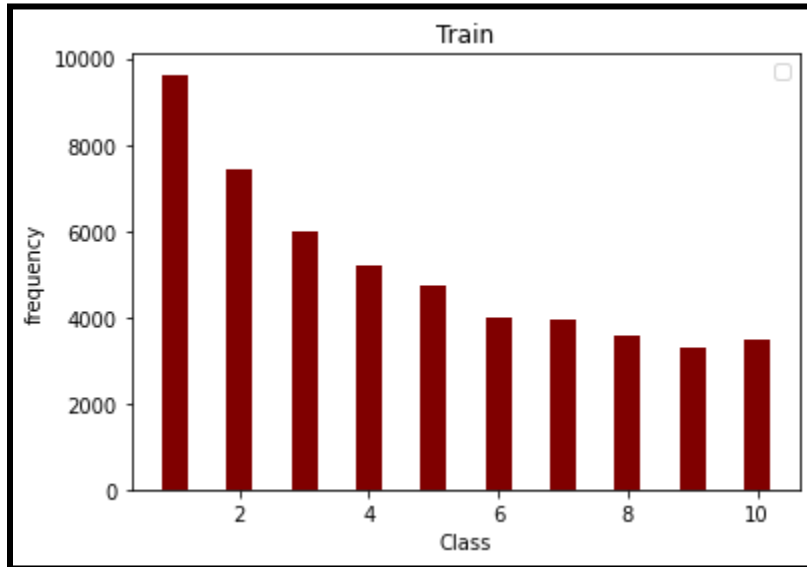


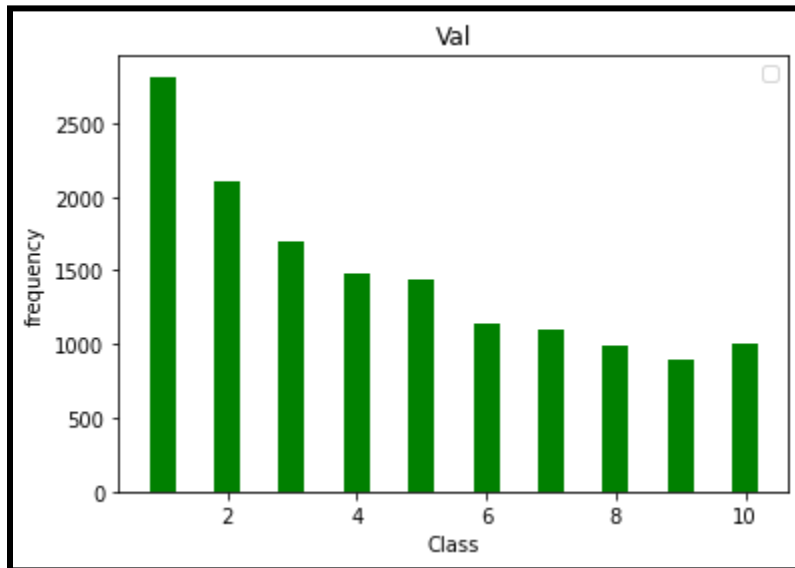
Report

1.

Visualizing train

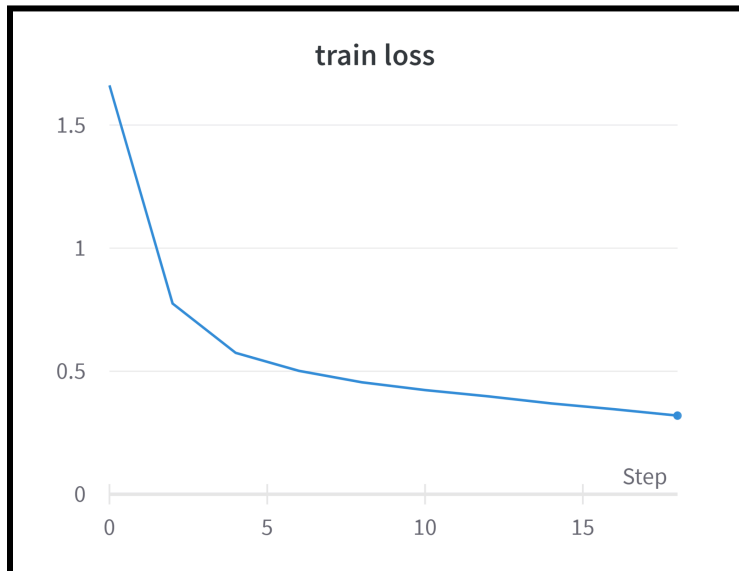
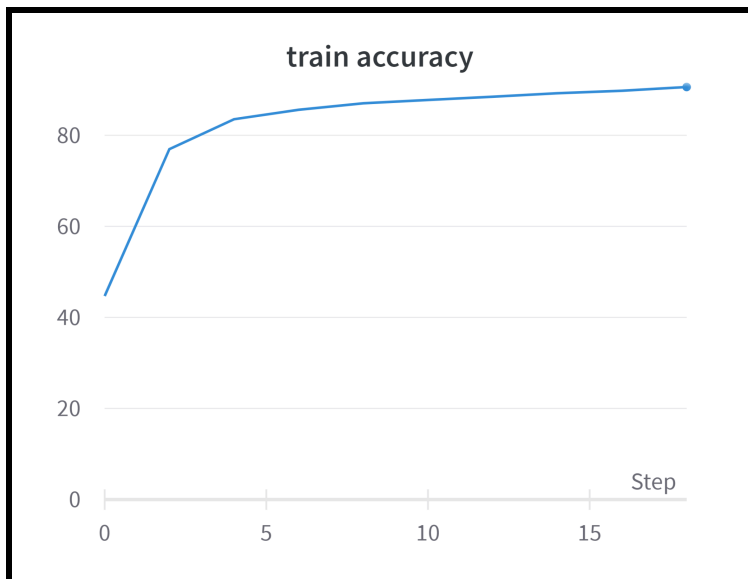


