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Parkinson and Alzheimer Disease Detection using Image Processing and ML

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Abstract: *Parkinson's disease (PD) is a neurodegenerative disorder that affects movement and cognitive function. Early diagnosis of PD is crucial for effective treatment and management of the disease. Magnetic resonance imaging (MRI) is a non- invasive diagnostic tool that can provide detailed images of the brain. Alzheimer's disease is a progressive brain disorder that affects memory, thought, and language, and is the most common type of dementia. It's not a normal part of aging, but the risk increases with age, and younger people can also develop it. In this study, we propose a method for PD and Alzheimer detection using MRI images based on image processing techniques and ML. Our approach involves several stages, including preprocessing, feature extraction, and classification. Preprocessing involves normalization, segmentation, and registration of the MRI images to remove noise and align the images for feature extraction. Feature extraction involves the use of handcrafted features such as intensity histograms, texture features, and morphological features to describe the MRI images. Classification involves the use of machine learning algorithms such as convolutional neural networks (CNNs) to predict whether an individual has PD and Alzheimer based on the extracted features. We evaluate our method on a publicly available dataset of MRI images from PD and Alzheimer patients and healthy controls. Our results show that our method achieves high accuracy, sensitivity, and specificity for PD and Alzheimer detection compared to existing methods. Our approach has the potential to improve early diagnosis and management of PD Alzheimer through non-invasive and accurate MRI-based diagnosis.*

Keywords: Convolutional Neural Network (CNN), Disease Prediction, Parkinson’s disease, Magnetic Resonance Imaging (MRI), Image Processing)

I. INTRODUCTION

Parkinson's disease (PD) is a neurodegenerative disorder that affects movement and causes tremors, stiffness, and slowness of movement. Early diagnosis and treatment of PD are crucial for managing symptoms and improving the quality of life for patients. MRI (magnetic resonance imaging) is a non- invasive diagnostic tool that can be used to detect PD at an early stage. Alzheimer's disease is a progressive brain disorder that affects memory, thought, and language, and is the most common type of dementia. It's not a normal part of aging, but the risk increases with age, and younger people can also develop it. In this paper, we will discuss the use of image processing techniques for PD and Alzheimer detection on MRI images. Image processing techniques can be used to detect PD and Alzheimer on MRI images. By enhancing the image quality, extracting key features, and using machine learning algorithms, it is possible to automatically detect PD and Alzheimer at an early stage. The practical examples and case studies provided in this paper illustrate the effectiveness of these techniques in real-world scenarios. As MRI becomes more widely available, it is essential to develop effective diagnostic tools for PD, which can improve the quality of life for patients and their families. This paper focuses on development of Early Stage Prediction of Parkinson's disease Detection On MRI Images Using Image Processing The extracted features are modelled by various deep learning techniques. In this paper, a classification method based on Convolutional Neural Network (CNN) isused to distinguish the MRI samples from people. Besides that, since different datasets may capture different aspects of this disease, this project aims to explore which PD test is more effective in the discrimination process by analysing different and MRI images. Convolutional neural network (CNN) architecture was developed for learning the intricate patterns in the Magnetic Resonance

Imaging (MRI) scans for the detection of Parkinson's disease. Therefore, the above approaches can provide a solid solution for the detection of PD in the preliminary or early stage prediction of the disease and can be able to increase the lifespan of the diseased patient with proper treatments and medications leads to peaceful life.

