IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Automatic Alzheimer's Disease Recognition from MRI Data Using Deep Learning Method

Ms. M. RUPA RAJESWARI [#1], Mr. S. JAMALAIAH [#2], Mr. D.D.D.SURIBABU [#3]

[#1]M.Tech Student, [#2]Associate Professor, [#3]Associate Professor & HOD

Department of Software Engineering

International School of Technology and Sciences (Women)

(Affiliated to JNTUK),East Gonagudem, Rajanagaram, Rajamahendravaram,

East Godavari District, Andhra Pradesh, India– 533294.

ABSTRACT

Alzheimer's Disease (AD), the most common form of dementia, is an incurable neurological condition that results in a progressive mental deterioration. Although definitive diagnosis of AD is difficult, in practice, AD diagnosis is largely based on clinical history and neuropsychological data including magnetic resource imaging (MRI). Increasing research has been reported on applying machine learning to AD recognition in recent years. This paper presents our latest contribution to the advance. It describes an automatic AD recognition algorithm that is based on deep learning on 3D brain MRI. The algorithm uses a convolutional neural network (CNN) to fulfil AD recognition.It is unique in that the three dimensional topology of brain is considered as a whole in AD recognition, resulting in an accurate recognition. The CNN used in this study consists of three consecutive groups of processing layers, two fully connected layers and a classification layer. In the structure, every one of the three groups is made up of three layers, including a convolutional layer, a pooling layer and a normalization layer. The algorithm was trained and tested using the MRI data from Alzheimer's Disease Neuroimaging Initiative. The data used include the MRI scanning of about 47 AD patients and 34 normal controls. The experiment had shown that the proposed algorithm delivered a high AD recognition accuracy with a sensitivity of 1and a specificity of 0.93.

KEYWORDS:

Alzheimer's Disease, Neuroimaging, Deep Learning, Neuropsychological.

1. INTRODUCTION

A group of signs and symptoms brought on by brain abnormalities are referred to as dementia. More than 46.8 million individuals worldwide currently have dementia, and 131.5 million are expected to have it by 2050 [1]. Alzheimer's Disease (AD) is the most prevalent type of dementia, though there are other varieties as well. Definitive dementia diagnosis is typically challenging, despite significant attempts to understand the pathophysiologic processes of dementia and create effective therapies. Some computer-aided systems have been studied to diagnose AD in the hunt for an efficient method. These methods rely on machine learning and clinical history data as well as neuropsychological data from positron emission tomography, structural magnetic resonance imaging (sMRI), functional magnetic resonance imaging (fMRI), and magnetic resource imaging (MRI) (PET). Deep learning (DL) mimics the human brain's hierarchical organisation by processing input at successively higher levels and progressively building up a larger and larger set of semantic notions.

Deep learning has received more attention in the development of big data and artificial intelligence technologies as a new machine learning paradigm. [2] [3] [4]. Recently, certain deep learning-based methods have been suggested to identify or detect AD. [5] presented a deep learning technique using 3D convolutional neural networks and sparse autoencoders. Based on an MRI scan, it can forecast a patient's disease status.

A multimodal neuroimaging feature extraction pipeline for the identification of multiple classes of AD was provided in [6]. It created a framework for deep learning using a zero-masking strategy to preserve all possible information encoded in imaging data. It achieved high accuracy of 87%. [7] Outlined deep learning-based pipelines employed to distinguish Alzheimer's MRI and fMRI from normal healthy control data for a given age group. It almost perfectly distinguished Alzheimer's patients from healthy normal brains. [8] Proposed to predict the AD with a deep 3D convolutional neural network. The network was built upon a 3D convolutional autoencoder, which is pre-trained to capture anatomical shape variations in structural brain MRI scans. Experiments on the adopted MRI dataset with no skull-stripping Pre-processing had shown that it outperformed several conventional classifiers by accuracy.

2. EXISTING SYSTEM AND ITS LIMITATIONS

In the existing system there was no proper method to identify the Alzheimer's disease prediction using any ML or DL algorithms. The following are the main limitations in the existing system.

LIMITATION OF PRIMITIVE SYSTEM

The following are the limitations of the existing system.

