Train a Brain Tumor Detection Model

In this project I have used “YOLO v8n” model to detect the brain tumor using MRI Images. Moreover this model also classifies the types of tumor present i.e :-

1. Glioma
2. Meningioma
3. Pituitary

For training my model I have the dataset from “Kaggle”. This dataset contains 1594 healthy brain samples, 1321 glioma, 1339 meningioma, and 1457 pituitary brain tumor samples.

Preprocessing Steps :-

The data which I have used is a preprocessed dataset in which I need not to worry about the resizing and normalisation.But in case my data is not a preprocessed data then we need to preprocess it because the quality of data ensures that model can extract the most value from it.

Model Architecture :-

I have used a “YOLO v8n” model which is a object detection model for my project.I have fine-tuned it to detect the brain tumor. I have used yolov8n because it is latest version of yolo in which n stands for nano variant.It has higher accuracy and being nano it has fewer parameters thus requiring less computational power.

Fine-tune a model means making small adjustments to pre existing model so that it can be used to do tasks which is supposed to be done. In layman language it is like training a robot a few dance steps which already knows how to dance.

Training Process :-

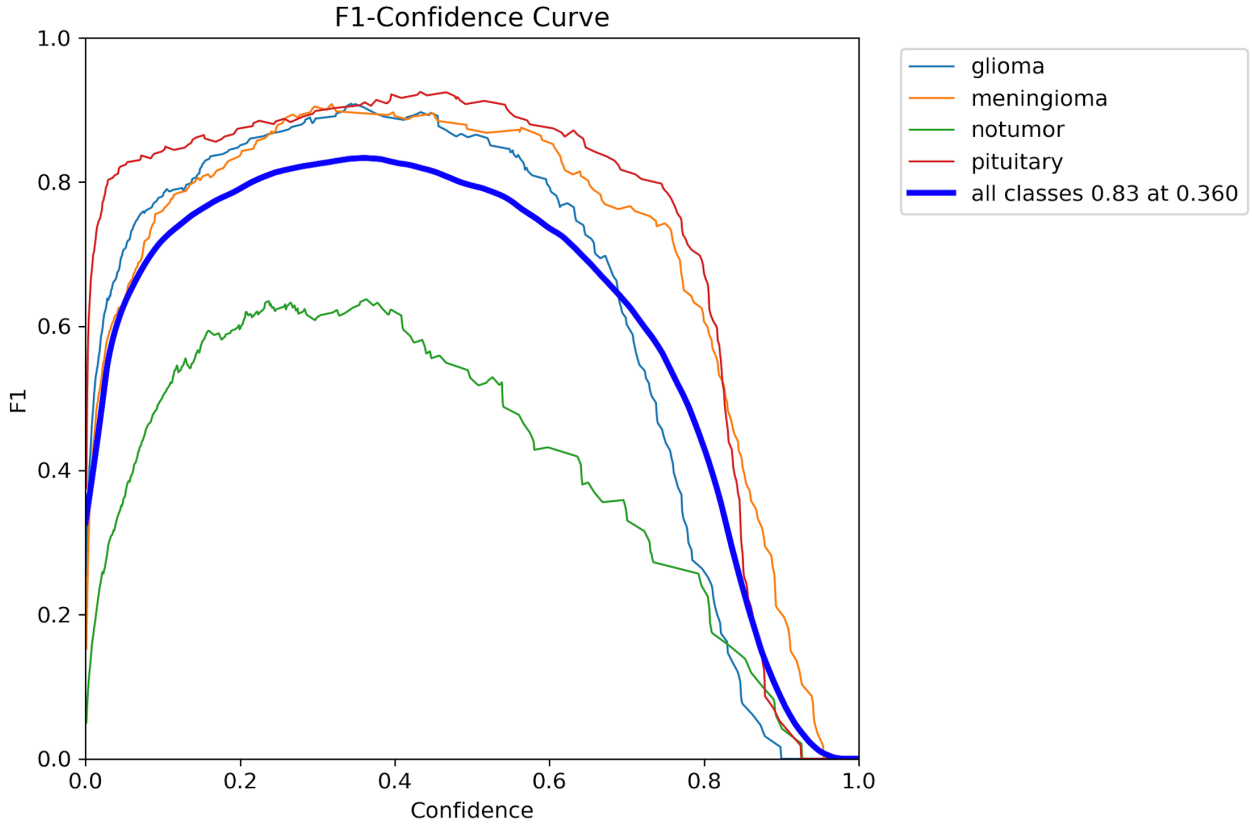
Before the training starts it is necessary to split the dataset into test and train because after training the data it is necessary to evaluate it and ensure that it will give you the robust predictions. I have split it in ratio 0.2.
For training the data the hyper parameters such as
Batch size - 16
Learning rate - 0.01
Number of Epoch - 25