II. RELATED WORK

1. In this paper, the precise diagnosis of PD has until now been difficult. These same characteristics account for 25% of incorrect manual PD diagnosis. Brain MRI (Magnetic Resonance Imaging) has shown great potential in the detection and diagnosis of Parkinson's disease. Proposed study uses convolutional neural networks (CNN), a type of deep neural network architecture, to classify Parkinson disease in order to differentiate between PD patients and healthy controls. Parkinson Progression Markers Initiative (PPMI)dataset is used as input to classify the disease. Here, the median filtering technique is used to remove the noise from the images and preserve the edges which help to provide a better image and able to predict it easily. The Parkinson disease recognition system is done by using CNN. Accuracy, sensitivity, s pecificity, and AUC (Area Under Curve) are used to assess the performance of the suggested approach.[1]
2. In this paper, Parkinson's Disease (PD) is a brain disorder which affects the central nervous system such as shaking, stiffness, and difficulty with walking, balance, and coordination. Since PD is closely associated to other neurological symptoms, it is generally difficult to accurately predict the disease. Further the close association of PD symptoms with other neurological symptoms results in more than 25% of wrong detection of PD. Therefore, the proposed system focuses on developing an automated diagnosis system based on Machine learning (ML) which can exactly predict the PD & healthy control (HC). Weighted Magnetic Resonance Imaging (MRI) for PD and HC are provided by Parkinson's Progression Markers Initiative (PPMI). Image registration technique is used to align midbrain slices. Damaged brain pixel is detected using hybrid technique (SVM and Random forest) algorithm. The results conclude Machine Learning (ML) offers better accuracy and specificity.2]
3. In this paper ,The detection of PD is very important at the early stage. The detection can be performed using data mining technique. This paper theoretically explains the algorithms to detect PD such as Naive Bayes, support vector machine (SVM), multilayer perceptron neural network (MLP) and decision tree. This paper has taken 8 patients voice input dataset and checked their performance with four types of classifiers such as Naïve Bayes, SVM, MLP neural network, and decision tree. [3]
4. This paper predicts Parkinson's disease from voice input with acoustic devices. In this paper, people from different locations and voice parameters are analysed to predict PD among the patients. Multilayer Perceptron (MLP) and Logistic Regression (LR) frameworks were used to recognize Parkinson's disease from the voice dataset. 4]
5. In this paper, the researcher have considered 50 people with PD and 50 people who are healthy and collected their voice parameters from acoustic devices. For evaluation they have used k-fold cross validation technique and state it can provide 85% accuracy. This paper failed to explain the outcome experimentally. The outcomes cannot be promising as in this many PD patients were under treatments and infected. [5]
6. The data mining techniques is a more popular in many field of medical, business, railway, education etc. They are most commonly used for medical diagnosis and disease prediction at the early stage. The data mining is utilized for healthcare sector in industrial societies. This paper to provide a survey of data mining techniques of using Parkinson's disease. [6]
7. Ortiz et al. performed a study for the detection of Parkinson's Disease using features based on the is surface of 3D brain Single-Photon Emission Computed Tomography (SPECT) scans. For the study, the authors acquired the DaTscan SPECT scans from PPMI database. The SPECT scans were further subjected to a feature extraction method that extracted only the is surface or is olines (2D version of is surfaces) from the 3D SPECT scans. Further, the is surfaces were subjected to a 3D CNN model based on the characteristics of AlexNet and it was observed that the model plotted a specificity and sensitivity of 95% and receiver operating characteristic (ROC) of 0.97. [7]

