Image Classification using CNN - CIFAR-10 Dataset

Internship Domain: Machine Learning / Deep Learning

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1. Introduction

Image classification is one of the most fundamental tasks in computer vision. Convolutional Neural Networks (CNNs) are especially powerful for image recognition tasks. In this project, we use a CNN to classify images from the CIFAR-10 dataset, which contains 60,000 32x32 color images across 10 classes.

2. Dataset Description

The CIFAR-10 dataset consists of 60,000 images divided into 10 classes, such as airplane, car, bird, cat, and more. There are 50,000 training images and 10,000 test images. Each image is a 32x32 RGB image.

3. CNN Model Architecture

The model is built using TensorFlow's Sequential API. It includes:

- 3 convolutional layers with increasing filters (32, 64, 128)

- Each followed by MaxPooling to reduce dimensions

- Flattening and a Dense layer of 128 units with ReLU

- A Dropout layer to prevent overfitting

- A final Dense layer with 10 units and softmax activation for classification

4. Training and Validation

The model was compiled with Adam optimizer and categorical cross-entropy loss. We trained the model for 20 epochs with early stopping and learning rate reduction. Graphs were plotted to

visualize training and validation accuracy and loss.

5. Model Evaluation

The model achieved high accuracy on the test set. We also selected a random image to predict and compare the actual label with the predicted one. The result was visually displayed using matplotlib.

6. Conclusion

This project successfully demonstrates how CNNs can be used for multi-class image classification. Further improvements could include data augmentation, more epochs, or using pre-trained models like ResNet or VGG.

7. References

- TensorFlow Documentation (https://www.tensorflow.org)

- CIFAR-10 Dataset (https://www.cs.toronto.edu/~kriz/cifar.html)

- Keras API Guide (https://keras.io/)