IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

DETECTION OF ALZHEIMER'S DISEASE USING DEEP LEARNING

[1]Dr.Rejeesh Rayaroth, [2]Abhithesh Ramachandran, [3]Adithya Dinesh, [4]Aswan Krishnan, [5]Hemanth Suresh

[1]Assistant Professor, Mangalore Institute of Technology and Engineering, Moodbidre, Karnataka, India, [2]Student, Mangalore Institute of Technology and Engineering, Moodbidre, Karnataka, India, [3]Student, Mangalore Institute of Technology and Engineering, Moodbidre, Karnataka, India, [4]Student, Mangalore Institute of Technology and Engineering, Moodbidre, Karnataka, India, [5]Student, Mangalore Institute of Technology and Engineering, Moodbidre, Karnataka, India

Abstract: Millions of individuals throughout the world are afflicted with the progressive neurological ailment known as Alzheimer's disease. For Alzheimer's disease to be effectively treated and managed, early diagnosis is essential. . The ability of convolutional neural networks (CNNs) to identify Alzheimer's disease from medical pictures has shown considerable promise. CNN is a deep learning method that is frequently employed for pattern identification and picture analysis. In this approach, a CNN-based method for exploiting Magnetic Resonance Imaging (MRI) data to identify Alzheimer's disease is used. The dataset of MRI scans from people with Alzheimer's disease and healthy people are collected. To improve the picture quality and lower noise, the MRI scans undergo pre-processing. A CNN model is trained using the pre-processed pictures, and it is then tuned using fine-tuning methods. This CNN-based method for Alzheimer's disease detection may help doctors identify the condition early and begin therapy. The adoption of CNN models for Alzheimer's disease detection can increase diagnostic precision and lower visual interpretation variability. The method can assist in decreasing the expense and time involved in MRI scan interpretation, making it a more effective and economical method for detecting Alzheimer's disease.

Keywords - Alzheimer's disease, Ailment, Convolutional Neural Networks, Magnetic Resonance Imaging.

1. INTRODUCTION

Alzheimer's disease (AD) is a neurological ailment that worsens with time and causes short-term memory loss, psychosis, and delusional thoughts that are misdiagnosed as signs of stress or ageing. About 5.1 million Americans are afflicted by this disease. AD does not receive enough medical care. AD must be treated with medication consistently. Because AD is chronic, it can last for a long time or for the rest of your life. Therefore, in order to prevent significant brain damage, it is crucial to prescribe medication at the right time. Early diagnosis of this disease is a time-consuming and expensive process since we need to gather a lot of data, apply advanced algorithms for prediction, and include an expert physician. Automated systems can be employed in medical decision-making since they are more accurate than human judgement. Researchers have used MRI scans, biomarkers (chemicals, blood flow), and numerical data extrapolated from the MRI scans to analyze this disease based on prior studies on AD.As a result, they could tell if a person has Alzheimer's or not. Automating Alzheimer's diagnosis will decrease further human contact in addition to cutting down on diagnosis time. Automation also lowers overall expenses and yields more precise outcomes. For instance, by examining MRI images and using prediction tools, we may determine whether a patient has dementia.

In this work, we present an android application that allows detection and classification of Alzheimer's disease. Using MRI as inputs, we use a multi-layered CNN model to analyze the image and classify accordingly. A web interface is provided to the administrators to keep track of users (patients), add notes, and view prediction history. The android application is provided to the users for uploading MRI for disease prediction ,they can also add notes and important reminders.

2. NEED OF THE STUDY

The catastrophic effects of Alzheimer's disease on people, families, and society as a whole make research into the condition of highest importance. Alzheimer's is a neurological condition that worsens over time and affects memory, cognition, and behaviour severely impairing daily functioning. Alzheimer's disease prevalence is predicted to increase considerably as the world's population ages, creating a significant public health concern. It is essential to comprehend the underlying causes, risk factors, and mechanisms of Alzheimer's in order to create effective preventative plans, diagnostic tools, and specialized treatments. This area of study seeks to solve the riddles of the illness, identify biomarkers for early identification, consider potential pharmaceutical solutions, and enhance the quality of life for those with Alzheimer's and those who care for them. In the end, a thorough investigation of Alzheimer's disease is necessary to lessen its effects, ease the suffering of affected people, and advance the search for a solution.

