PROGRAMMING TASK
for the Internship role
at Volkswagen Group Research (AI and Deep Learning for
Automated Driving)

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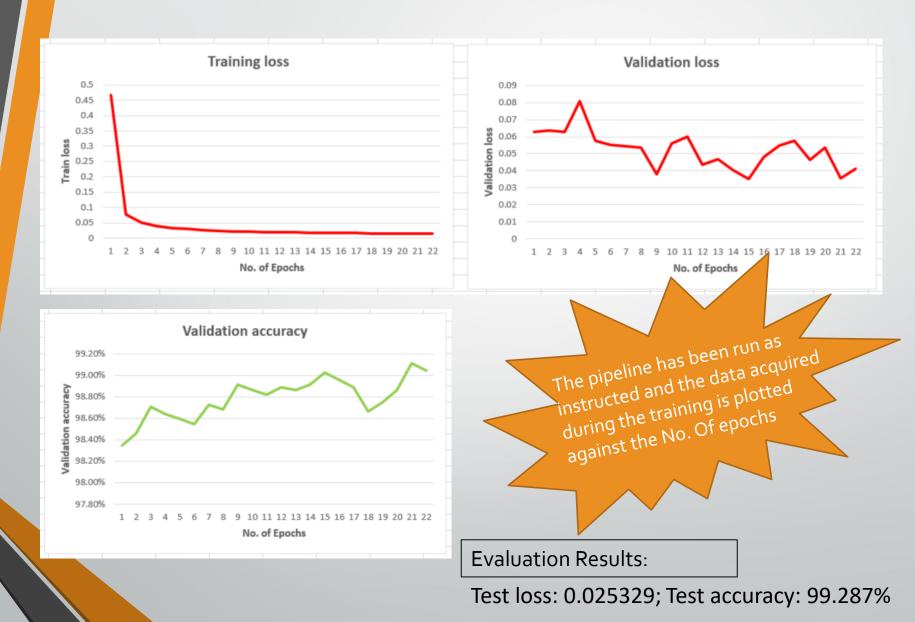
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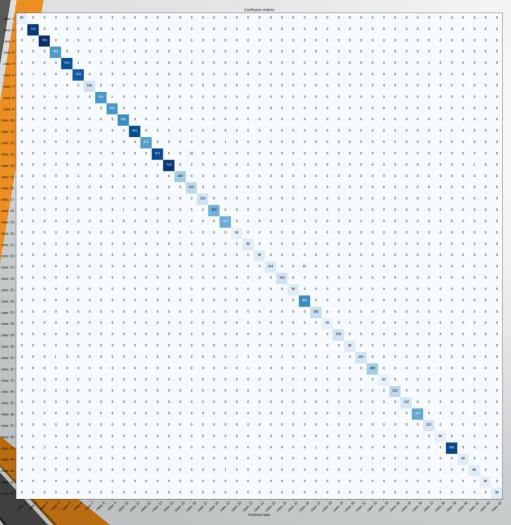
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EXPERIMENT NO. 1 (WITH STN)



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CONFUSION MATRIX



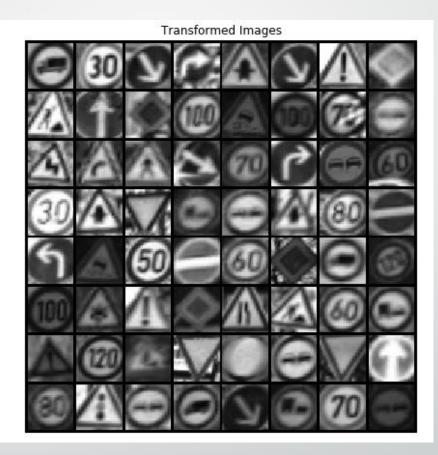
- The confusion matrix is generated and plotted as a heat map
- One can witness the blue diagonal in the heat map, which proves the effectiveness of the model
- We can also understand where the model gets confused by understanding the map in depth

Performance metrics:

Accuracy: 0.992874= 99.29% Recall: 0.991303 = 99.13 % Precision : 0.988662 = 98.87 % F1_Score : 0.989980 = 99 %