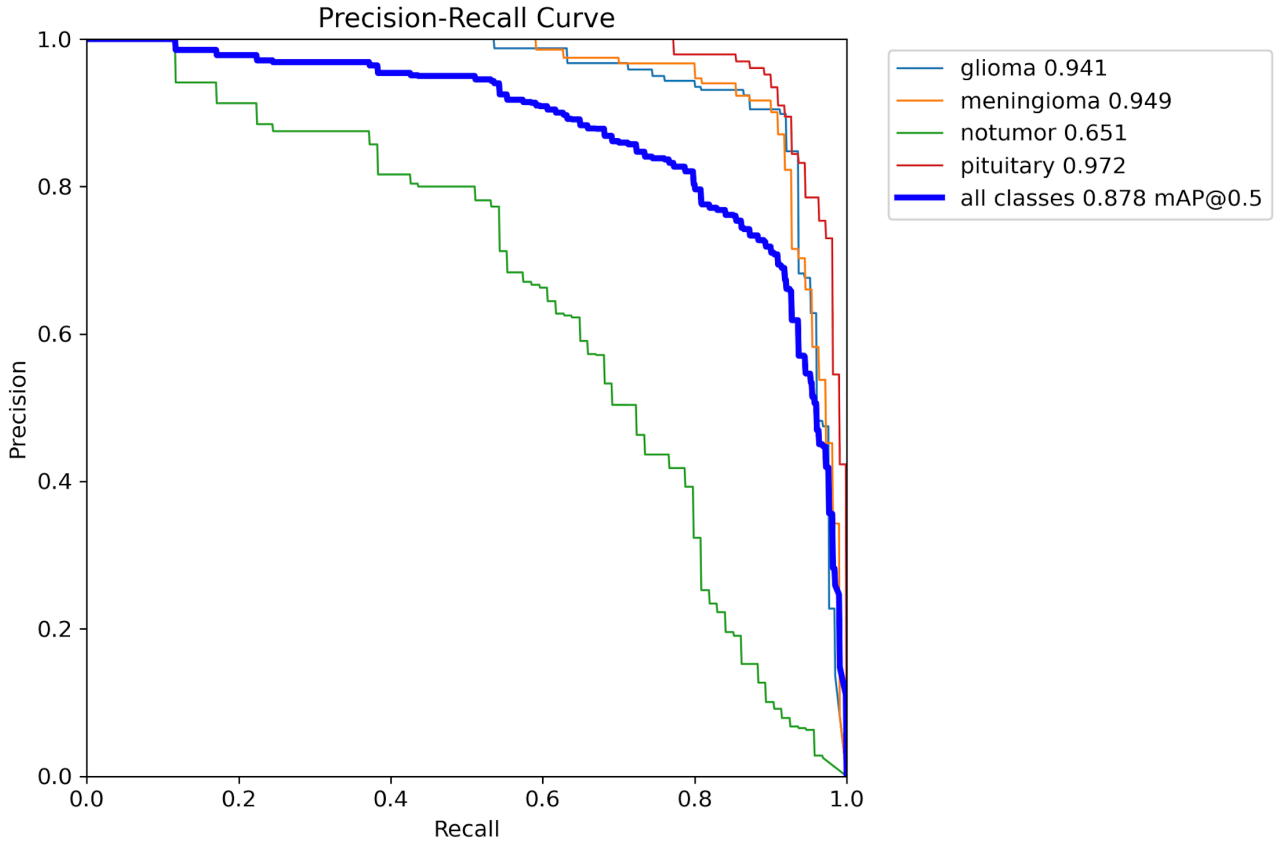
After each batch size model updates it parameters ensuring it would increase model performance.
An Epoch in training a model is one complete round of teaching the model using the entire dataset.In this project number of epoch is 25 which means my complete dataset is trained 25 times. In this project it took 25 minutes to complete the whole training process.

