Medical Image Classification

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1. PROBLEM STATEMENT:

In this project, we implement Deep Neural Networks to solve Medical Image Classification problems. The objective of this project is to implement models that can precisely detect particular sections, elements or conditions present in an image, such as cancers from X-rays or anomalies in MRI scans. In order to complete the project, a number of steps must be taken, including gathering, pre-processing and feature engineering of the sizable datasets of medical images. This must be followed by choosing and training deep learning models. We also utilize two Convolutional Neural Networks to perform Transfer Learning operations on multiple datasets, and assessing the model's performance using multiple metrics.

Application :. By offering fresh perspectives on the patterns and connections between the various medical images and their corresponding medical disorders, the model can help research efforts. Overall, the medical disease classification project has the potential to have a big impact on the field of medicine by offering a way for diagnosing, that is quicker, more accurate, and consistent.

Goal of the Project:. We aim to categorise and classify several phases of dementia (Mild to Severe) in Alzheimer's patients, look for COVID-19, and identify various retinal illnesses in people.

2.DATASET SELECTION:

For the purpose of detecting a particular disease we need to obtain an ample amount of reliable data to enable the model to learn important information. Due to the sensitive nature of medical data it is less available and highly controlled, thus, the access to quality data is limited.

Parameter	Alzheimer	Retinal	Covid-19
Classes	4	20	3
Images	6400	2208	17104
Image Size	128*128778	520*520-3400*2800	224*224
Format	.jpg	.jpg,.tiff	.png
Download Link	Link-1	Link-2	Link-3

Table 1: Statistical details of the Dataset

i. Alzheimer's: . The dataset contains MRI images with four different stages of Alzheimer's diseases and can be classified into No dementia (3200), Very Mild Dementia (2240), Mild Dementia (896), and Moderate Dementia (64) [1].

ii. Retinal: . The MuReD dataset is the only publicly available dataset that employs a series of post-processing steps to guarantee the quality of the images, the variety of pathologies, and the number of samples per label, resulting in the increased data quality and a significantly reduced class imbalance present in the publicly available dataset [6]. The classes that are available for classification are: Diabetic Retinopathy - DR, Normal Retina - NORM, Media Haze - MH, Optic Disc Cupping - ODC, Tessellation - TSLN, Age-Related Macular Degeneration - ARMD, Drusen - DN, Myopia - MYA, Branch Retinal Vein Occlusion - BRVO, Optic Disc Pallor - ODP, Central Retinal Vein Oclussion - CRVO, Choroidal Neovascularization - CNV, Retinitis - RS, Optic Disc Edema - ODE, Laser Scars - LS, Central Serous Retinopathy - CSR, Hypertensive Retinopathy - HTR, Arteriosclerotic Retinopathy - ASR, Chorioretinitis - CRS, Other Diseases - OTHER.

iii. COVID-19: . Seven open-source datasets were combined to create a chest CT scan dataset for COVID-19 identification. It is now the largest COVID-19 CT collection with patient metadata across the country. The dataset covers three classes: COVID-19, Normal, and Community-acquired Pneumonia, and it contains cases from 13 different nations.

