***Assignment-4(vchalla3)***

***CIFAR-10 dataset***

Baseline Model.

A graph with blue and orange lines

Description automatically generated

A graph with blue and orange lines

Description automatically generated

Observations from the above plot.

Models are overfitting as the number of epochs increases. It means the graphs indicate that the training accuracy is increasing but the test accuracy is not performing better. It is Caused due the model learning the exact features of the training data. This overfitting of data is overcome by data augmentation. Loss plot shows that as the number of epochs are increased the loss on training data is getting decreased, but the loss Comparatively for the testing data is getting high. Which means the model is overfitting with the training data.

Confusion Matrix for the Baseline Model is:

[[ 94 91 106 108 88 128 89 67 127 102]

[ 99 93 98 106 90 116 108 85 99 106]

[ 87 98 106 94 88 109 110 74 131 103]

[ 99 93 97 105 83 126 105 68 113 111]

[ 97 82 92 108 94 114 94 88 137 94]

[ 91 95 104 110 84 110 107 76 135 88]

[106 88 98 87 99 113 111 81 130 87]

[ 85 98 113 85 77 124 110 78 126 104]

[ 97 98 94 104 97 112 98 74 118 108]

[ 92 73 100 98 88 127 120 86 126 90]]

Classification reports for the Baseline Model is:

precision recall f1-score support

0 0.77 0.69 0.73 1105

1 0.74 0.86 0.80 863

2 0.69 0.45 0.54 1514

3 0.43 0.56 0.48 766

4 0.51 0.68 0.58 748

5 0.56 0.59 0.58 955

6 0.79 0.70 0.74 1118

7 0.72 0.73 0.73 990

8 0.76 0.83 0.79 921

9 0.78 0.77 0.78 1020

accuracy 0.67 10000

macro avg 0.67 0.69 0.68 10000

weighted avg 0.69 0.67 0.67 10000

From the Above data we can say that the predications probability for the data.

Augmented Model:

A graph of a loss

Description automatically generated with medium confidence

Observations from the Above Pictures.

Both the training and testing data are performing better, and they are approaching converging in few iterations. From the picture we can say that the model is learning and performing better on training and testing data respectively. As the training accuracy increases the testing accuracy also increased parallelistic improvement of the testing and training accuracies is caused due to the Data Augmentation which helped to extra the multiple features from the transformations. Loss is also getting minimized over the training and testing accuracies. As the plot shows, the training and testing losses also getting minimized from the graph.

ConfusionMatrix:

[[ 71 117 64 90 121 95 124 96 128 94]

[ 80 90 98 83 121 80 105 115 118 110]

[ 95 96 98 88 110 119 110 83 108 93]

[ 79 95 89 98 99 93 128 102 121 96]

[ 85 97 99 92 120 104 126 87 107 83]

[ 79 96 80 85 115 92 105 99 130 119]

[ 94 104 87 91 119 94 93 101 125 92]

[ 86 100 77 92 116 94 109 102 122 102]

[ 68 116 92 99 110 69 114 107 130 95]

[ 98 108 85 92 109 83 117 91 127 90]]

Classification Matrix:

precision recall f1-score support

0 0.09 0.07 0.08 1000

1 0.09 0.09 0.09 1000

2 0.11 0.10 0.10 1000

3 0.11 0.10 0.10 1000

4 0.11 0.12 0.11 1000

5 0.10 0.09 0.10 1000

6 0.08 0.09 0.09 1000

7 0.10 0.10 0.10 1000

8 0.11 0.13 0.12 1000

9 0.09 0.09 0.09 1000

accuracy 0.10 10000

macro avg 0.10 0.10 0.10 10000

weighted avg 0.10 0.10 0.10 10000

***Benefits and Challenges of Data Augmentation:***

Data Augmentation increases the diversity in the training data by transformations like rotating the image, flipping etc. Which helps to robust on the future coming data. Mitigates overfitting by providing more training samples by augmenting the data which will less likely make the model memorize the data and instead learn the generalizable features. Enhanced Training Efficiency as the Augmented datasets can be generated on-the-fly, reducing the need to store a large amount of preprocessed data. This can save storage and memory resources. Better Model Performance than baseline model trained with data augmentation often achieves better accuracy on test data compared to models trained without augmentation. Challenges Takes More Computational/training time to train the data as the number of images increased. tuning hyperparameters by the trial-and-error method. Domain Specific challenges like in medical field it may lead to change of decisions.