LEVEL 2
Intermediate Techniques (Performance Improvement)

Problem Statement : To improve the baseline CIFAR-10 image classification model developed in Level 1 using intermediate deep learning techniques such as:

- Data Augmentation
- Regularization
- Improved generalization strategies

Dataset & Split Strategy :

Dataset: CIFAR-10
Total Images: 60,000

As per Terafac dataset split requirement (80-10-10):

Split	Images	Source
Train	40,000	From CIFAR-10 training set
Validation	5,000	From CIFAR-10 training set
Test	10,000	Official CIFAR-10 test set

Techniques Applied :

Data Augmentation:

- Random Horizontal Flip
- Random rotation
- Random crop with padding
- Color jitter
- Normalization

Validation and test sets does not use augmentation

Regularization :

- Dropout(p=0.5) added before final classification layer
- Weight decay (L2 Regularization) applied in optimizer

Training Configuration :

- Optimizer: Adam
- Weight Decay: 1e-4
- Learning Rate: 0.0001
- Loss Function: CrossEntropyLoss
- Batch Size: 64
- Epochs: 5

Results :

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MODEL EVALUATION RESULT (LEVEL 2 - IMPROVED MODEL)
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Test Accuracy: 94.74%
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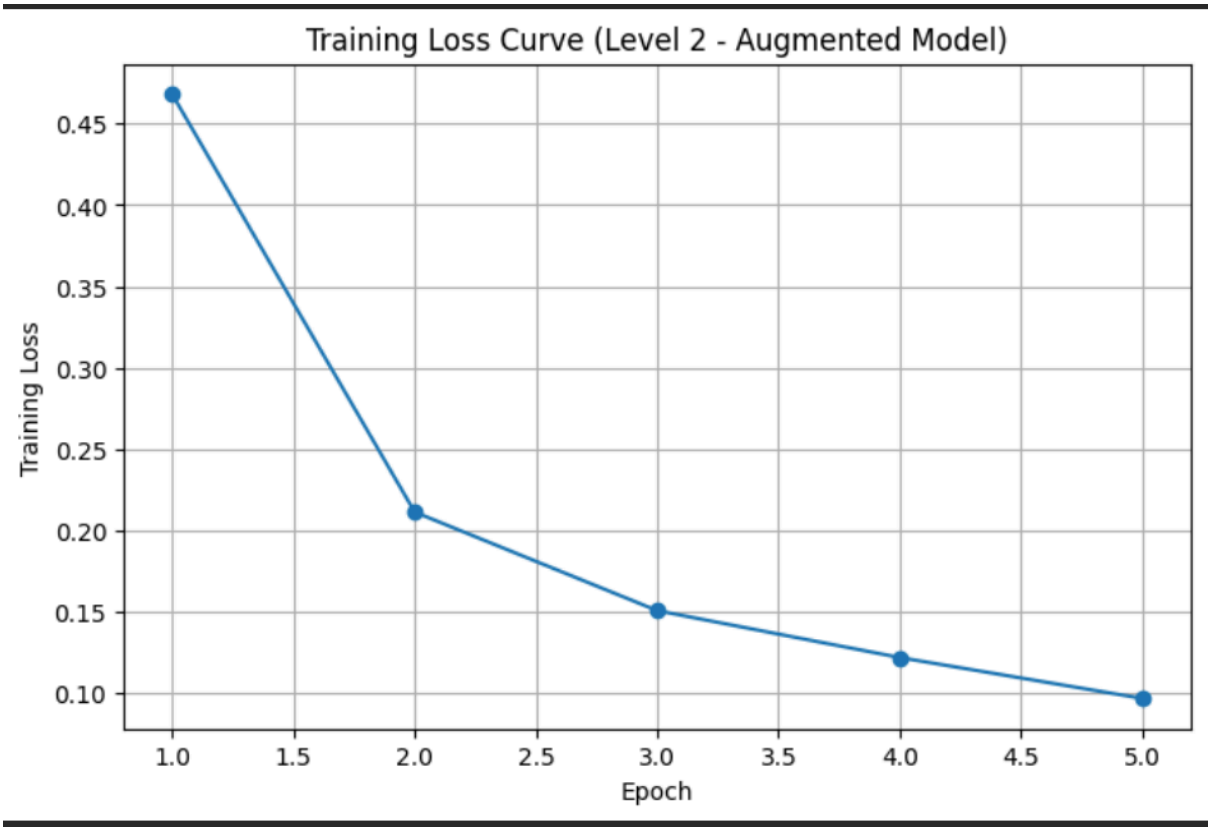
Plot:

Training Curve



Comparison Table :

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ACCURACY COMPARISON (COMPARISON STUDY)
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                                              Model  Test Accuracy (%)
0                 Level 1 Baseline (No Augmentation)              93.13
1  Level 2 Improved (With Augmentation + Regulari...              94.74
```

Observations :

- The improved model achieves **higher test accuracy** compared to the baseline.
- Data augmentation exposes the model to diverse image variations, improving robustness.
- Dropout regularization prevents overfitting by discouraging co-adaptation of neurons.
- Weight decay helps control model complexity and improves generalization.
- The performance gain of **+1.61%** demonstrates the effectiveness of intermediate techniques.
- This confirms that the Level 2 training strategy improves model generalization over the baseline.

Colab Notebook Link:

- Terafac_ML_Test_Level1-3.ipynb