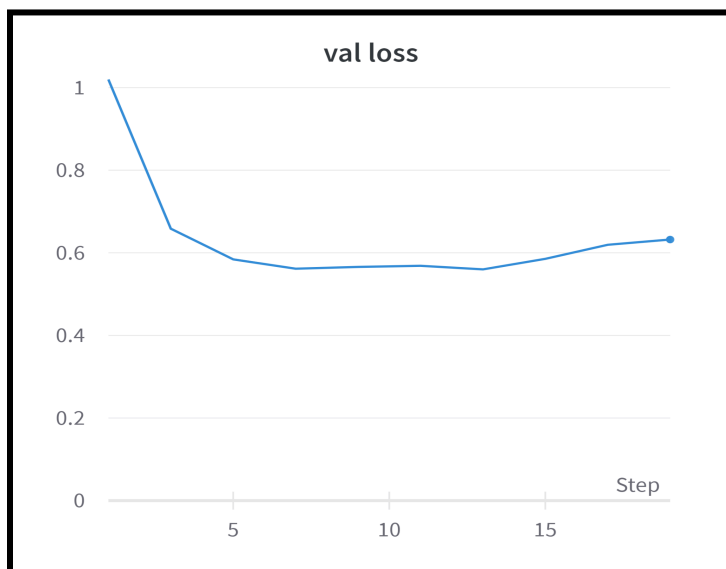
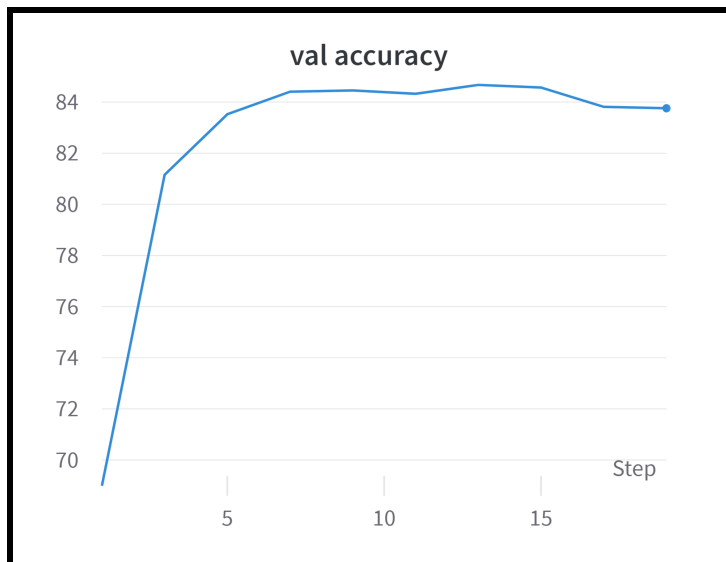
Visualizing Val



2.

(b)

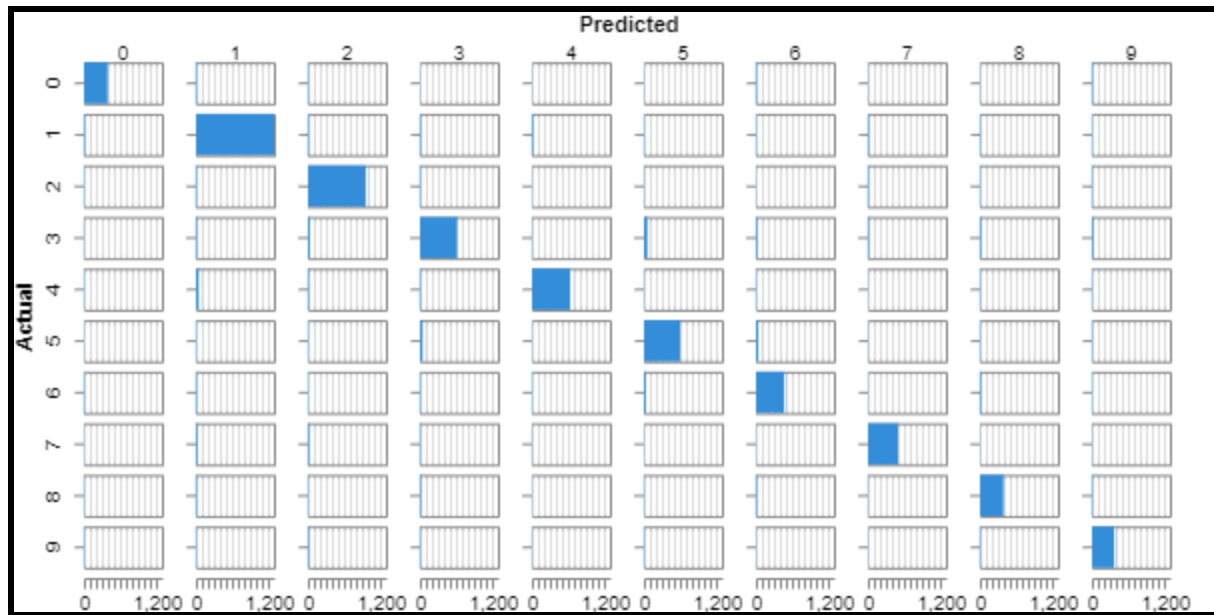




(c)

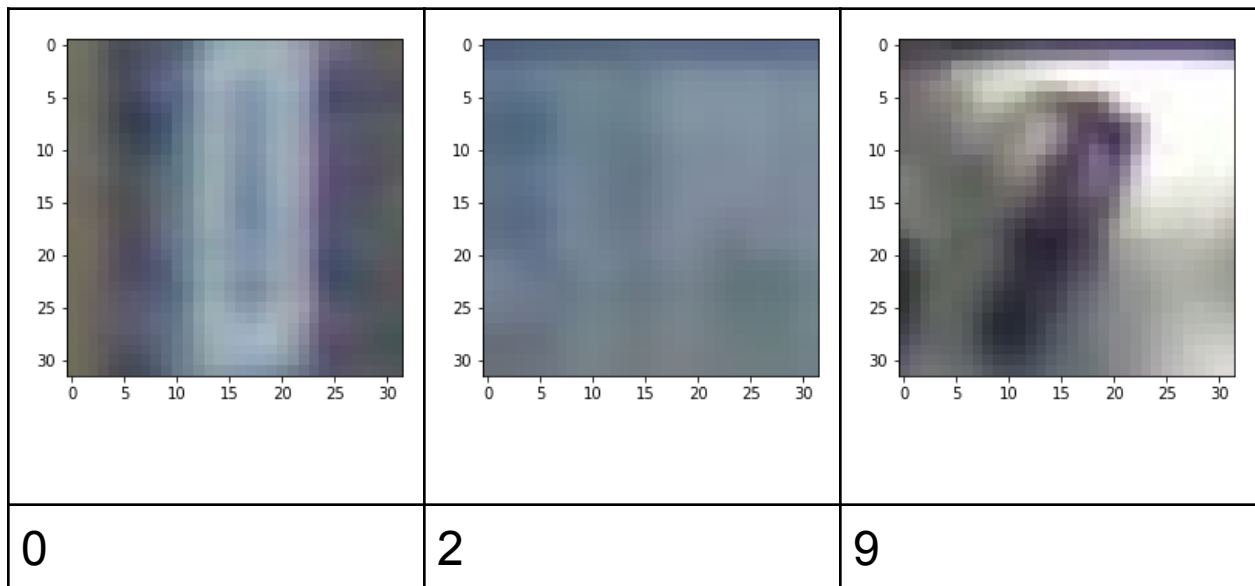
Accuracy	F1 Score
84.25938	84.26

Confusion Matrix

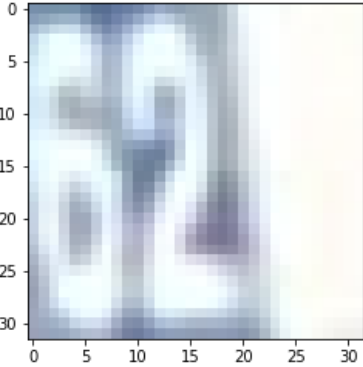
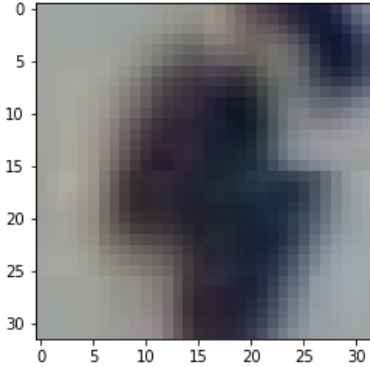
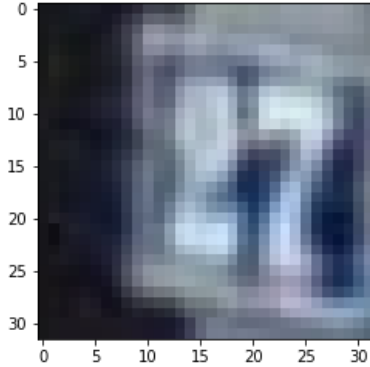


