. Here are some key points to understand about cerebral microbleeds

WHAT ARE THE CAUSES OF CEREBRAL MICROBLEEDS ?

Hypertension (High Blood Pressure): Chronic high blood pressure can damage small blood vessels in the brain, leading to microbleeds.

Cerebral Amyloid Angiopathy (CAA): This condition is characterized by the buildup of amyloid protein in the blood vessel walls of the brain, making them more fragile and prone to bleeding.

Aging: CMBs are more common in older individuals, and their prevalence tends to increase with age.

Head Trauma: Traumatic brain injury or repeated head trauma can also lead to microbleeds.

Underlying Vascular Diseases: Other vascular disorders, such as arteriovenous malformations (AVMs) or aneurysms, can cause microbleeds.

Certain Medications: Some medications, such as anticoagulants and antiplatelet drugs, can increase the risk of microbleeds.

WHICH MACHINE LEARNING ALGORITHM TO USE AND WHAT IS IT ?

SUPPORT VECTOR MACHINE- It uses the extreme cases to justify a given set of problems and also uses the same to classify the given data into the desired segments of a large dataset. In this project we will be using the kernel method (if required) and RBF because of the nature of the dataset which is clearly non linearly separable.

CONFUSION MATRIX- A confusion matrix is a fundamental tool in the field of machine learning and classification problems. It is used to evaluate the performance of a classification algorithm by summarizing the results of predictions made on a dataset. A confusion matrix is particularly useful when dealing with binary classification problems (two classes), but it can be extended to multiclass classification as well.

Python will be used to devise the algorithm along with use of libraries such as tensorflow, scikit learn, numpy, panda, and also we will use the help of csv or comma separated value dataset to feed our model the required training dataset and also the test dataset.

PROCEDURE- First we need to search for the relevant dataset and then we need to preprocess it according to our needs.

Next we will divide the dataset into training dataset and test dataset as per our requirement and generally the split is 80 percent by 20 percent.

Then we will start the coding part which requires selecting necessary libraries required for the model.

Checking the mathematical intuition and its relevance with computerized code that we are developing for the prediction.

Debugging if required and then compiling the code and generating the predicted percentage of the desired event or problem.

MATHEMATICAL INTUITION :-

SUPPORT VECTOR MACHINE- we can use 3 type of method in support vector machine that are the for linearly separable dataset we can use the linear hyperplane classification and for non linearly separable dataset we can use radial basis function and kernel method whichever is suitable for the dataset we are taking.
For SVM we use either euclidean distance from the hyperplane method or we can use the gaussian RBF to pinpoint the location of a dataset to its closest neighbor to predict the average distance between the likelihood and unlikelihood of the event happening.
We can also transform a 2 dimensional data set into a 3 dimensional dataset to be able to use 3 dimensional hyperplane technique in it and classifying different

parts of data and then taking average of each and every classified portion of the data and then prediction the required efficiency of the model.

CONFUSION MATRIX- It works on the same rules as matrices and determinants in mathematics.

RESULTS- When provided with sufficient number of support vectors(distinguishable factors) the svm model is able to predict an efficiency of 96 percent but applying a 2 layer filtering mechanism we should be able to increase the baseline efficiency to greater than 96 percent.

CONCLUSION- Prediction using machine learning algorithms can be a game changing device to save lives and to detect these brain defects before they are not curable anymore and at last resulting in the death of the patient.

THANK YOU