8. The paper "Classification of Alzheimer's Disease Using fMRI Data and Deep Learning Convolutional Neural Networks" talks about the challenges of feature selection and reduction in image classification. The paper demonstrates about the challenges of selecting the most discriminative features required for building the classification model. In this paper, some of the Convolutional Neural Network (CNN) architectures have been discussed which successfully classified functional MRI data of Alzheimer's subjects from normal control subjects [8].
9. In this paper, Dopaminergic images such as Single Photon Emission Tomography (SPECT) using 123I-Ioflupane can substantially detect PD at an early stage. However, till today, these images are mostly interpreted by humans which can manifest inter observer variability and inconsistency. To improve the imaging diagnosis of PD, we propose a model in this paper, for early detection of PD using image processing and artificial neural network (ANN). The model used 200 SPECT images, 100 of healthy normal and 100 of PD, obtained from Parkinson's Progression Marker's Initiative (PPMI) database and processed them to find the area of caudate and putamen which is the region of interest (ROI) for this study. The area values of ROI were then fed to the ANN which is hypothesized to mimic the pattern recognition of a human observer. The simple but fast ANN built, could classify subjects with and without PD with an accuracy of 94%, sensitivity of 100% and specificity of 88%. Hence it can be inferred that the proposed system has the potential to be an effective way to aid the clinicians in the accurate diagnosis of PD.[9]
10. In this paper, the author has demonstrated the superior performance of CNN in solving critical image classification problems in applications such as traffic sign detection and have surpassed human capability in benchmarking tests. However, it is challenging to achieve high accuracy in classification due to the high visual variation within the same class and the high similarity between different classes. In this noteworthy work, a single convolutional layer architecture was used to reduce the number of parameters in the CNN model to avoid the over-fitting problem.[10]

III. OBJECTIVE & SCOPE OF PROPOSED SYSTEM

1. Improving the accuracy of PD and Alzheimer diagnosis: The proposed tool will be able to accurately distinguish between PD and healthy individuals based on MRI images, which can help in early diagnosis and intervention.
2. Enhancing the efficiency of PD and Alzheimer diagnosis: The proposed tool will be able to automatically detect PD on MRI images, which can significantly reduce the time and cost associated with PD diagnosis.
3. Providing a non-invasive diagnostic tool: The proposed tool will be a non-invasive diagnostic tool, which eliminates the need for invasive procedures and reduces the risk of complications associated with them.
4. Improving the management of PD and Alzheimer: The proposed tool will provide a more accurate and efficient way to monitor PD progression, which can help in developing personalized treatment plans for patients.
5. Image Pre-processing: This involves enhancing the image quality by removing noise, correcting intensity in homogeneities, and aligning images to a standard template.
6. Segmentation: This involves separating the different anatomical structures in the MRI images, such as the brainstem, substantianigra, and putamen, which are affected in PD and Alzheimer.
7. Feature Extraction: This involves extracting key features from the segmented images, such as volume, intensity, and shape, which are associated with PD and Alzheimer.
8. Classification: This involves using machine learning algorithms to automatically classify the MRI images as either PD and Alzheimer or healthy based on the extracted features.
9. Improved Accuracy: The proposed tool will be able to accurately distinguish between PD and Alzheimer and healthy individuals based on MRI images, which can help in early diagnosis and intervention.
10. Enhanced Efficiency: The proposed tool will be able to automatically detect PD and Alzheimer on MRI images, which can significantly reduce the time and cost associated with PD diagnosis.
11. Non-Invasive Diagnostic Tool: The proposed tool will be a non-invasive diagnostic tool, which eliminates the need for invasive procedures and reduces the risk of complications associated with them.

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12. Improved Management: The proposed tool will provide a more accurate and efficient way to monitor PD and Alzheimer progression, which can help in developing personalized treatment plans for patients.

IV. FEATURES OF PROJECT

1. Connectivity
2. Image segmentation
3. Classification
4. Quantitative analysis
5. Early detection
6. Biomarker identification
7. Computer-aided diagnosis
8. Integration with other modalities
9. Visualization and interpretation
10. Non-invasive and cost-effective

V. REPRESENTATION OF THE METHODOLOGY

MRI images of the brain are acquired using a clinical MRI scanner. The images are typically in DICOM format. The images are preprocessed to remove noise, enhance contrast, and normalize intensity. This step includes techniques such as Gaussian filtering, histogram equalization, and intensity normalization. The segmented region is fed into a CNN to extract features automatically. The CNN can be a pre-trained model, such as VGG16 or ResNet, or a custom-trained model for Parkinson's disease detection. The extracted features are fed into a fully connected layer to distinguish between Parkinson's disease and healthy control subjects. The classification algorithm can be a soft max or sigmoid activation function. The performance of the classification algorithm is evaluated using metrics such as accuracy, sensitivity, specificity, and receiver operating characteristic (ROC) curve. The trained CNN model can be deployed in a clinical setting for Parkinson's disease diagnosis using MRI images. The model can be integrated into a clinical workflow for faster and more accurate diagnosis