d) Misclassified Images

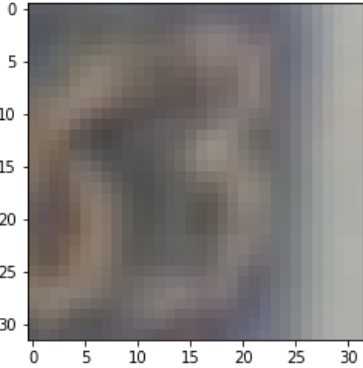
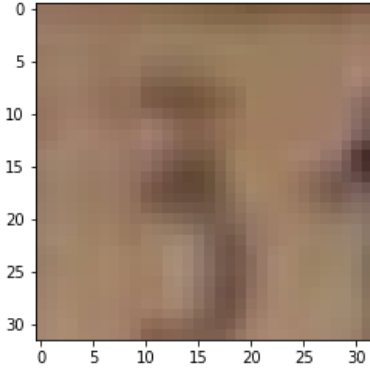
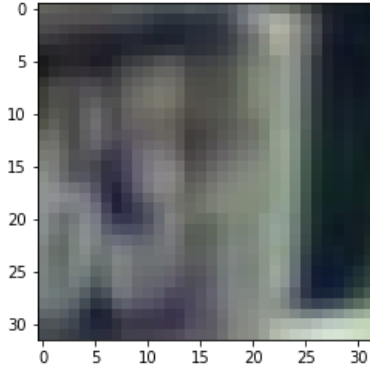
One



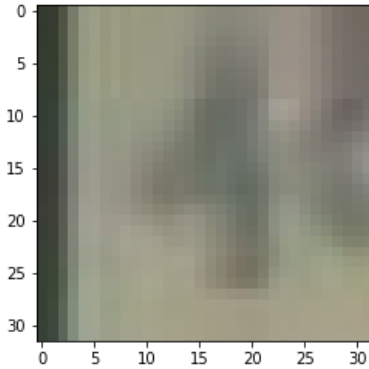
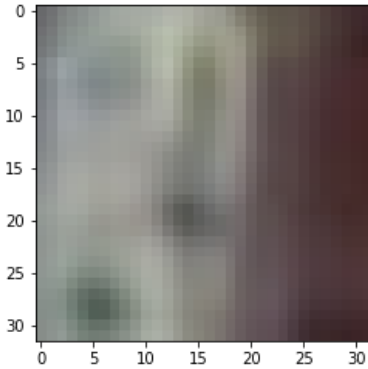
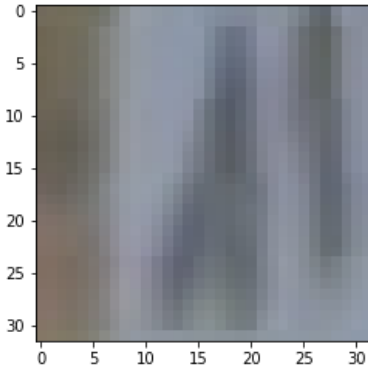
Two

		
6	3	7

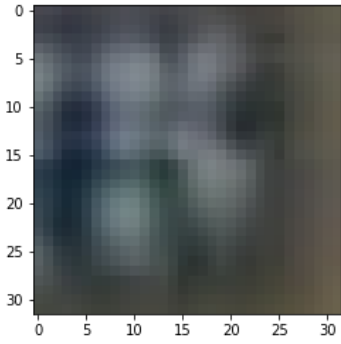
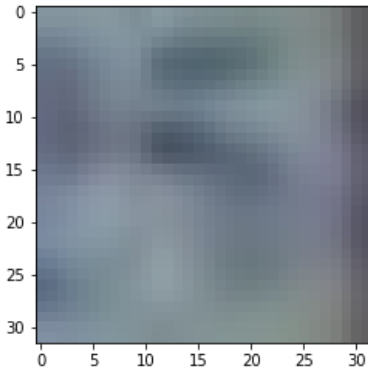
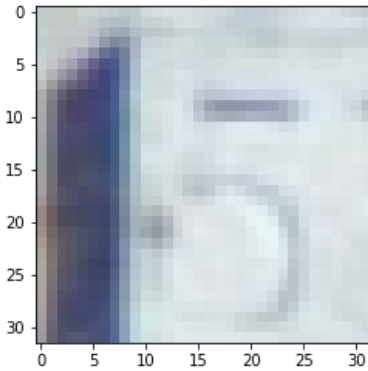
Three

		
2	2	0

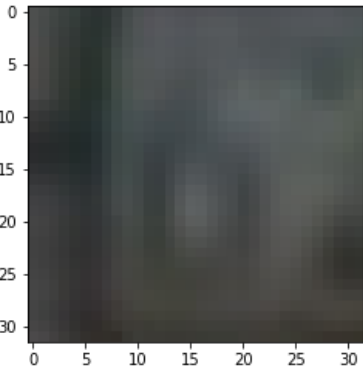
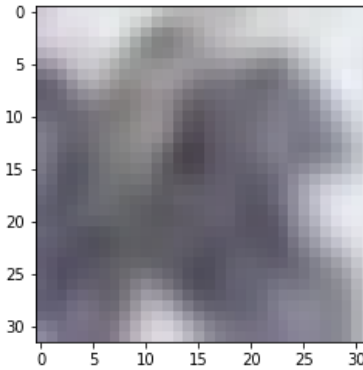
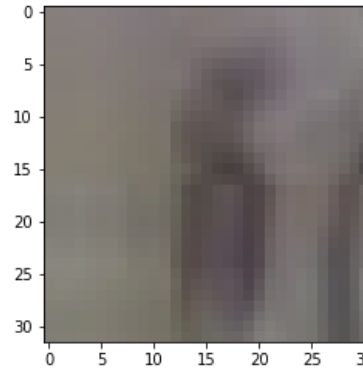
Four

