**Related work:**

**Deep learning-based diagnosis of Alzheimer’s disease using FDG-PET images**

In the paper [1] the authors propose to use Fluorodeoxyglucose positron emission tomography (FDG-PET) scans which highlight the glucose/metabolism levels in the brains along with Mini Mental State Examination (MMSE). They have used a deep neural network of pre-trained VGG-19 with 19 convolutional layers. Skull scripted, image registering, and slice selection of images are done as a part of pre-processing the datasets where it removes unwanted parts of the images to make more precise datasets. The prediction of the AD disease by comparing one by one and classified four classes by comparing CN, AD, sMCI, and pMCI with an accuracy of 99.54% for AD vs MCI, 99.88% for CN vs MCI, 96.81% for pMCI vs. sMCI, 99.31% for CN vs. AD. Authors have predicted MCI to AD without any external information.   
**Note:** FDG-PET scans are rarely processed based on patient interest, but MRI is basic and more focused on structural and behavioral of brain (fMRI & sMRI).

**Early Alzheimer’s Detection Using Random Forest Algorithm**

The author uses T1-weighted MRI scans for traditional machine learning, proposing models such as Naive Bayes, Support Vector Machines, Logistic Regression, Random Forest, and Decision Trees. Feature selection was done using a correlation matrix to identify the most significant input variables, which were then submitted through an HTML form and converted into a NumPy array for the Alzheimer detection model. Random Forest proved to be the most effective model, achieving an accuracy of 93.69%. It has been integrated into a graphical user interface (GUI) application built with Flask for the backend and HTML, CSS, and Bootstrap for the frontend. It has the highest accuracy by comparing with a ranking of models from highest to lowest performance is Random Forest, Support Vector Machines, Naive Bayes, Logistic Regression, and Decision Trees. Additionally, researchers suggest that combining neuroimaging, cerebrospinal fluid (CSF), the Mini-Mental State Examination (MMSE), blood biomarkers, and patient history could further enhance diagnostic accuracy.

**A CNN Model: Earlier Diagnosis and Classification of Alzheimer Disease using MRI**

Researchers use MRI scans of Mild, Cognitive Normal, and AD. They applied deep learning of Convolutional Neural Networks for detecting early Alzheimer's disease. Authors pre-processed the datasets of .nii format file (from ADNI) to .jpg format as an image directly. Convolution operations are done, on the image of size 8 blocks with a kernel size of 45\*45\*45, stride 1,2,3 have used 2 convolutional layers with the first filter having 32 kernels of 3\*3. There are different layers in the CNN network such as convolutional, activation, pooling, and fully connected layers. In which the first layer is the Convolutional layer which takes the input image using a kernel (ReLU) or filter and identifies the relationship between the image and its features. The second layer is the activation layer which applies the Rectified Linear Unit (ReLU) to increase the nonlinear properties in the CNN model because of its training speed.

**Deep Learning Approaches for Early Detection of Alzheimer's Disease using MRI Neuroimaging**

Authors observed Deep learning models have been very effective and have shown powerful performance in neuroimaging analytics using Magnetic Resonance Imaging (MRI). Deep learning models, like CNNs, ResNet, and VGG, have shown excellent performance in analyzing brain MRIs and are widely used in neuroimaging for assessing AD progression. Structural MRI (sMRI) and functional MRI (fMRI) were used to classify MCI and AD. The study compares similar papers to identify challenges and corrections. As per the authors, Deep learning performs well, but separating MCI from AD remains difficult due to overlapping features. The paper highlights the potential of combining MRI with other data, such as PET scans or blood tests (multi-modal learning), to improve accuracy.

**Early detection of Alzheimer's Disease and Dementia Using Deep Convolutional Neural Networks**

The study focuses on using a convolutional neural network (CNN) to detect Alzheimer’s disease (AD). By analyzing 3D MRI brain scans, the CNN model classifies images into four stages: Non-dementia (ND), Very Mild Dementia (VMD), Mild Dementia (MD), and Moderate Dementia (MoD). The CNN model has six layers, including convolutional and pooling layers to automatically extract features followed by a fully connected layer with a dropout technique to improve accuracy and reduce bias. Using traditional algorithms requires external inputs like feature extraction but still gets lower accuracy compared with convolutional neural network (CNN).

**Deep Learning Approach for Early Detection of Alzheimer’s Disease**

This study considers the use of deep learning, specifically convolutional neural networks (CNN), to classify Alzheimer’s disease (AD) into four stages as normal, mild, moderate, and advanced. Two approaches are examined, one utilizes simple CNN architectures for analyzing 2D and 3D brain scans from the ADNI dataset while the other uses pre-trained models like VGG19 through transfer learning. The process starts by collecting MRI scans in coronal, sagittal, and axial views monitored by preprocessing steps such as resizing, cleaning, normalizing, and balancing the data to ensure fairness among stages. Data augmentation techniques are applied to expand the dataset and prevent overfitting. Eventually, both CNN and VGG19 are used for classification. CNNs automatically extract key features during training, leading to higher efficiency and performance compared to traditional classifiers. This approach offers a reliable method for analyzing brain scans and detecting Alzheimer’s disease at various stages.

**A Deep Learning Based Ensemble Method for Early Diagnosis of Alzheimer’s Disease using MRI Images**

Researchers reviewed a few papers and tried to ensemble methods to get more precise early detection. They have used few individual algorithms and found ensemble methods by six best individual CNN-based classifiers were selected to combine and constitute the ensemble model. The training and evaluation show swift results with an accuracy rate of 98.57, 96.37, 94.22, 99.83, 93.88, and 93.92 for NC/AD, NC/EMCI, EMCI/LMCI, LMCI/AD, four-way, and three-way classification groups, respectively. There is low performance on validation with an accuracy of 88.46 for three-way classification but this is the best performance according to the previous studies.