A GAUSSIAN DISCRIMINANT PSYCHIATRY BASED DEEP LEARNING ALGORITHM FOR THE PREMATURE DIAGNOSIS OF PLACID COGNITIVE MUTILATION IN ALZHEIMER'S DISEASE

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Abstract— Alzheimer's Disease is a relatively common neurodegenerative disabling disease. It affects central nervous system with profound effect on the motor system. Alzheimer's disease can affect a person as a result of cerebro vascular disease, brain tumor. For solving this high dimensional classification problem, the widely used algorithm remains to be Support Vector Machines. This approach we introduces a novel algorithm based on the Gaussian discriminant analysis for a more effective and accurate analysis and deep learning for classification.

Keywords— *GDA , Deep learning , SVM***.**

I. INTRODUCTION

Alzheimer's (AHLZ-high-merz) is a disease of the brain that causes problems with memory, thinking and behavior .It is not a normal part of aging. Alzheimer's gets worse over time. The disease may cause a person to become confused, lost in familiar places, misplace things or have trouble with language. Early diagnosis Alzheimer's allows prompt treatment of reversible symptoms. This can often lead to improvement of cognitive symptoms such as memory problems.

A CT scan is a construction of Computed Tomography scan. It is also known as a CAT (Computer Axial Tomography) scans. CT scanner is a special kind of X-ray machine, which combines many x-ray images instead of just one with the assistance computer. It employs the process of generating a 2-dimensional image with assistance of the computer. In some cases a 3-dimensional image can also be formed by taking many pictures of the same region from varying angles. CT scan helps in early diagnosis in Alzheimer's Disease and shows a degree of generalized cerebral atrophy. An edge is usually a step change in intensity of the image (CT image). It corresponds to the boundary between two regions or a set of points in the image where luminous intensity changes very sharply. Determination of, whether pixel is an edge point or not, bases on how much its local neighbours respond to a certain edge detector. Over the years, many methods have been proposed for detecting edges in images. Some of the earlier methods, such as the Sobel and Prewitt detectors, used local gradient operators to obtain spatial filter masks. The procedure is to compute the sum of products of the mask coefficients with the intensity values in the region encompassed by the mask. Also the Canny edge detector which depends on the Gaussian distribution in obtaining the operators for the gradient and Laplacian masks is a well-known edge detector.

II. PROPOSED WORK

Alzheimer's Disease (AD) is a relatively common neurodegenerative disabling disease. It affects central nervous system with profound effect on the motor system. The most common symptoms include slowness, rigidity and tremor during motion. It has been suggested that the vocal cords are among the first one to be affected and thus the speech is affected at very early stage of the disease and continues to deteriorate as the disease progress. Alzheimer's disease can affect a person as a result of cerebro vascular disease, brain tumor. several approaches have been proposed to assist in the

early diagnosis of Alzheimer's disease (AD) and its prodromal stage of mild cognitive impairment (MCI). For solving this high dimensional classification problem, the widely used algorithm remains to be Support Vector Machines (SVM). But due to the high variance of the data, the classification performance of SVM remains unsatisfactory, especially for delineating the MCI group from the cognitively normal control (CN) group. This approach we introduces a novel algorithm based on the Gaussian discriminant analysis (GDA) for a more effective and accurate analysis and Deep Learning for Classification. This study also shows that by separating shimmer and jitter hemispheres of the brain data into two decision spaces, then combining the results of these two spaces, the classification performance can be improved significantly, an assertion proven in this study.

This Synopsis aims to introduce a novel generative learning algorithm based on the Gaussian discriminant analysis (GDA) with a focus placed on CN vs. MCI. Moreover, this study proposes the use of two high dimensional decision spaces instead of typically using only one by manipulating each of the left and the right hemispheres of the brain separately, and then using Deep Learning combining the outcomes to yield a higher classification accuracy.

III. PROBLEM STATEMENT

AD would have started causing its damage to the brain perhaps for a decade or more before evident symptoms can be observed. Although there still is no known cure for the disease, alleviation of specific symptoms is possible through treatment for some patients. Multiple modalities of biomarkers have been considered to be significantly sensitive in assessing the progression of AD, including structural magnetic resonance imaging (MRI), positron emission tomography (PET), fluorodeoxyglucose (FDG)-PET, cerebrospinal fluid (CSF), and electroencephalographic (EEG) rhythms. As one of the most popular machine learning algorithms capable of dealing with this type of high dimensional problem with multiple variables, Support Vector Machines (SVM) has been widely applied to classification and regression analysis in the context of disease diagnosis and transition predictions.

- SVM has there remain inherent limitations itself, where subtle differences between any two groups are difficult to ascertain.
- Making the classification problem difficult in defining that optimal hyperplane in between the two groups, for discriminating MCI from cognitively normal control (CN).

IV. OBJECTIVE

- The main objective of this paper is to identify the Alzheimer's disease among the people using deep learning algorithm.
- By using only structural MRI data, the proposed GDAbased generative learning algorithm achieved an accuracy of 85.90%, sensitivity of 83.87%, specificity of 87.23%,positive predictive value of 81.25%.
- And negative predictive value of 89.13% for discriminating AD from CN; these results for these two groups were expected. But more importantly, an accuracy of 82.20%, sensitivity of 83.10%, specificity of 80.85%, positive predictive value of 86.76%,and negative predictive value of 76.00% were obtained for discriminating MCI from CN that are very competitive.
- The proposed GDA-based classifier is capable of solving nonlinear boundaries for discriminating AD and MCI from CN in consideration of correlations among all variables. And most importantly, by separating left and right hemispheres of the brain into two decision spaces.
- And then combining results of these two spaces to determine the final outcomes, the classification performance is improved significantly.