		
1	2	1

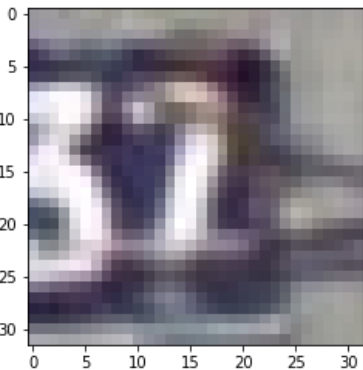
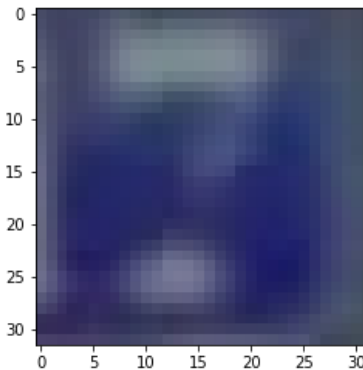
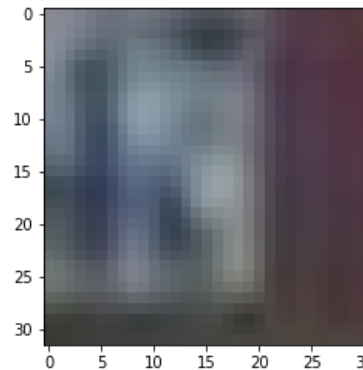
Five

		
6	2	0

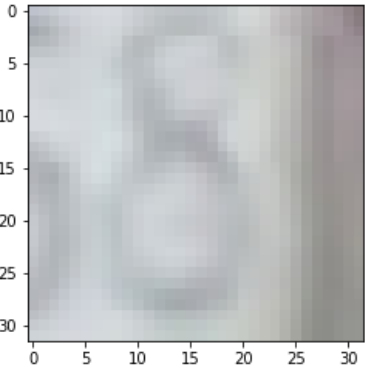
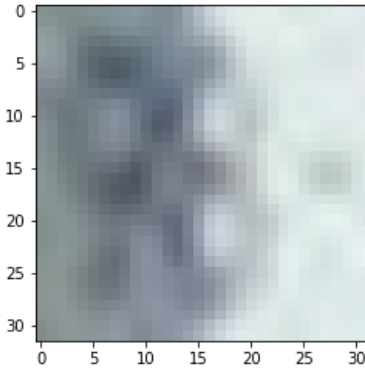
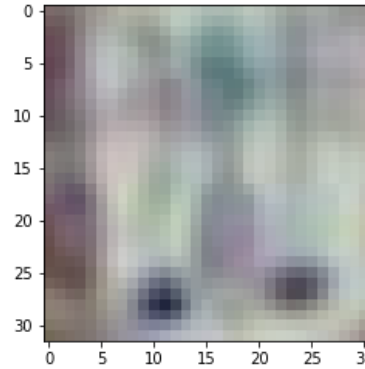
Six

		
0	2	1

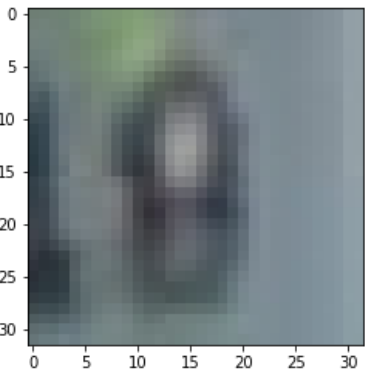
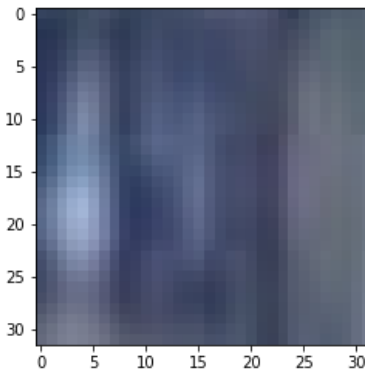
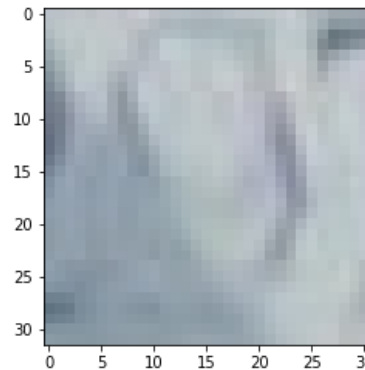
Seven

		
2	1	8

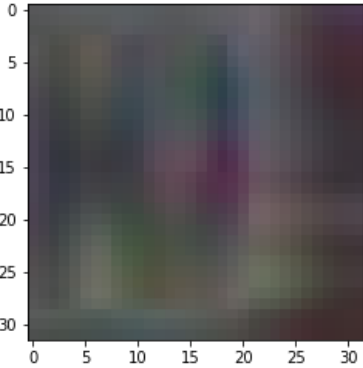
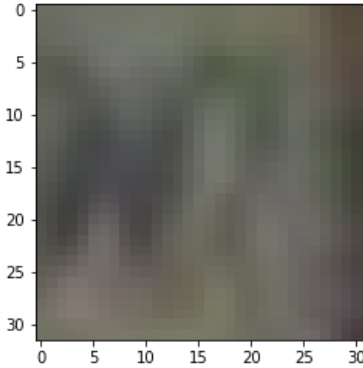

Eight

		
0	0	1

Nine

		
8	1	0

Zero

		
1	2	1

Observation:

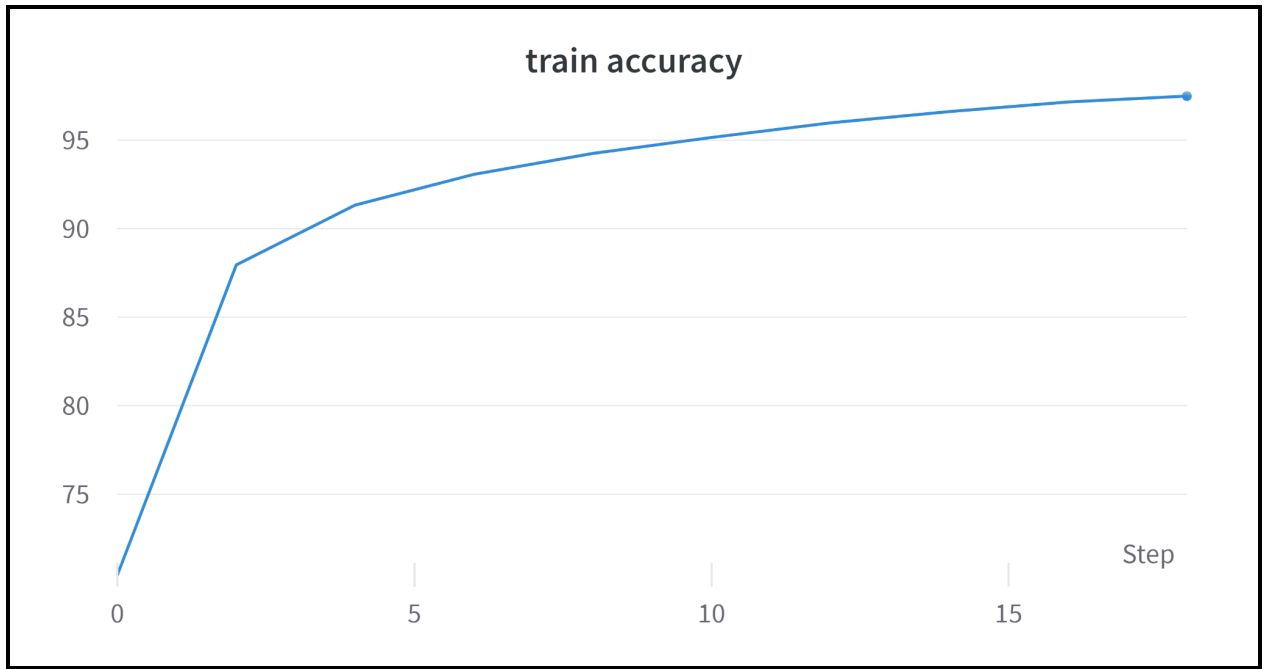
Our model fails in certain cases when the image is not clear (blurry or very light lines) i.e. nothing is visible (naked eye) and no patterns or distinct lines are visible. In this case our model prediction is wrong.