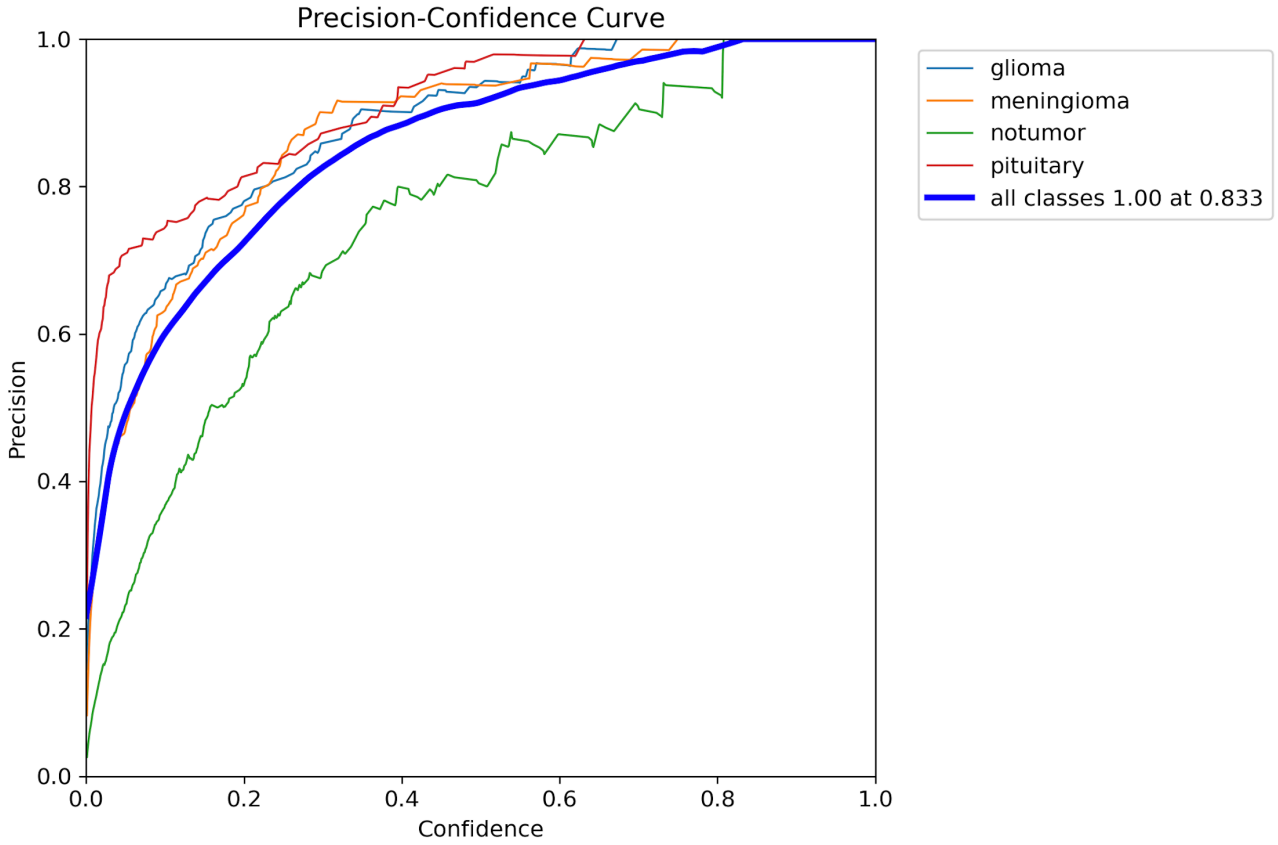
Evaluation-Metrics :-

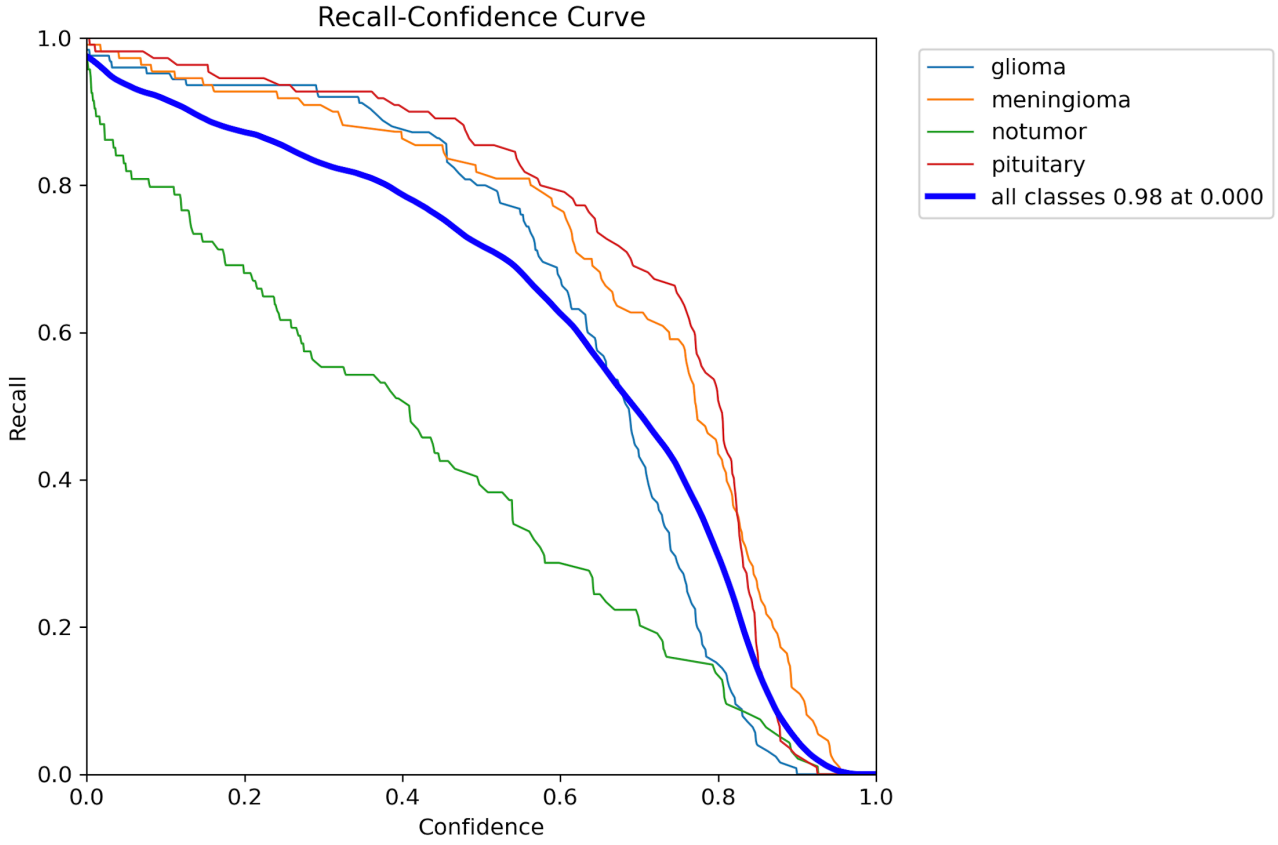
Several evaluation metrics involved in this project are as follows :-

1. F1 score
2. Precision
3. Recall
4. Confidence


F1-Confidence Curve
glioma
meningioma
notumor
pituitary
all classes 0.83 at 0.360
F1
Confidence
0.0
0.2
0.4
0.6
0.8
1.0


Precision-Recall Curve
glioma 0.941
meningioma 0.949
notumor 0.651
pituitary 0.972
all classes 0.878 mAP@0.5
Precision
Recall
0.0
0.2
0.4
0.6
0.8
1.0


Precision-Confidence Curve
Precision
Confidence
0.0
0.2
0.4
0.6
0.8
1.0
glioma
meningioma
notumor
pituitary
all classes 1.00 at 0.833


Recall-Confidence Curve
Recall
Confidence
0.0
0.2
0.4
0.6
0.8
1.0
glioma
meningioma
notumor
pituitary
all classes 0.98 at 0.000

Accuracy is not a good parameter for evaluating the model. Like take an example if there is imbalanced data in which most of the MRI Images has no tumor so the model will predict no tumor most of the time and its accuracy will be high but that is not the actual case like we have 100 images in which there are 95 images with no tumor and 5 images with tumor but if model predicts no tumor in all the cases even then the model will have 95% accuracy but that is not the case as it predicted wrong in all the cases having tumor.

Precision measures how many of the predicted positive cases were actually correct. Like in the above example our precision will be 0 as our model predicted all the wrong answer in case of tumor.So,it is a better parameter to go with.

Recall measures how many actual positive cases the model correctly identified. In simple terms, it shows how good the model is at finding all the true positives. High recall means the model successfully catches most of the actual cases, like detecting most brain tumors in a patient population.

So, recall and precision both are good parameters in this case but there is one more parameter F1 score which combines both the recall and precision to give a single measure of a model's performance.It balances how many true positives the model finds/recall and how many of its positive predictions are correct/precise. A

high F1 score means the model is good at identifying the right cases.
All the evaluation that I have attached are for the the training data.

Instructions :-
I was not able to test on a new image which would be uploaded by the user.

I have not written the code on myself I have copied the code from here.
Although I understood various concepts related to how to train a model what are dataset, preprocessing, fine tuning, why accuracy is not a good parameter, evaluating and many more.

Name :- Piyush Goenka
Batch :- 2
Roll no :- 24bcs10234