3. LITERATURE REVIEW

"Region-Based Brain Selection and Classification on PET Images for Alzheimer's Disease Computer Aided Diagnosis", Imene Garali et al. [1]. This paper describe their methodology, which involves region-based brain selection and classification. They likely propose a technique to automatically identify and extract relevant brain regions from PET images that are indicative of Alzheimer's disease. This may involve techniques such as image segmentation or feature extraction to capture specific biomarkers or patterns associated with the disease.

The paper likely presents the classification model used for Alzheimer's disease diagnosis. The authors may employ machine learning algorithms or other statistical techniques to train a classifier using the extracted features from the PET images. They may discuss the choice of the classifier, its parameters, and the evaluation metrics used to assess its performance.

"Automatic classification of MR scans in Alzheimer's disease", S. Klöppel, C. M. Stonnington, C. Chu, B. Draganski, R. I. Scahill, J. D. Rohrer, N. C. Fox, C. R. Jack Jr, J. Ashburner and R. S. J. Frackowiak [2]. This paper outlines the process used, which probably entails taking pertinent information from the MR scans and training a classification model. The authors may have extracted structural or volumetric information from the brain scans using methods like voxel-based morphometry or other image processing techniques.

The study's findings are given, showing how well the automatic classification system can discriminate between those with Alzheimer's disease and healthy people based on MR scans. The authors might have used metrics like sensitivity, specificity, and total accuracy to assess the effectiveness of the categorization model.

"2012 Alzheimer's disease facts and figures", William Thies, Laura Bleiler [3]. This paper emphasizes the ageing population's role in the global burden of Alzheimer's disease. It talks about the estimated number of people affected by the disease and the expected rise in new cases over the next few years. Age, genetics, and lifestyle variables are all thoroughly investigated as risk factors for the condition.

The writers talk about how crucial it is to diagnose Alzheimer's disease correctly and early. They provide details on the many diagnostic tools that are available and emphasize the need for better diagnostic methods in order to support early intervention and treatment.

"Statistical Parametric Mapping: The Analysis of Functional Brain Images", Friston K., Ashburner J., Kiebel S., Nichols T., Penny W [4]. In this paper the practical application of SPM is studied in detail, outlining the precise steps for preprocessing and examining functional brain pictures. Techniques like smoothing, model specification, estimation, and statistical inference may be included in this. It may also involve spatial normalization. The book may also address more complex SPM subjects, including the modelling of temporal relationships, multi-subject or multi-session investigations, and the fusion of anatomical and functional data.

"The Alzheimer's Disease Neuroimaging Initiative: a review of papers published since its inception", M. W. Weiner et al [5]. This paper emphasizes noteworthy advancements in our understanding of Alzheimer's disease as well as key discoveries from the ADNI research articles. They could talk about how these discoveries affect illness monitoring, early diagnosis, and the creation of cutting-edge treatments.

Here insights on the approaches and procedures employed in the ADNI research, including cognitive testing, cerebrospinal fluid biomarkers, and structural and functional neuroimaging are discussed. The writers may talk about the benefits and drawbacks of these strategies and point out areas for further study and development.

"Discrimination of Alzheimer's disease using hippocampus texture features from MRI", J. Rajeesh, S.M Rama, S. Palinikumar and T. Gopalakhrisnan [6]. In this paper the discriminatory power of the hippocampus texture features in distinguishing between individuals with Alzheimer's disease and healthy controls is demonstrated. The authors may report the classification accuracy achieved by the proposed method and compare it with other existing approaches or studies conducted previously.

The potential clinical implications of using hippocampus texture features for Alzheimer's disease discrimination are likely discussed. The authors may highlight the potential of this approach for assisting in the early diagnosis or screening of Alzheimer's disease based on non-invasive MRI scans.

4. RESEARCH METHODOLOGY

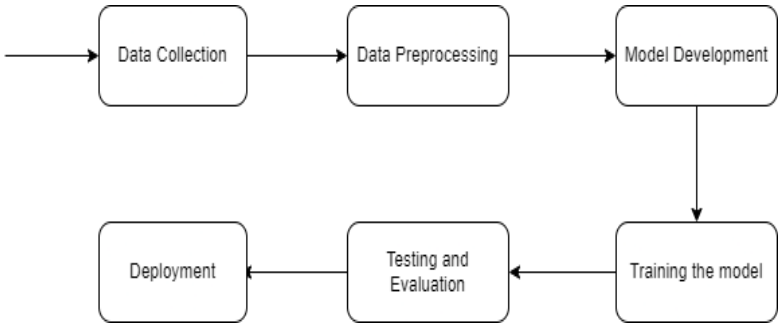

Fig1.Working of the Model

The methodology section outline the plan and method that how the study is conducted. This includes Universe of the study, sample of the study, Data and Sources of Data, study's variables and analytical framework. The details are as follows;