However it also fails in some cases when there are more than 1 digit in image. In such cases our model might be confused and might look at the other digit than what is annotated.

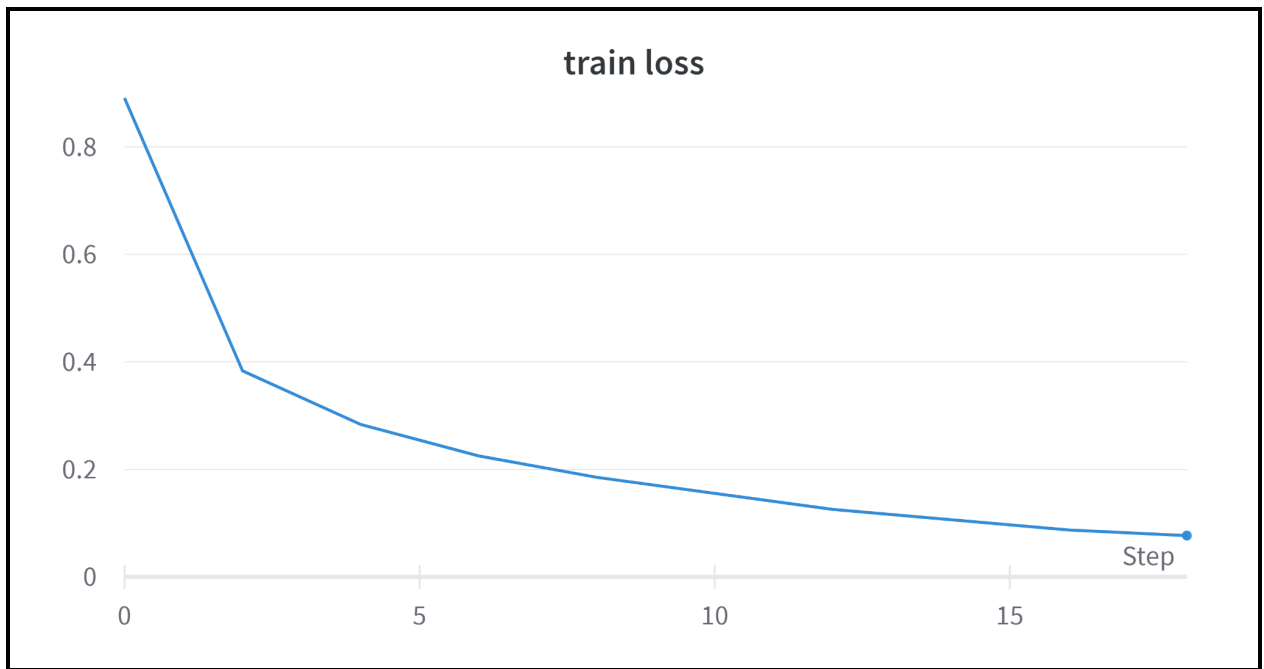
In some of the cases it predicts wrongly because of similarity in the pattern and shape. 8 is often mistaken as 0. In other cases one of the above mentioned things can happen.

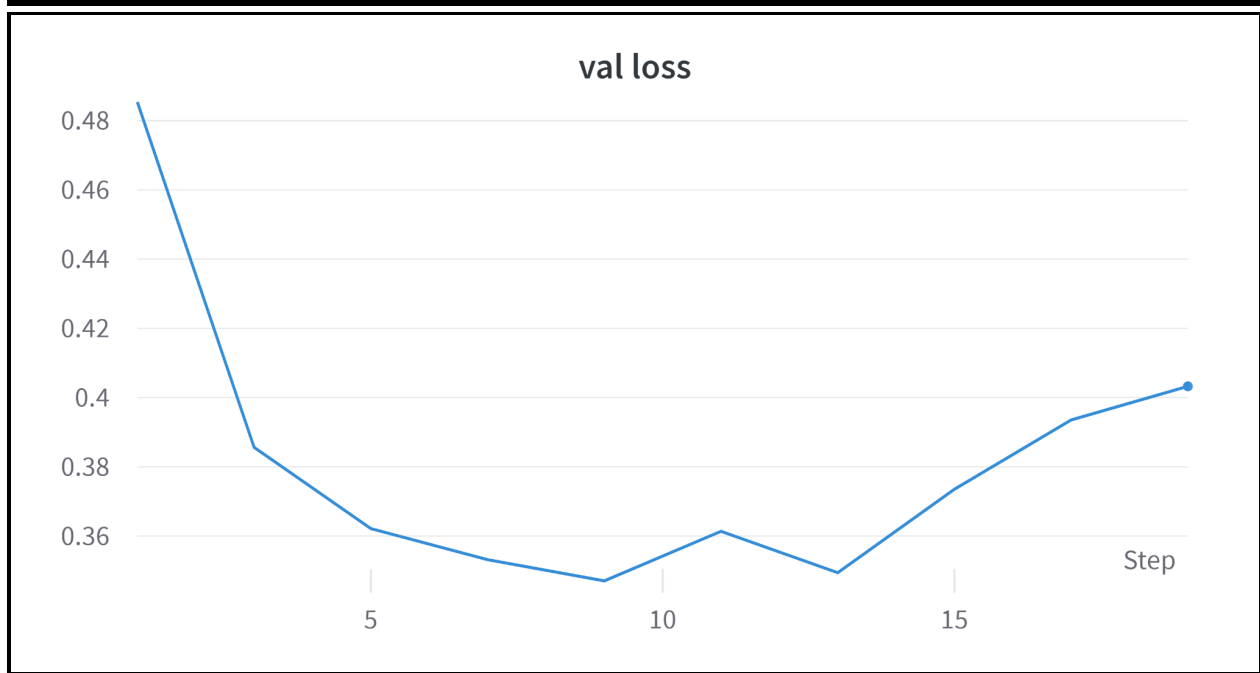
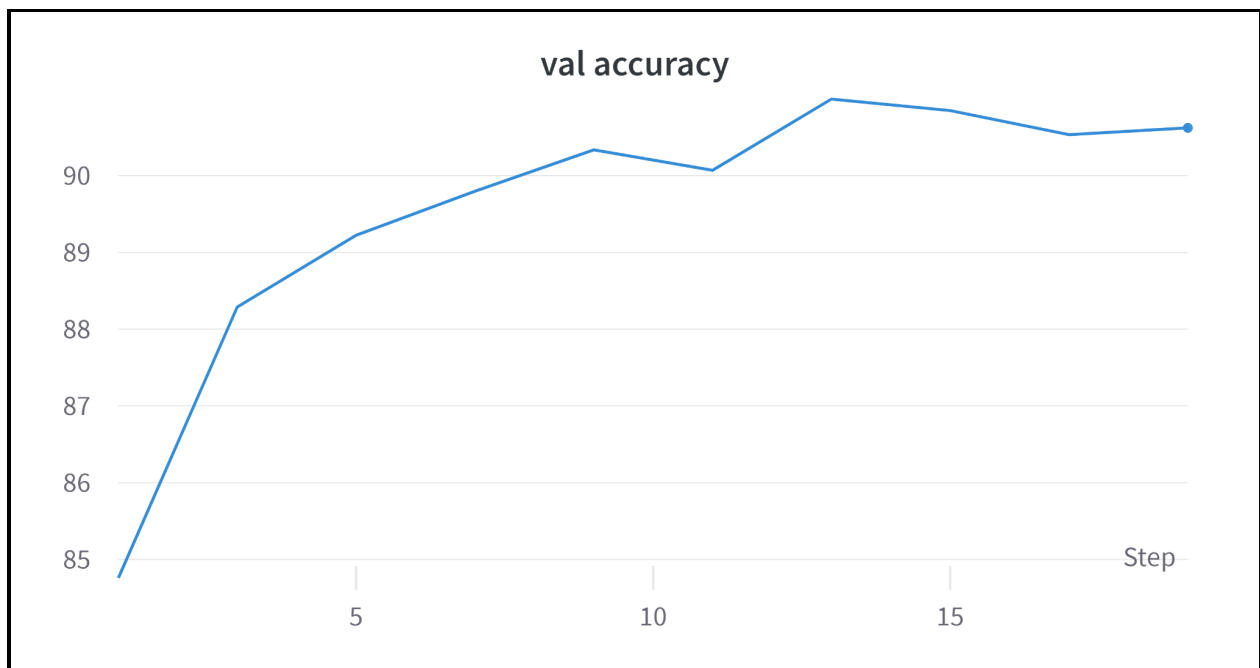
3.

