

# Report: Image Classification using ResNet on CIFAR-10 Dataset

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## Introduction:

This report outlines the process of building and training an image classification model using the ResNet architecture on the CIFAR-10 dataset. The goal is to classify images into one of the ten classes present in the CIFAR-10 dataset, including objects like airplanes, automobiles, birds, cats, deer, dogs, frogs, horses, ships, and trucks.

## Methodology:

### 1. Data Preparation:

- CIFAR-10 dataset is used, consisting of 60,000 32x32 color images in 10 classes, with 6,000 images per class.
- Data augmentation techniques such as random rotation and horizontal flip are applied to the training set to increase variability.
- The dataset is split into training and testing sets, with 50,000 images in the training set and 10,000 images in the testing set.

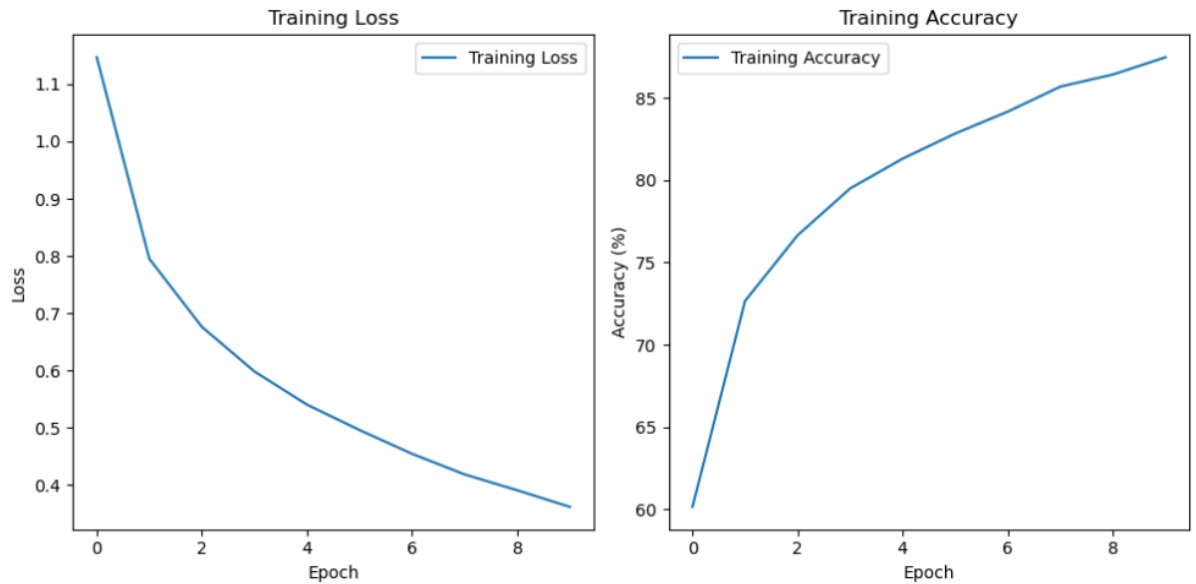
### 2. Model Architecture:

- ResNet architecture is utilized as the base model.
- The fully connected layer of the ResNet model is replaced with a new linear layer to adapt the output to 10 classes.
- Pretrained ResNet model with weights trained on ImageNet dataset is used as the starting point.

### 3. Training:

- Adam optimizer is used with a learning rate of 0.0001.
- The model is trained for 10 epochs, monitoring loss and accuracy during training. The model's performance improved steadily over the course of training, as both loss and accuracy metrics showed improvement with each epoch. I am adding picture of loss and accuracy.

```
Epoch [1/10], Loss: 1.1469, Accuracy: 60.15%
Epoch [2/10], Loss: 0.7953, Accuracy: 72.66%
Epoch [3/10], Loss: 0.6765, Accuracy: 76.65%
Epoch [4/10], Loss: 0.5985, Accuracy: 79.50%
Epoch [5/10], Loss: 0.5407, Accuracy: 81.31%
Epoch [6/10], Loss: 0.4964, Accuracy: 82.83%
Epoch [7/10], Loss: 0.4549, Accuracy: 84.17%
Epoch [8/10], Loss: 0.4189, Accuracy: 85.69%
Epoch [9/10], Loss: 0.3913, Accuracy: 86.42%
Epoch [10/10], Loss: 0.3623, Accuracy: 87.47%
Finished Training
```



#### 4. Evaluation:

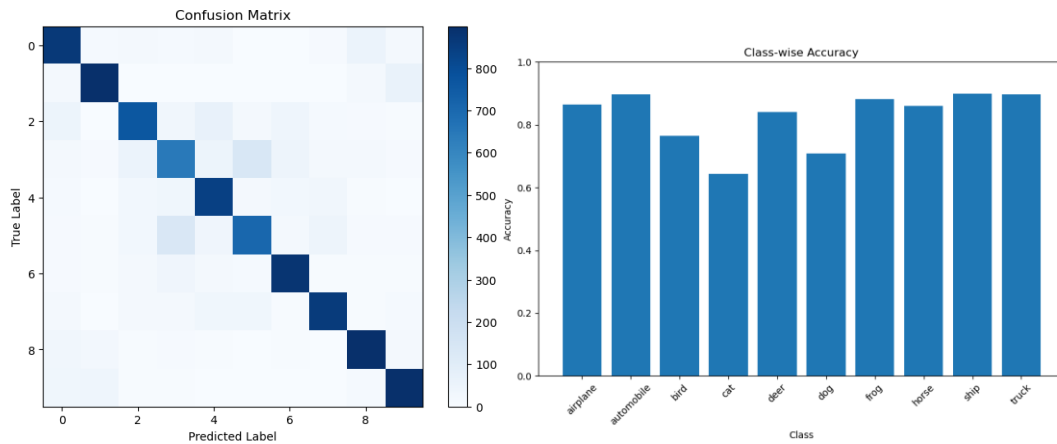
- The trained model is evaluated on the testing set to compute accuracy.
- Confusion matrix and classification report are generated to evaluate the performance of the model on individual classes.

#### 5. Prediction:

- An image is uploaded and passed through the trained model to predict its class.
- The predicted class label and the uploaded image are displayed.

### Results:

- Training Loss and Accuracy: The training loss decreases, and accuracy increases with each epoch, indicating effective learning.
- Testing Accuracy: The accuracy of the model on the testing set is computed to be approximately 82%.
- Confusion Matrix: Provides insights into the model's performance on individual classes.
- Classification Report: Includes precision, recall, F1-score, and support for each class.
- Class-wise Accuracy: The model's accuracy varies across different classes, with some classes being predicted more accurately than others.
- Here I am adding pictures of confusion matrix, and plot of class wise accuracy.



## Conclusion:

The ResNet model trained on the CIFAR-10 dataset demonstrates strong performance in image classification, achieving an accuracy of approximately 82% on the testing set. The model exhibits variations in accuracy across different classes, indicating areas for potential improvement. Overall, the use of the ResNet architecture proves effective for image classification tasks on the CIFAR-10 dataset.

Pictures that my model is predicting good.

Predicted Class: airplane



Predicted Class: cat