V.METHODOLOGY

A. Gaussian Discriminant analysis (GDA)

In order to maintain only few but key variables and still ensure good classification performance, an incremental error analysis was performed to determine how many of the topranked variables ought to be included in the classifier. In the initial phase, the proposed GDA-based classifier only used the first-ranked variable. The error analysis was employed whereby introducing the next top-ranked variable in the classifier at each subsequent phase, and recording the corresponding classification statistics, which then would be compared with the previous phase. Until the performance cannot be improved significantly any more, the optimal set of variables would have *been obtained.*

B. Deep Learning

Data used for this work are available online in the UCI Machine Learning Repository. For each individual, the records of the A, O, U vowels pronunciation, several words, short sentences and numbers from 1 to 10 have to be taken. Therefore, this would be the key for the data classification. Method of cross-validation is being used in order to divide the dataset into the training and testing sub-sets. One subset is utilized for testing model accuracy and the remaining sub-sets are utilized to train the model. This process is repeated, whilst different testing set is used for each attempt. The number of repeats depends on the multiplicity of cross-

validation. For the data used, 4 and 5-fold cross validation was selected. Classifiers are used to distinguish between individuals suffering from PD and healthy individuals. The obtained results are summarized.

C. System Architecture

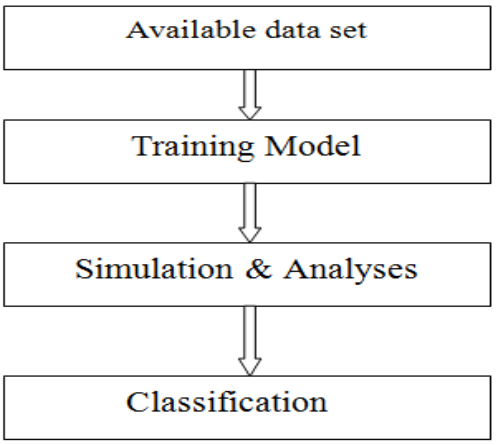

Fig.1 Block Diagram of Proposed System

D. Motivation

People suffering from Alzheimer's Disease are not able to speak properly. Since central nervous system get damaged they cannot do their work properly. They have to depend upon their family members to do their work. There are numerous symptoms among the population suffering from the disease including tremor, slowed movement, impaired posture and balance, and rigid muscles, however dysphonia – changes in speech and articulation – is the most significant precursor. This is the reason why the work is focused on patients classification based on their speech signals.

E. Applications

Application of this work is

- Mainly in communication and neural networking domain
- Radio transformer networks for augmented signal processing Algorithms.

VI.PROJECT OUTCOME AND MODE OF DEMONSTRATION

a. *Gaussian discriminant analysis model is a* generative learning algorithm in which we assume p(x|y) is distributed according to a multivariate normal distribution.

b. By using three layer networks and increasing number of neurons and hidden layers, the accuracy of the classification is to be found.

Always take a moment to examine and interpret these bivariate analyses for two reasons:

1. We need to know these results to properly interpret the multivariate results – identifying the occurrence of suppressors and other "surprises"
2. At some point you will need to determine whether to present the multivariate results or just the bivariate analyses (depending upon intent, audience, "value" of the multivariate results, etc.)

it is a bad idea to exclude variables from a multivariate analysis because they don't have bivariate differences – this ignores suppressor effects, multivariate power issues as well as the basic idea that more complicated models are more likely to capture the complexities of behavior.

1) *Feasibility Analysis*

i) Evaluation of technological and system requirements

The evaluation of technological and system requirements in this proposal refers basically to issues related to the type, availability and quality of the following, we used in the project:

- Signal data of Alzheimer's Disease
- Gaussian Discriminant Analysis (Gda), Deep Learning
- Python

ii) Evaluation of legal requirements

The evaluation of legal requirements concerns basically the rules of publishing and using data, software and methods. A part of the rules concerning publishing spatial data can be found in the INSPIRE directive and in copyright laws. Most data and software include information on the form of publishing in metadata or websites where such data is published.

iii) Evaluation of operational requirements

Allowing for the level of knowledge and skills necessary for data acquisition, and later to process, analyze and visualize them, as well as to implement the results, is of paramount importance in the evaluation of operational requirements. Since the projects involved concern sustainable development and spatial planning it is also important to allow for public participation (e.g. practitioners or representatives of local community).

iv) Evaluation of economic requirements:

Two components are important in the evaluation of economic requirements:

The cost of data or software procurement,

The cost of employing workforce for specific tasks,

The cost of possible improvement of qualifications of the workforce employed.

v) *Evaluation of requirements related to the schedule*:

The evaluation of requirements related to the schedule concerns the estimation of time necessary to complete

respective parts of a project, e.g. data procurement and processing.

VII.RESULT AND CONCLUSION

People suffering from Alzheimer's disease are not able to speak properly. Since central nervous system gets damaged they cannot do their work properly. They have to depend upon their family members to do their work. There are numerous symptoms among the population suffering from the disease including tremor, slowed movement, impaired posture and balance, and rigid muscles, however dysphonia – changes in speech and articulation – is the most significant precursor. This is the reason why the work is focused on patients classification based on their magnetic resonance image (MRI).

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