a.



a.

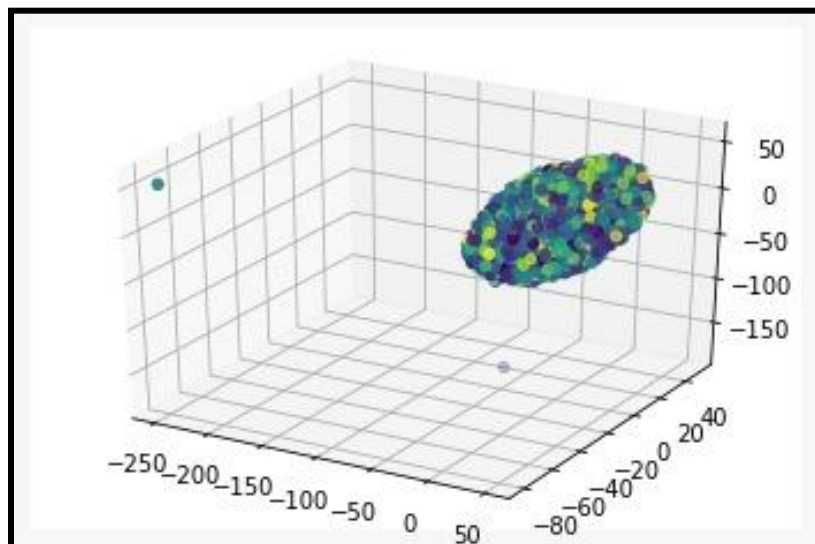
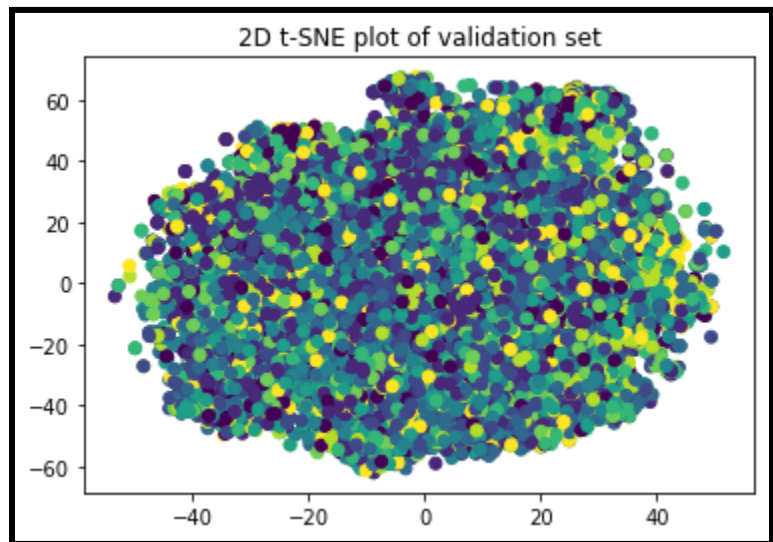
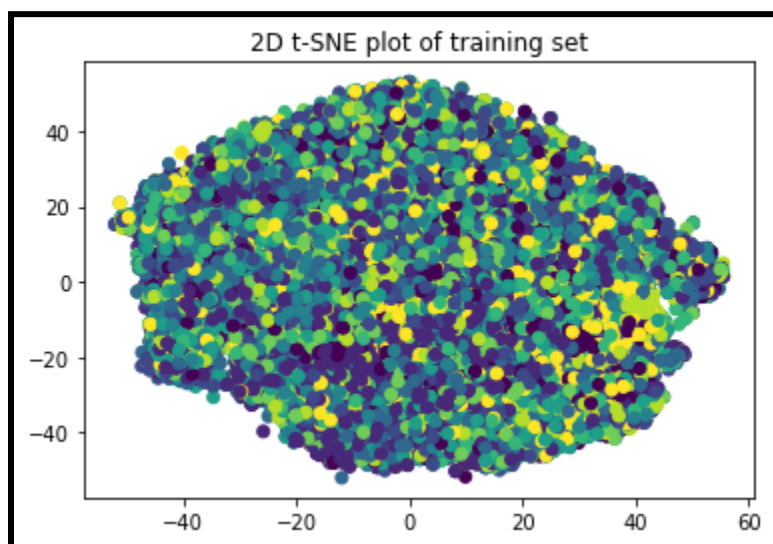




b.

Accuracy	F1 Score
89.9658	89.97

C.