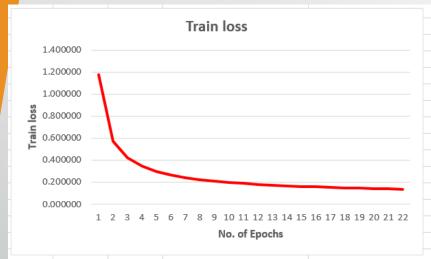
EXPERIMENT NO. 1 (WITH STN)

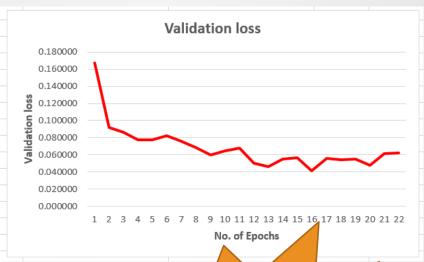


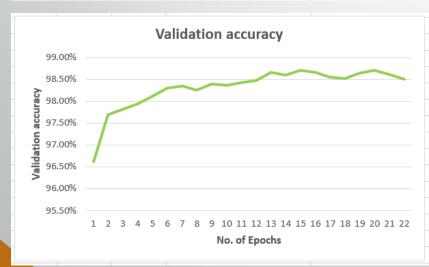


The role of STN layer in a model is clearly depicted in this visualization. The traffic signs are made to go through a spatial transformations to achieve the geometric invariance of the model

EXPERIMENT NO. 2







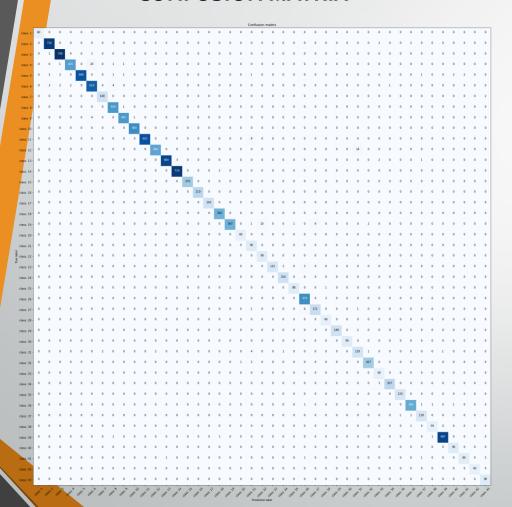
The layer STN is removed from the model, rerun the pipeline and plotted the results

Evaluation Results:

Test loss: 0.041385; Test accuracy: 98.678%

EXPERIMENT NO. 2 (W/O STN)

CONFUSION MATRIX



 From the performance metrics values comparison with both the experiments 1 and 2, we can clearly say that the STN layer addition to the model enhances the classifier's ability to correct identify the traffic sign and give better results

Performance metrics:

Accuracy: 0.986778 = 98.68 % Recall: 0.986499 = 98.65 % Precision: 0.977475 = 97.75 % F1_Score: 0.981967 = 98.20 %

EXPERIMENT NO. 3

Activation output of conv3 layer of one image: Class 16 (with STN)



- The feature map clearly captures only the central element of the traffic sign, which increases the spatial invariance for the end result
- (It is mainly due to the spatial transformations that took place at the start of the network).

EXPERIMENT NO. 3

Activation output of conv3 layer of one image: Class 16 (w/o STN)



- The absense of STN layer in the spatial invariance is clearly perceivable in this conv layer.
- As opposed to the fig. in the previous slide, the background of the sign is also present in the feature maps, which would influence the final result of classification

CHALLENGES AND DEADLOCKS:

- As I do not have enough computing power and due to time constraints, with your acknowledgement, I reduced the number of epochs to 22, hence, the performance of the results might have taken a hit, compared to the original performance.
- In the Experiment 3, I have been asked to get the gradients calculated for the layer "conv3" for the images from both of the trained models in the Experiments 1 and 2
 - 1. To my understanding, only during the training process, the model would carry the gradient values of the convolutional layer. With the trained model, and during the prediction, there would be no gradients present in the layer
 - 2. Please correct me also, if I am wrong. I am humbly open to learn it, if I am mistaken

I hope you liked my presentation. I am happy to answer any questions, if there are any....

THANK YOU