1. More Time Delay in finding the root cause of Alzheimer's disease(AD).
2. There is no prevention technique due to late prediction.
3. There is no early prediction of Alzheimer's disease due to lack of knowledge
4. All the existing systems try to predict the AD based on manual approach by learning strong knowledge about the concept.
5. There is no method to identify the Alzheimer's disease based on ML and DM Methods

3. PROPOSED SYSTEM AND ITS ADVANTAGES

In this proposed system we try to find out the Alzheimer's disease detection based on Inception V3 model by considering all the possible factors which are required for disease prediction. In this application we try to find out the accuracy and which stage of disease the patient is presently suffering with. Here in our application we have some possible stages such as: Very Mild Demented, Non Demented, MildDemented, and ModerateDemented. The following are the advantages of the proposed system. They are as follows:

1) By using proposed Inception V3 model, we can get accurate Alzheimer's disease detection with more accuracy.
2) In this paper we survey different papers in which one or more algorithms are used for efficient prediction of AD.
3) Results clearly state that it is very accurate in identification of AD.

4. IMPLEMENTATION PHASE

The step of implementation is when the theoretical design is translated into a programmatically-based approach. The application will be divided into a number of components at this point and then coded for deployment. Google Collaboratory is used for the application's front end, and AD was used as the back-end data store. Python is being used in this instance to implement the current application. The following five modules make up the bulk of the application. These are what they are:

1. Import Necessary Libraries
2. Load Dataset Module
3. Data Pre-Processing
4. Train the Model Using Inception V3
5. Result Analysis

1) Import Necessary Libraries

We must first import all the relevant libraries into this module in order to build the model. Here, we make an effort to employ every library available for converting data in a useful way. Since the data in this case is broken down into numerical values that the system can recognise easily, we try to import the numpy module, and to

present the data in graphs and charts, we utilised the Matplot library.

2) Load Dataset Module

The user attempts to load a dataset that has been obtained or collected from the KAGGLE Repository in this module. The dataset names are stored here as "alzheimers-dataset-4-class-of-pictures.rar"; this dataset provides a collection of images of the human brain.

3) Data Pre-Processing Module

In this section, we try to perform a pre-processing operation on the input dataset to identify any missing values or incomplete data. In the event that such data are included in the dataset, the programme will disregard them and only load the relevant data. In this application, all input images will be taken as MRIs; no other images will be used as input images

4) Train the Model Using Inception V3

Here, we attempt to train the existing model using the Inception v3 model to identify the best algorithms for properly and efficiently identifying and classifying the input information. The goal is to determine which algorithms are most effective at predicting the onset of Alzheimer's disease. Here, we attempt to forecast Alzheimer's disease and the class to which it belongs using the Inception V3 algorithm.

5) Result Analysis Module

Here in this module we try to compare the given dataset by using inception V3 model and check the data comes under which following category such as :

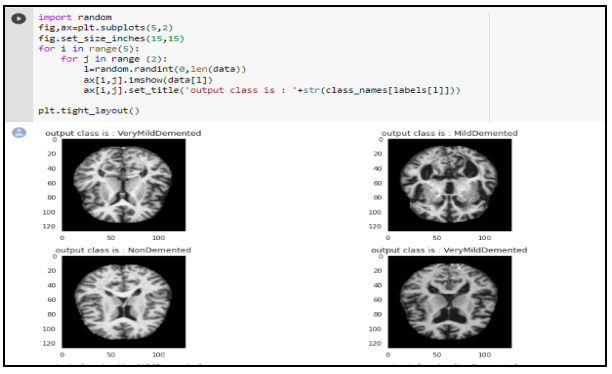
1. VeryMildDemented
2. NonDemented
3. MildDemented
4. ModerateDemented

Here we can able to extract the following case by examining the records.

5. EXPERIMENTAL RESULTS

In this section we try to design our current model using Python as programming language and we used Google Collab as working environment for executing the application. Now we can check the performance of our proposed application as follows:

INPUT TEST DATA



The above window clearly represents the input is taken.