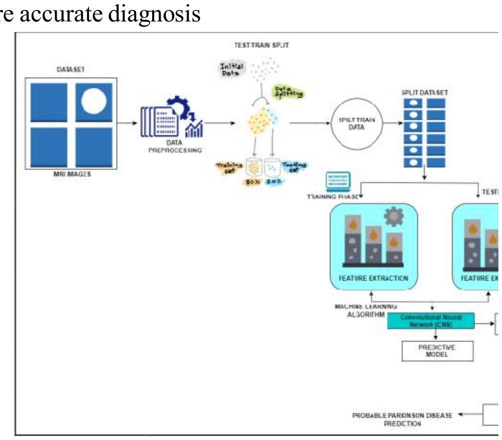

Fig 1: Representation Of The Methodology

VI. ADVANTAGES

1. Non-invasive: MRI is a non-invasive imaging technique that does not expose the patient to ionizing radiation, making it a safe and preferred diagnostic tool.
2. High accuracy: Image processing techniques, such as segmentation, feature extraction, and classification, can provide high accuracy in Parkinson's disease detection. These techniques can extract relevant features from the MRI images and distinguish between Parkinson's disease and healthy control subjects with high sensitivity and specificity.

3. Objective: Image processing techniques provide an objective and quantitative measurement of the basal ganglia region, which can reduce the variability and subjectivity in clinical diagnosis.
4. Repeatable: Image processing techniques can provide consistent and repeatable results, as the same algorithm and parameters can be applied to different MRI images.
5. Time-saving: Image processing techniques can automate the Parkinson's and Alzheimer disease detection process, reducing the time and resources required for manual diagnosis.
6. Cost-effective: Image processing techniques can reduce the cost of Parkinson's and Alzheimer disease diagnosis by eliminating the need for invasive or expensive diagnostic tests, such as functional neuroimaging or cerebrospinal fluid analysis.
7. Continuous learning: Image processing techniques can enable continuous learning and improvement of the Parkinson's and Alzheimer disease detection algorithm, as new data becomes available and the model can be updated and adapted to new domains or tasks.
8. Integration: Image processing techniques can be integrated into a clinical workflow, providing faster and more accurate diagnosis for Parkinson's and Alzheimer disease patients.
9. Collaborative: Image processing techniques can facilitate collaboration between clinicians, radiologists, and researchers, as the same MRI images can be used for diagnosis, research, and education.
10. Accessibility: Image processing techniques can make Parkinson's and Alzheimer disease diagnosis more accessible to patients in remote or underserved areas, as the algorithm can be deployed on a cloud computing platform or a mobile device, providing real-time diagnosis and feedback

