CNN for Alzheimer's Disease Diagnosis

The problem statement

1. Using Convolutional Neural Networks to predict Alzheimer's disease.
2. It will help in early diagnosis of the disease and also help to cut costs in its identification by performing the work done by the Radiologist

About Alzheimer's Disease

Alzheimer's Disease is a progressive neurodegenerative disease, where dementia symptoms gradually worsen over a number of years. It is the cause of 60-70% of the cases of Dementia. (Memory Loss)

The greatest known risk factor is increasing age, the majority of people with Alzheimer's being 65 and older. But Alzheimer's is not just a disease of old age. Approximately 200,000 Americans under the age of 65 have younger-onset Alzheimer's disease.

It is the sixth leading causing of death in the United States.

Alzheimer's has no current cure.

How can we fight this?

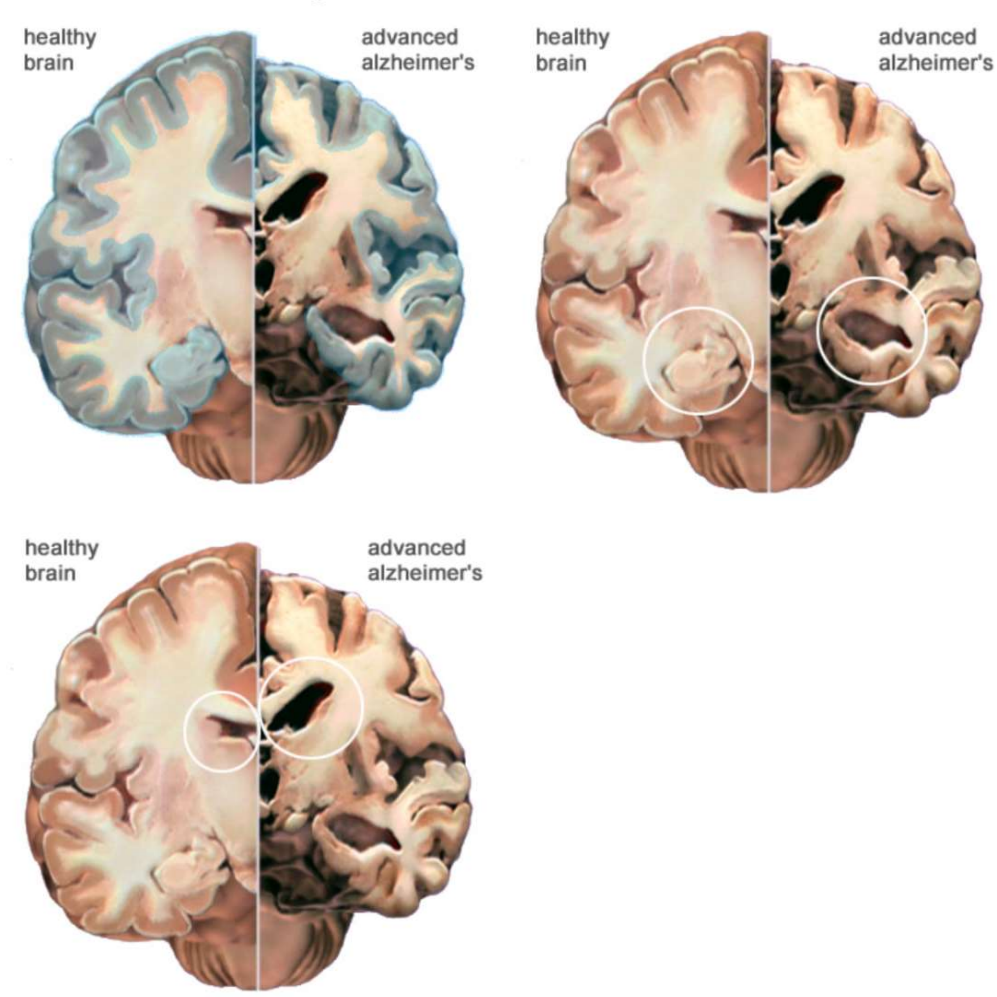
The best way to fight this disease is early detection. This can help target the disease before irreversible brain damage or mental decline has occurred.

Although current Alzheimer's treatments cannot stop Alzheimer's from progressing, they can temporarily slow the worsening of dementia symptoms and improve quality of life for those with Alzheimer's and their caregivers.

The goal of this project was to create a basic neural network that can can differentiate between normal patients and those affected by Alzheimer based on their MRI brain scan.

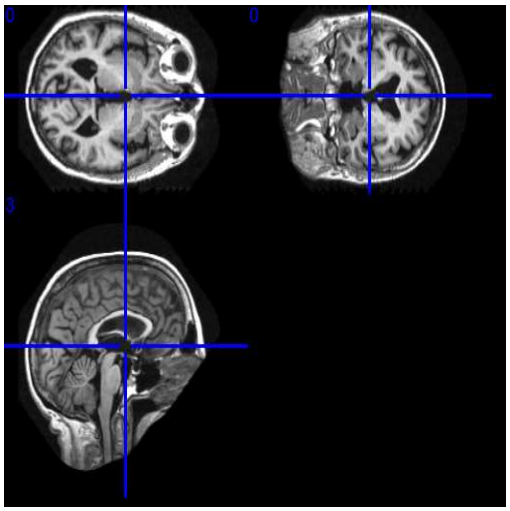
The idea behind the project

There are several visual differences between a normal brain and a brain affected with Alzheimer's. The aim was to build a neural network that could identify these differences.



Data

The data was procured from oasis-brains.org and consisted of the 3D MRI scans of 416 patients out of which 100 patients were diagnosed with Alzheimer.



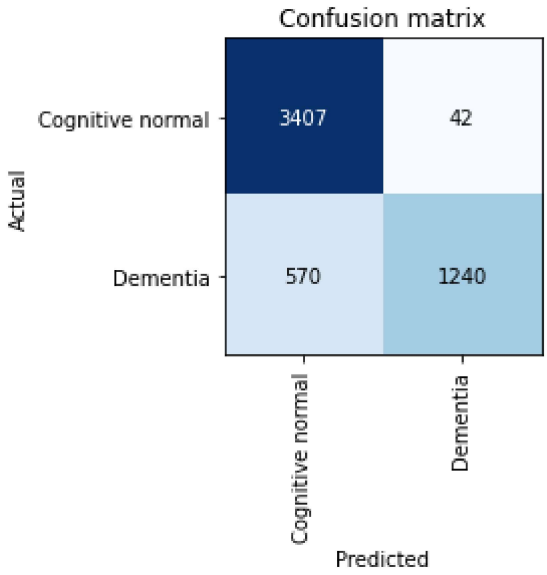
Testing out other convolutional networks

The 2D CNN was built using FastAi library, taking multiple slices from all the patients. All slices corresponds to a middle cross section of the brain where the regions affected in the brain in Alzheimers can be viewed clearly.

Results

The model acheived an accuracy of 80% on the test data after training on the 20th epoch. This was also the epoch with the second highest validation accuracy and the lowest validation loss among all 50 epochs the model had been trained on.

The results show that the model is still confused with classifying the patients that are suffering from Alzheimer. However, it has started to learn some of the features for doing so and with more data may yield better results.



Proceeding from here

Some new approaches that can be tried include:

1. Transfer Learning: This approach involves changing the last two layers of the pre-trained Google Inception Model that was initially trained on 10000 labels of different categories. This network has more than a dozen layers and may perform better due to its sheer complexity.
2. Artificially expanding the dataset: Since the dataset size is very small, one can consider creating more data from the existing data by flipping, translating the image etc.