3. METHODOLOGY:

For the pre-processing of the data we perform Data cleaning, Data Augmentation to generate variations in the data, and Feature selection to avoid correlation in the data to prepare the data to be utilised by the following models:
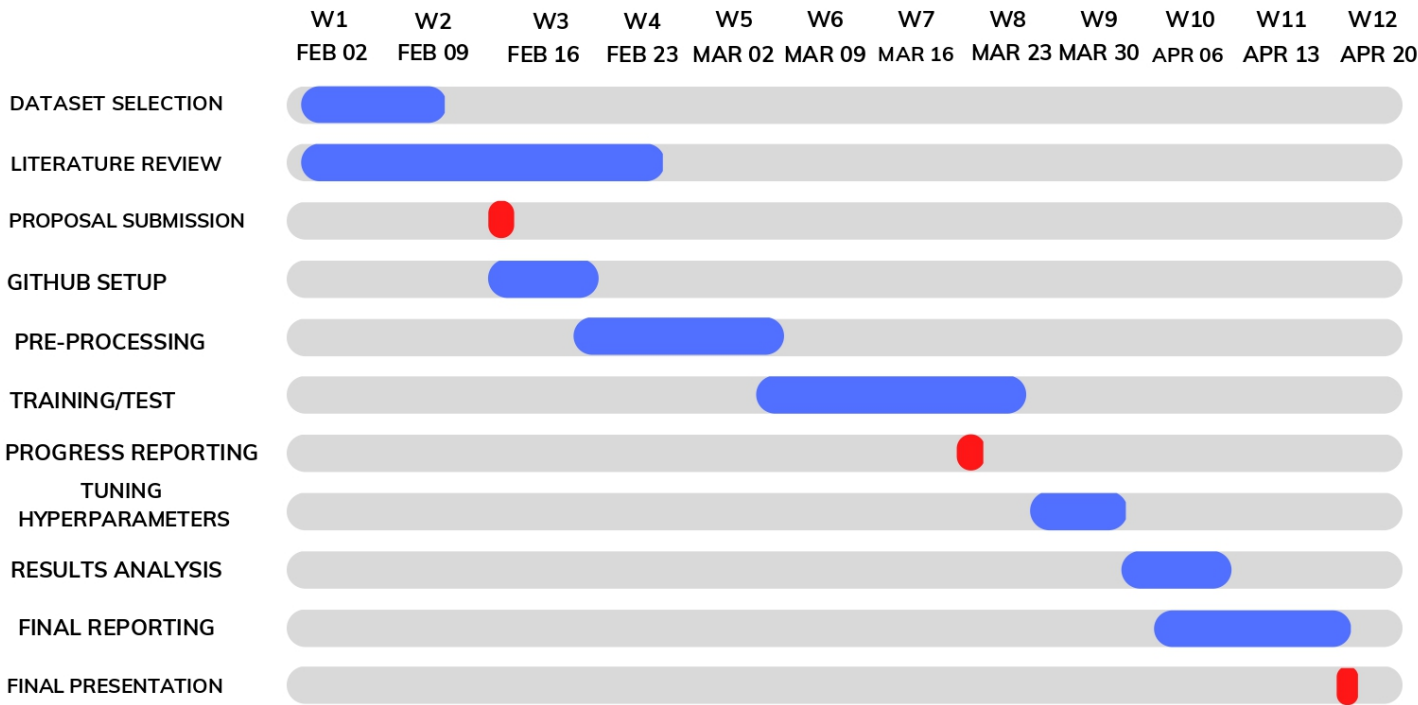
Inceptionv3:. On the ImageNet dataset, it has been demonstrated that Inception v3 can achieve more than 78.1 accuracy. Convolutions, average pooling, max pooling, concatenations, dropouts, and fully linked layers are some of the asymmetric and symmetric building blocks that make up the model. The model heavily applies batch normalisation to the activation inputs. Loss is computed using Softmax.

ResNet50: . ResNet-50 is pretrained on ImageNet dataset with over a million images. The pretrained network can categorize images into 1000 different object categories, including several animals, a keyboard, a mouse, and a pencil. The network has therefore acquired rich feature representations for a variety of images.

EfficientNet. EfficientNet is a convolutional neural network architecture and scaling method that uniformly scales all dimensions of depth/width/resolution using a compound coefficient.EfficientNets also transfer well and achieve state-of-the-art accuracy on CIFAR-100 (91.7%), Flowers (98.8%), and 3 other transfer learning datasets, with an order of magnitude fewer parameters.

4. GANTT CHART:

GANTT CHART

	W1 FEB 02	W2 FEB 09	W3 FEB 16	W4 FEB 23	W5 MAR 02	W6 MAR 09	W7 MAR 16	W8 MAR 23	W9 MAR 30	W10 APR 06	W11 APR 13	W12 APR 20
DATASET SELECTION	■											
LITERATURE REVIEW	■	■	■									
PROPOSAL SUBMISSION		●										
GITHUB SETUP			■									
PRE-PROCESSING				■	■							
TRAINING/TEST						■	■					
PROGRESS REPORTING							●					
TUNING HYPERPARAMETERS									■			
RESULTS ANALYSIS										■		
FINAL REPORTING											■	
FINAL PRESENTATION												●

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