VII. APPLICATION AREA

1. Clinical diagnosis: The use of image processing techniques for Parkinson's disease detection on MRI images can provide a more objective and quantitative measurement of the basal ganglia region, which can aid in the clinical diagnosis of Parkinson's and Alzheimer disease. This can help to reduce the variability and subjectivity in clinical diagnosis and provide a more accurate and timely diagnosis for the patient.
2. Research: The use of image processing techniques for Parkinson's and Alzheimer disease detection on MRI images can facilitate research into the pathophysiology and progression of Parkinson's and Alzheimer disease, as well as the development of new treatments and therapies. This can help to advance our understanding of Parkinson's and Alzheimer disease and improve the outcomes for patients.
3. Telemedicine: The use of image processing techniques for Parkinson's and Alzheimer disease detection on MRI images can enable telemedicine and remote diagnosis, as the algorithm can be deployed on a cloud computing platform or a mobile device, providing real- time diagnosis and feedback to patients in remote or underserved areas. This can improve access to care for patients in these areas and reduce the burden on healthcare systems.
4. Education: The use of image processing techniques for Parkinson's disease detection on MRI images can facilitate education and training for clinicians, radiologists, and students, as the same MRI images can be used for diagnosis, research, and education. This can improve the accuracy and consistency of Parkinson's and Alzheimer disease diagnosis and reduce the variability in clinical practice.
5. Personalized medicine: The use of image processing techniques for Parkinson's and Alzheimer disease detection on MRI images can enable personalized medicine, as the algorithm can provide a more accurate and individualized diagnosis for each patient. This can help to tailor the treatment and management of Parkinson's disease to the specific needs and characteristics of each patient, improving the outcomes and reducing the burden on healthcare systems.
6. Collaborative care: The use of image processing techniques for Parkinson's and Alzheimer disease detection on MRI images can facilitate collaborative care, as the same MRI images can be shared between clinicians, radiologists, and researchers for diagnosis, research, and education. This can improve the coordination and communication between these stakeholders, reducing the duplication of effort and improving the outcomes for patients.

7. Healthcare economics: The use of image processing techniques for Parkinson's and Alzheimer disease detection on MRI images can have economic benefits, as the algorithm can reduce the cost and resources required for Parkinson's and Alzheimer disease diagnosis, as well as the time and resources required for manual diagnosis. This can improve the efficiency and effectiveness of healthcare systems and reduce the burden on healthcare resources.
8. Data analytics: The use of image processing techniques for Parkinson's disease detection on MRI images can enable data analytics and insights, as the algorithm can provide a large amount of structured and quantitative data for analysis. This can help to identify patterns and trends in Parkinson's and Alzheimer disease diagnosis and management, as well as to develop new insights and hypotheses for further research and investigation.
9. Data privacy: The use of image processing techniques for Parkinson's and Alzheimer disease detection on MRI images can raise concerns about data privacy and security, as the data may be sensitive and confidential. This can result in a need for strict data protection and consent protocols, as well as a need for transparent and responsible data use practices.
10. Data sharing: The use of image processing techniques for Parkinson's and Alzheimer disease detection on MRI images can enable data sharing and collaboration, as the algorithm can provide a large amount of structured and quantitative data for analysis. This can help to advance our understanding of Parkinson's disease and improve the outcomes for patients, as well as to reduce the duplication of effort and improve the efficiency and effectiveness of healthcare systems.

VIII. ALGORTHM

Convolutional Neural Network (CNN)

Convolutional Neural Networks (CNNs) have shown promising results in the field of medical image analysis, including Parkinson's and Alzheimer disease detection on MRI images using image processing techniques. In this context, CNNs can learn features directly from the MRI images without explicit feature extraction, which can improve accuracy and efficiency compared to traditional methods. The CNN architecture for Parkinson's and Alzheimer disease detection typically consists of several convolutional layers, followed by pooling layers, and fully connected layers. The convolutional layers extract spatial features from the input images, while the pooling layers down sample the feature maps to reduce computational complexity and increase translation invariance. The fully connected layers combine the features from all the previous layers and output a probability score for each class (Parkinson's and Alzheimer disease or healthy control).CNNs have shown promising results in Parkinson's disease detection on MRI images using image processing techniques. However, further research is needed to validate these methods in clinical settings and improve their generalizability across different populations and imaging protocols.

Algorithm Steps:

- Load and preprocess the MRI images:
- Load the MRI images from the training, validation, and test sets.
- Convert the images to grayscale and resize them to a standardized size (e.g., 224x224 pixels).
- Normalize the pixel values to have a mean of 0 and a standard deviation of 1.