4.1 Data Collection

Collection of large dataset of MRI scans of brain images from patients diagnosed with Alzheimer's disease and healthy individuals. The dataset consisted of MRI scans classified to the four stages i.e. Non Demented, Mild Demented, Moderately Demented and Severely Demented.

4.2 Data Pre-processing

Pre-process the data by resizing and grey scaling the data in order to ensure the data is in a suitable format for the deep learning model.

4.3 Model Development

Develop a deep learning model that can classify Alzheimer's disease accurately. Here we used the CNN model that takes image as an input in order to predict and classify the image. The CNN model consists of several convolutional layers, pooling layers, and fully connected layers. The number of filters, kernel size, and stride length can be adjusted in each convolutional layer to achieve optimal performance.

4.4 Training the model

This step involves tuning the hyper parameters of the model, such as the learning rate, number of layers, and number of filters in each layer, to achieve the best possible performance.

4.5 Testing and evaluation

Evaluate the performance of the CNN model against a separate test dataset. Use standard evaluation metrics such as accuracy, precision to measure the performance of the model.

4.6 Deployment:

Once the CNN model has been trained and evaluated, deploy it into a system that can be used to detect Alzheimer's disease in new patients. An android application is provided to users to upload the MRIs which is tested against the model and result is predicted.

Fig 2. Model accuracy after training

5. RESULTS AND DISCUSSION

Output of this approach is an application that allows users to upload MRIs and have it predict the appropriate results with great accuracy along with other functionalities like reminders, notes et cetera, and a web interface is provided for users with admin access which allows for special functionalities like viewing notes, prediction history, et cetera.

Fig 3. Prediction of very mild dementia

Fig 4. Prediction of moderate dementia

Fig 5. Prediction of mild dementia

Fig 6. Prediction of non-dementia

6. CONCLUSION

Conventional Alzheimer's detection techniques may have limited accuracy and lack of sensitivity resulting in irregular detection of subtle changes in the brain in early stages of the disease with CNN we can automatically extract and analyze complex features from medical imaging data reducing the need for manual interpretation and potentially.

REFERENCES

[1] I. Garali, M. Adel, S. Bourennane and E. Guedj, "Region-based brain selection and classification on pet images for Alzheimer's disease computer aided diagnosis," 2015 IEEE International Conference on Image Processing (ICIP), Quebec City, QC, Canada, 2015, pp. 1473-1477, doi: 10.1109/ICIP.2015.7351045.

[2] S. Klöppel, C. M. Stonnington, C. Chu, B. Draganski, R. I. Scahill, J. D. Rohrer, N. C. Fox, C. R. Jack Jr, J. Ashburner and R. S. J. Frackowiak, "Automatic classification of MR scans in Alzheimer's disease, " Brain, vol. 131, no. 3, pp. 681-689, 2008.

[3] W. Thies and L. Bleiler, "2012 Alzheimer's disease facts and figures," Alzheimer's & Dementia, vol. 8, no. 2, pp. 131-168, 2012.

[4] K. Friston, J. Ashburner, S. Kiebel, T. Nichols, and W. Penny, "Statistical Parametric Mapping: The Analysis of Functional Brain Images," in IEEE Transactions on Medical Imaging, vol. 22, no. 12, pp. 1530-1553, Dec. 2003

[5] M. W. Weiner, A. Aisen, L. Jack Jr., P. Jagust, W. Jagust, J. R. Trojanowski, and A. Shaw, "The Alzheimer's Disease Neuroimaging Initiative: A Review of Papers Published Since Its Inception Alzheimers Dement, vol. 8, pp. 61-68, 2012.

[6] J. Rajeesh, S.M. Rama, S. Palinikumar, and T. Gopalakhrisnan, "Discrimination of Alzheimer's disease using hippocampus texture features from MRI," in Asian Biomedicine Vol. 6 No. 1 February 2012; pp. 87-94, doi: 10.5372/1905-7415.0601.131