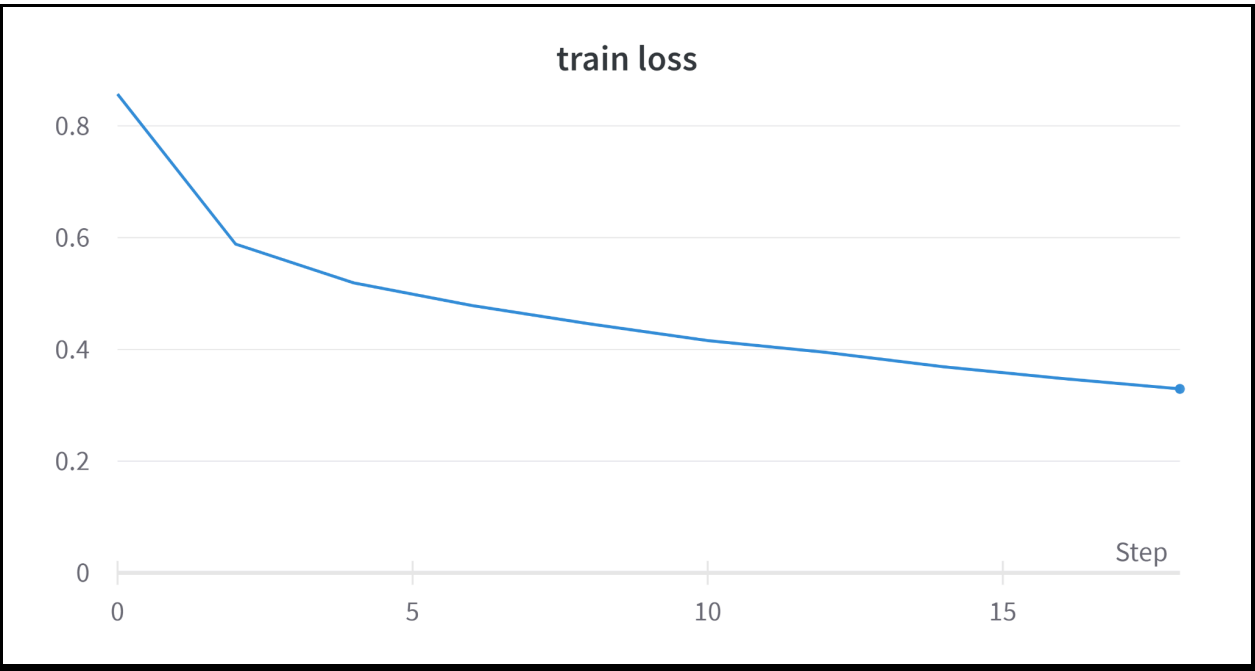
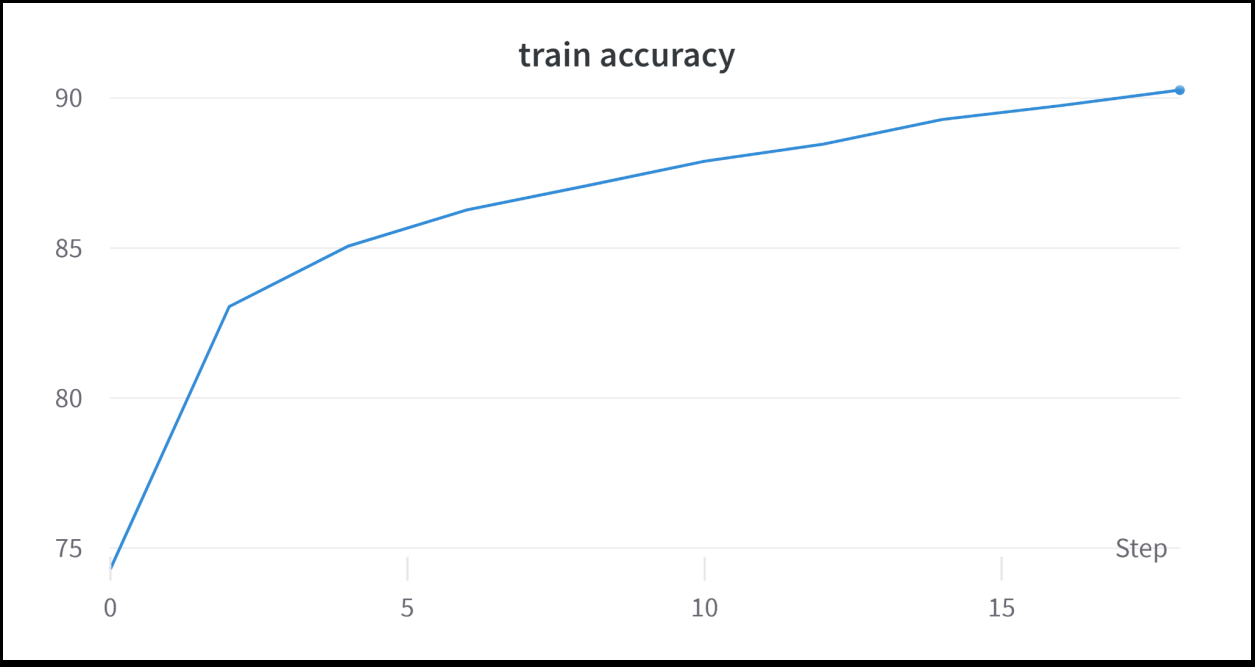
4.