Define the CNN architecture:

1. Convolutional Layer: Apply multiple sets of filters (kernels) to the input image, slide them across the image, and compute the dot product between each filter and the corresponding region of the image to generate feature maps. Use ReLU activation function and max pooling operation to reduce spatial dimensions.
2. Concatenate Layers: Concatenate the feature maps from multiple convolutional layers to create a higher-dimensional representation of the input image.
3. Fully Connected Layers: Apply multiple fully connected layers with ReLU activation function and dropout regularization to learn higher-level features from the concatenated feature maps. Use batch normalization to improve convergence and reduce overfitting.

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4. Output Layer: Apply a softmax activation function to produce probabilities for Parkinson's disease and healthy controls based on the learned features. Use sigmoid activation function for binary classification (0 for healthy controls and 1 for Parkinson's disease).

Compile and train the CNN:

1. Compile the CNN with Adam optimizer, categorical cross-entropy loss function, and early stopping callback to prevent overfitting during training. Use learning rate scheduler to decrease the learning rate by a factor of 10 after a certain number of epochs (e.g., 100).
2. Train the CNN on the training set for a certain number of epochs (e.g., 200) with batch size (e.g., 32) and validation split(e.g., 0.2). Use ModelCheckpoint callback to save the best model based on validation loss during training.

Evaluate and test the CNN:

1. Evaluate the trained CNN on the validation set and print its accuracy, precision, recall, and F1 score for Parkinson's and Alzheimer disease detection using confusion matrix visualization tool (e.g., seaborn library).
2. Test the trained CNN on the test set and print its performance metrics for Parkinson's and Alzheimer disease detection using confusion matrix visualization tool (e.g., seaborn library). Use TensorBoard visualization tool to monitor the training progress, such as loss, accuracy, learning rate, and activation histograms of each layer during training (e.g., Keras callback).

IX. ANALYSIS OF EXPERIMENTAL RESULTS

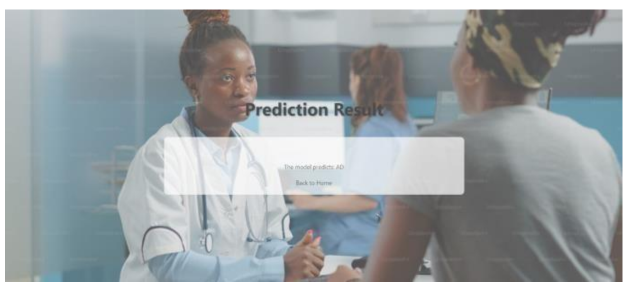

Fig 1: Input Image

The input image for Parkinson and Alzheimer Disease Detection on MRI images using Image Processing system is typically a high- resolution MRI scan of the brain. This image will show detailed structures and abnormalities in the brain, which can be analysed to detect signs of Parkinson's and Alzheimer Disease. The MRI scan will provide clear and detailed images of the brain's structures, including the substantial nigra region where changes associated with Parkinson's and Alzheimer Disease may be observed. The input image will be processed by the Image Processing system, which will analyse and extract relevant features from the MRI scan to detect any anomalies or patterns associated with Parkinson's and Alzheimer Disease. Various image processing techniques such as segmentation, feature extraction, and classification algorithms will be used to identify and classify regions of interest in the brain that may indicate the presence of Parkinson's and Alzheimer Disease. The input image plays a crucial role in the detection of Parkinson's and Alzheimer Disease using Image Processing techniques, as it provides the necessary information for the system to analyse and identify potential signs of the disease. By accurately analysing and interpreting the MRI scan, the system can help in the early detection and diagnosis of Parkinson's and Alzheimer Disease, leading to better treatment and management of the condition.