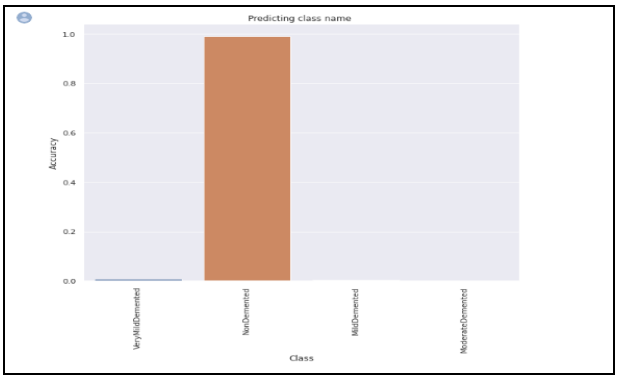
APPLY INCEPTION V3

From the above window we can see inception V3 is applied.

CONFUSION MATRIX

From the above window we can clearly see the confusion matrix is generated based on input.

PREDICTION



From the above window we can clearly see the list of alzeimers patient and normal patient details.

6. CONCLUSION

The automatic AD identification technique described in this research is based on deep learning using 3D brain MRI. For AD recognition, the programme makes use of a convolutional neural network (CNN). It is distinctive in that AD detection is correct since the entire 3D topography of the brain is taken into account. Three successive groups of processing layers, two fully connected layers, and a classification layer make up the CNN employed in this study. Each of the three groups in the structure is composed of three layers: a convolutional layer, a pooling layer, and a normalisation layer. The Alzheimer's Disease Neuroimaging Initiative's MRI data were used to train and evaluate the algorithm. The data used comprised the MRI scans of 34 healthy controls and approximately 47 AD patients. According to the results of the trial, the suggested algorithm had a high accuracy of AD recognition with a sensitivity of 1 and a specificity of 0.93. Future research will look for more effective data processing and CNN structures and test them on a larger number of examples.

7. REFERENCES

[1] Alzhemer's Australia. https://fightdementia.org.au/

[2] Arnold, L., Rebecchi, S., Chevallier, S. and Paugam-Moisy, H. (2011) An Introduction to Deep Learning. ESANN 2011 Proceedings , European Symposium on Artificial Neural Networks , Computational Intelligence and Machine Learning, Bruges, Belgium, 27-29 April 2011, 477-488.

[3] Najafabadi, M.M., Villanustre, F., Khoshgoftaar, T.M., Seliya, N., Wald, R. and Muharemagic, E. (2015) Deep Learning Applications and Challenges in Big Data Analytics. Journal of Big Data, 2, No.1. https://doi.org/10.1186/s40537-014-0007-7

[4] Liu, P., Su, S. and Chen, M. (2015) Deep Learning and Its Application to General Image Classification. International Conference on Informative and Cybernetics for Computational Social Systems (ICCSS), 7-10.

[5] Payan, A. and Montana, G. (2015) Predicting Alzheimer's Disease: A Neuroimaging Study with 3d Convolutional Neural Networks. arXiv preprint arXiv:1502.02506.

[6] Liu, S., Liu, S., Cai, W., Che, H., Pujol, S., Kikinis, R., Feng, D. and Fulham, M.J. (2015) Multimodal Neuroimaging Feature Learning for Multiclass Diagnosis of Alzheimer's Disease. IEEE Transactions on Biomedical Engineering , 62, 1132-1140.https://doi.org/10.1109/TBME.2014.2372011.

[7] Sarraf, S., Anderson, J. and Tofighi, G. (2016) Deep AD: Alzheimer's Disease Classification via Deep Convolutional Neural Networks Using MRI and fMRI. bioRxiv, p. 070441.

[8] Hosseini, E., Asl, R.K. and El Baz, A. (2016) Alzheimer's Disease Diagnostics by Adaptation of 3D Convolutional Network. IEEE International Conference on Image Processing (ICIP).

[9] The Alzheimer's Disease Neuroimaging Initiative (ADNI).http://www.adni-info.org/

[10] Krizhevsky, A., Sutskever, I. and Hinton, G.E. (2012) ImageNet Classification with Deep Convolutional Neural Networks. International Conference on Neural Information Processing Systems , 1097-1105.