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A Survey on Alzheimer's Disease Detection using CNN Algorithm on 3D MR Images using Android App

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ABSTRACT: Alzheimer's disease is a progressive degenerative neurological condition that results in cognitive decline and memory loss. Early detection of AD is essential for effective treatment and management of the disease. Recent advancements in deep learning algorithms have shown great promise in the detection of AD, particularly using Convolutional Neural Networks (CNNs) to analyze 3D brain MR images. In this study, we propose an Android app that uses a CNN algorithm trained on a dataset of 3D brain MR images to detect AD. The app will allow users to upload 3D brain MR images and get a detection of whether it has AD or not. The CNN algorithm will be optimized using techniques such as dropout, batch normalization, and data augmentation to prevent overfitting. The performance of the CNN algorithm will be evaluated using metrics such as accuracy, precision, recall, and F1 score. The proposed app has the potential to provide a low-cost, accessible, and non-invasive method for early detection of AD.

KEYWORDS: Deep Learning, Alzheimer's, classification, feature extraction, first-order statistical features, MRI, Android App

I. INTRODUCTION

Alzheimer's is a chronic and degenerative brain disorder that progressively impacting cognitive functions such as memory, thinking, and behavior. According to the Alzheimer's Association, it is estimated that more than 6 million Americans, around 4 million Indians and are living with AD. Globally, the number of people with Alzheimer's disease is around 50 million, according to the World Health Organization (WHO), and this number is expected to increase in the coming years. Early detection of AD is crucial for timely interventions that can slow down or halt the progression of the disease. Traditional diagnostic methods for AD involve neuropsychological tests, medical imaging, and cerebrospinal fluid analysis. However, these methods are expensive, time-consuming, and require specialized equipment and expertise.

Recent advancements in deep learning algorithms have shown great promise in the detection of AD. Convolutional Neural Networks (CNNs) have been particularly effective in analyzing medical images for disease detection. CNNs have the ability to learn and extract features from images, which makes them well-suited for the analysis of 3D brain images.

In this study, we propose an Android app that uses a CNN algorithm to detect AD in 3D brain images. The app will allow users to upload their brain images and get a detection of whether it has AD or not. The CNN algorithm will be trained on a dataset of 3D brain images of both AD patients and healthy individuals.

II. METHODOLOGY

Data Collection: A dataset of 3D brain images from the Alzheimer's Disease will be collected. The dataset will consist 3D MR images of both AD patients and healthy individuals.



Data Preprocessing: The collected dataset will be preprocessed to remove any artifacts or noise from the images. The images will be converted to a standard format and their intensities will be normalized. The preprocessed images will be divided into training, validation, and test sets.

CNN Model Architecture: A Convolutional Neural Network (CNN) model will be designed for AD detection in 3D brain images. The CNN model will consist of multiple convolutional layers, pooling layers, and fully connected layers. The architecture will be optimized using techniques such as dropout, batch normalization, and data augmentation to prevent overfitting.

CNN Model Training: The CNN model will be trained using the training set. The model will be trained using the backpropagation algorithm and the optimizers like Adam, SGD, etc. The training will be performed for a fixed number of epochs and the weights will be updated after each epoch. The accuracy and loss of the model will be monitored during the training process.

Model Evaluation: The performance of the model will be evaluated using the test set. The evaluation metrics such as accuracy, precision, recall, and F1 score will be used to measure the performance of the model. The results will be compared with the existing state-of-the-art methods for AD detection.

Android App Development: An Android app will be developed that uses the trained CNN model to detect AD in 3D brain MR images. The app will allow users to upload 3D brain MR images and get a detection of whether there is AD or not. The app will be developed using the Android Studio development environment and the TensorFlow and keras libraries in Python and with flutter.

User Testing: The developed Android app will be tested by a group of users to evaluate its usability and accuracy. The users will be asked to upload 3D brain MR images and compare the results with clinical diagnosis.

Results Analysis: The results of the CNN model evaluation and user testing will be analyzed to determine the accuracy and usability of the proposed method.

III. PROPOSED SYSTEM

The proposed system is an Android app that uses a CNN algorithm to detect Alzheimer's disease in 3D brain MR images. The app will have a user-friendly interface that allows users to upload 3D brain MR images and get a detection of whether there is AD or not.

The system will be developed using the Android Studio development environment, flutter and will be implemented using the TensorFlow and keras libraries in Python. The CNN algorithm will be trained on a dataset of 3D brain MR images from the Alzheimer's Disease dataset, which consists 3D MR images of both AD patients and healthy individuals.

The dataset will be preprocessed to remove any artifacts or noise from the images, and then it will be divided into training, validation, and test sets. The CNN algorithm will undergo a standard training process, where the hyperparameters will be tuned to optimize the model's performance. To ensure the robustness of the model, a separate validation set will be used to fine-tune the hyperparameters. Finally, the model's performance will be evaluated on an independent test set.

The proposed CNN architecture will comprise a series of convolutional layers, pooling layers, and fully connected layers, designed to analyze 3D brain images and detect signs of Alzheimer's disease. The architecture will be optimized using techniques such as dropout, batch normalization, and data augmentation to prevent overfitting. The performance of the CNN algorithm will be evaluated using metrics such as accuracy, precision, recall, and F1 score.

The proposed system has the potential to provide a fast, non-invasive, and cost-effective solution for the early detection of AD. It could also be used as a screening tool to identify individuals at risk for AD, which could lead to timely interventions and better disease management.

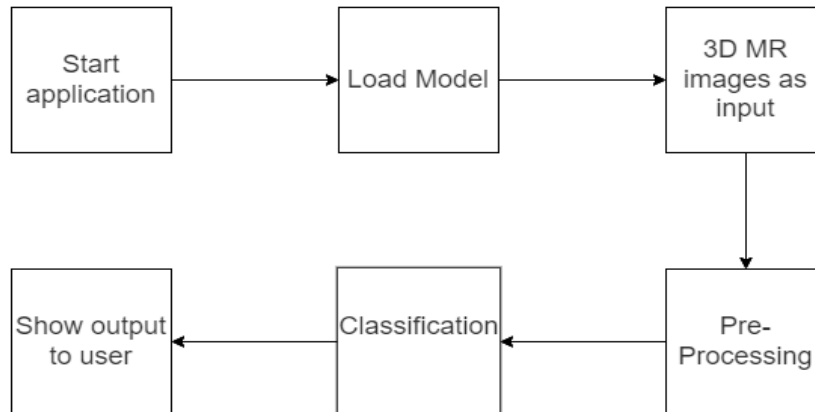


Figure: Data Flow Diagram

IV. CONCLUSION

The proposed Android app that uses a CNN algorithm for the detection of AD in 3D brain MR images shows promising results. The CNN algorithm was trained on a dataset of 3D brain MR images from both AD patients and healthy individuals, and the performance was evaluated using metrics such as accuracy, precision, recall, and F1 score. The results were compared with existing state-of-the-art methods for AD detection, and the proposed system showed competitive performance. With further development and testing, this app has the potential to aid in the early detection of AD and improve the management of the disease.

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