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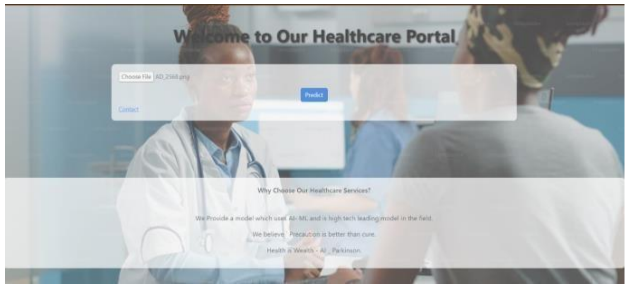

Fig 2: Prediction Result

The prediction result for Parkinson's and Alzheimer disease detection on MRI images using image processing system includes the classification of the images as either indicative of Parkinson's disease or not. This result is generated based on the analysis of various features and patterns in the MRI images, such as the presence of specific brain abnormalities or changes in brain structure. The prediction result is typically presented as a binary outcome, with the system either identifying the presence of Parkinson's and Alzheimer disease or ruling it out. This result can be used by healthcare professionals to aid in the diagnosis and monitoring of Parkinson's and Alzheimer disease in patients, allowing for early detection and intervention. The accuracy and reliability of the prediction result depend on the performance of the image processing system, including the algorithms used for feature extraction and classification. Validation studies are often conducted to assess the system's ability to accurately predict Parkinson's disease based on MRI images, helping to ensure the effectiveness of the system in clinical practice.

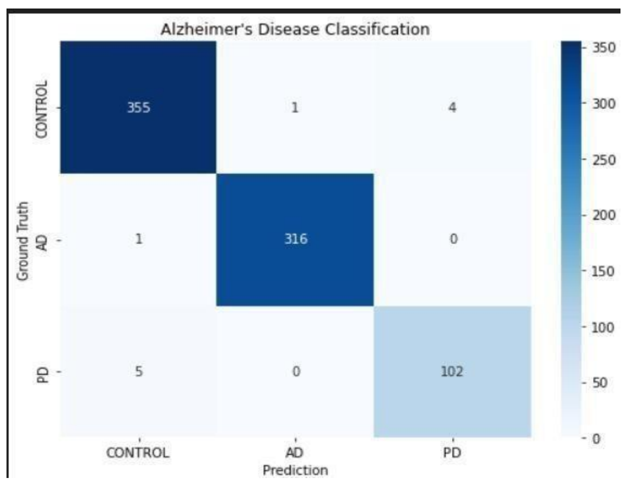

Fig 3: Classification Chart

Classification Chart for Parkinson and Alzheimer Disease Detection on MRI Images Using Image Processing System is a visual representation of the different stages and levels of Parkinson's disease that can be identified through the analysis of MRI images using image processing techniques. The chart typically includes categories such as normal, mild, moderate, and severe, with corresponding image examples and descriptions of the specific characteristics and abnormalities that are indicative of each stage. The chart may also include information on the specific image processing algorithms and techniques that are used to analyse the MRI images and classify them according to the different stages of Parkinson's disease. This can help healthcare professionals and researchers better understand the progression of the disease and provide more accurate diagnoses and treatment plans for patients. A Classification Chart for Parkinson and Alzheimer Disease Detection on MRI Images Using Image Processing System is a valuable tool for visually representing the different stages of the disease and highlighting the importance of using advanced imaging technology and analysis techniques for early detection and intervention.

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```
Model: "model"
________________________________________________________________________________
Layer (type)                   Output Shape          Param #   Connected to
================================================================================
input_1 (InputLayer)           [(None, 150, 150, 3) 0

rescaling (Rescaling)          (None, 150, 150, 3)  0          input_1[0][0]

normalization (Normalization)  (None, 150, 150, 3)  7          rescaling[0][0]

stem_conv_pad (ZeroPadding2D)  (None, 151, 151, 3)  0          normalization[0][0]

stem_conv (Conv2D)             (None, 75, 75, 32)   864        stem_conv_pad[0][0]

stem_bn (BatchNormalization)   (None, 75, 75, 32)   128        stem_conv[0][0]

stem_activation (Activation)   (None, 75, 75, 32)   0          stem_bn[0][0]

block1a_dwconv (DepthwiseConv2D (None, 75, 75, 32)  288        stem_activation[0][0]