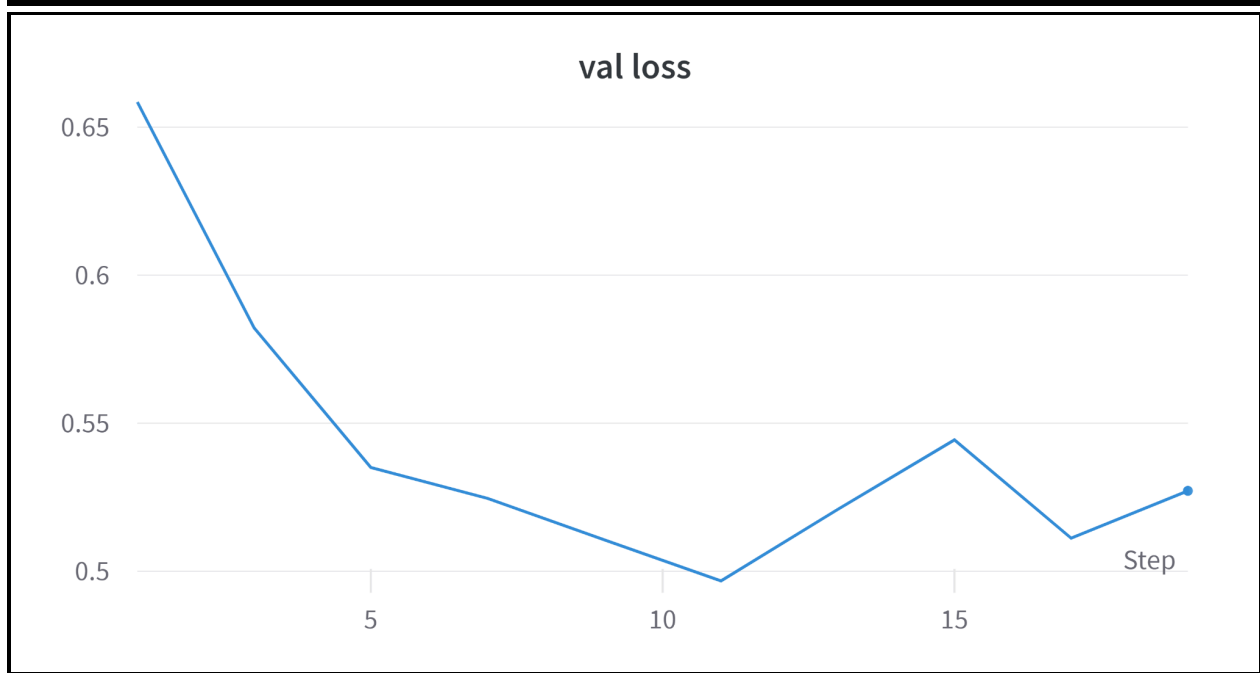
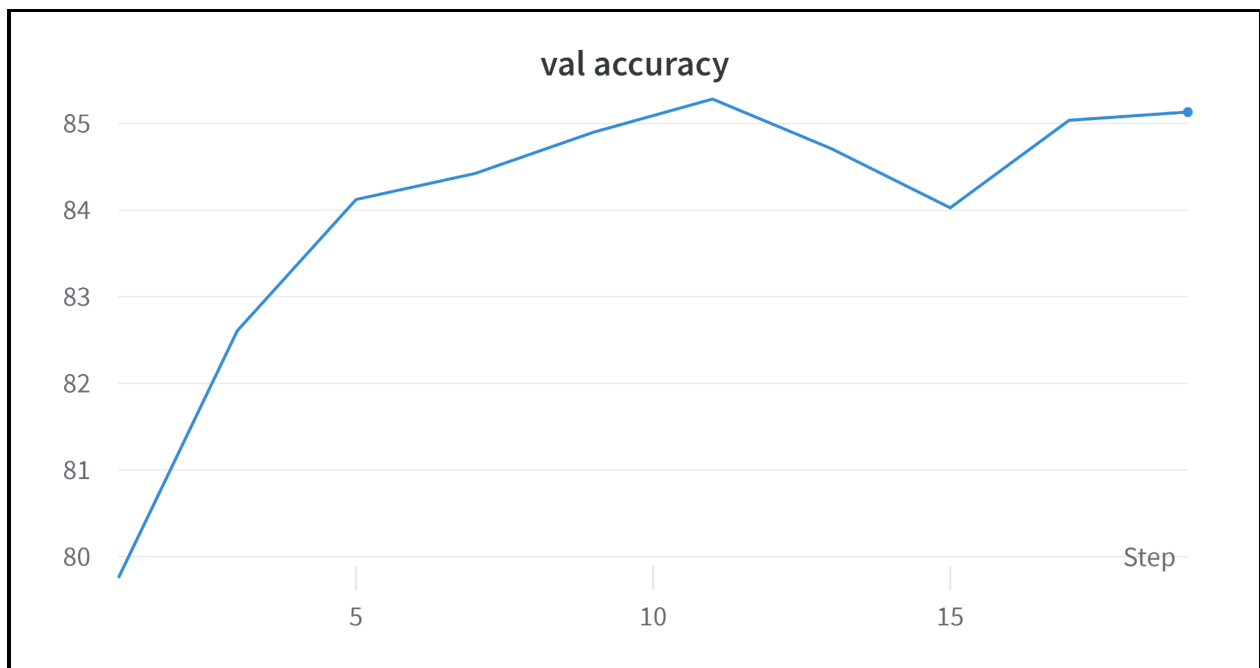
(a)

```
transforms.RandomGrayscale(p=0.6),  
transforms.RandomRotation(degrees = (0,90)),  
transforms.ColorJitter(brightness=(0.5,1.5), contrast=(1),  
saturation=(0.5,1.5), hue=(-0.1,0.1)),  
transforms.RandomHorizontalFlip(),
```

Note:I have augmented 30% of training set training times due to gpu and time constraints.

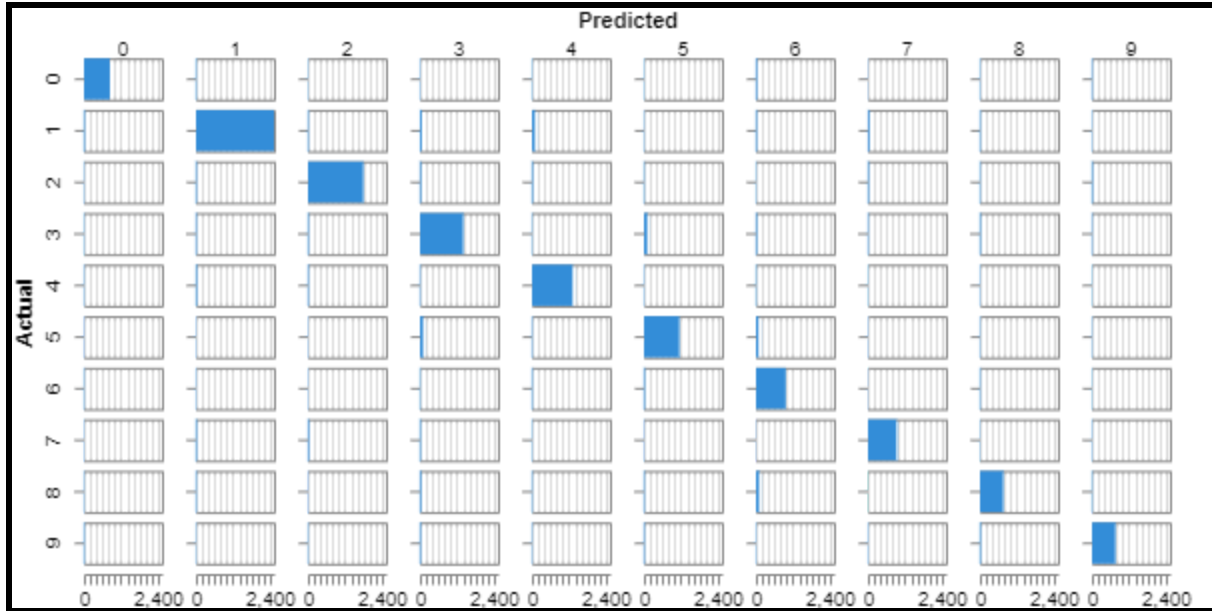
(b)





C)

Accuracy	F1 Score
85.04	85.0385



6.

We observe the following pattern

Accuracy

Training data : CNN < Augmented < Resnet

Validation data: CNN < Augmented < Resnet

Testing data : CNN < Augmented < Resnet (same for F1 Score)

Our model performed best on resnet in all the cases.

A simple CNN architecture which we trained on about 50k images performed worse when compared to when Augmented dataset in which various transformations of same training data was applied. As a result our data increased which led to CNN learning the model better.(can be seen with accuracy and loss).

However the best model was fine tuned resnet18 which was pre trained on large number of images. It consistently beat our cnn models in all the cases.

Because of the fact that it had seen a lot of data it predicted more accurately.

However Augmented data was always better than cnn showing that with the change in the properties of image and larger model our model can perform better.

However since we added only 0.3% training size images in addition to our original dataset our model performance was worse than the Resnet model which has already been trained on millions of images.