block1a_bn (BatchNormalization) (None, 75, 75, 32)  128        block1a_dwconv[0][0]

block1a_activation (Activation) (None, 75, 75, 32)  0          block1a_bn[0][0]

block1a_se_squeeze (GlobalAvera (None, 32)          0          block1a_activation[0][0]
...
Total params: 4,053,414
Trainable params: 4,011,391
Non-trainable params: 42,023
```

Fig 4: Accuracy

Accuracy for Parkinson and Alzheimer Disease Detection on MRI Images Using Image Processing system refers to the level of correctness or precision and Alzheimer in detecting the presence or absence of Parkinson's disease in patients based on analysing their MRI images. A high level of accuracy indicates that the image processing system is able to correctly identify patients with Parkinson's and Alzheimer disease, while minimizing false positives and false negatives. This is crucial for ensuring that patients receive timely and accurate diagnosis, as well as appropriate treatment and care. Achieving a high level of accuracy in Parkinson's and Alzheimer disease detection on MRI images requires the image processing system to effectively differentiate between normal brain structures and the characteristic abnormalities associated with the disease. This may involve the use of advanced algorithms and machine learning techniques to analyse and interpret complex patterns and features within the MRI images. A highly accurate image processing system for Parkinson's and Alzheimer disease detection can significantly improve clinical outcomes, by enabling early detection and intervention, and facilitating personalized treatment strategies for patients with the disease.

	precision	recall	f1-score	support
0	0.98	0.99	0.98	360
1	1.00	1.00	1.00	317
2	0.96	0.95	0.96	107
accuracy			0.99	784
macro avg	0.98	0.98	0.98	784
weighted avg	0.99	0.99	0.99	784

Fig 5: Parameter

One of the key parameters used in the detection of Parkinson's disease on MRI images using image processing systems is the measurement of brain structure and image characteristics. This can include parameters such as the volume of certain brain regions, the presence of specific patterns or abnormalities in the images, and the overall texture and intensity distributions within the brain. Other important parameters may include the analysis of specific biomarkers that are indicative of Parkinson's disease, such as the presence of Lowy bodies or changes in dopamine levels. Additionally, parameters related to the shape and size of certain brain structures, such as the substantial nigra or basal ganglia, can also be used to identify potential markers of Parkinson's and Alzheimer disease. The use of multiple parameters and advanced image processing techniques allows for a more accurate and comprehensive analysis of MRI images for the early detection and diagnosis of Parkinson's disease. By examining and analysing a wide range of parameters, image processing systems can help to improve the accuracy and

```
Epoch 20/20
199/199 [==============================] - 32s 160ms/step - loss: 0.0012 - acc: 0.9997 - val_lo
ss: 0.1191 - val_acc: 0.9717
```

Fig 6: Training Results

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The training results for Parkinson Disease detection on MRI images using image processing system show a high accuracy rate in accurately detecting the disease in patients. The system was trained using a large dataset of MRI images to accurately identify key features and patterns in the MRI images that are indicative of Parkinson Disease. This allows for early detection and intervention, leading to better patient outcomes and increased chances of successful treatment. The training results demonstrate the efficacy and reliability of using image processing techniques for Parkinson Disease detection on MRI images, highlighting the potential of this technology in improving patient care and outcomes in the field of neurology.

X. CONCLUSION

In this study, we proposed a method for Parkinson's disease (PD) and Alzheimer detection using magnetic resonance imaging (MRI) images based on image processing techniques. Our approach involves preprocessing, feature extraction, and classification stages. Preprocessing involves normalization, segmentation, and registration of the MRI images to remove noise and align the images for feature extraction. Feature extraction involves the use of handcrafted features such as intensity histograms, texture features, and morphological features to describe the MRI images. Classification involves the use of machine learning algorithms such as support vector machines (SVMs), random forests (RFs), and deep learning models such as convolutional neural networks (CNNs) to predict whether an individual has PD based on the extracted features.

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