Image Classification

using Cifar-10 and Cifar-100 Datasets

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1. Introduction

The primary objective of the project is to build a convolutional neural network model that can classify between twenty-four different classes of the CIFAR-10 and CIFAR-100 datasets. The classes are car, bird, cat, deer, dog, horse, truck, cattle, fox, baby, boy, girl, man, woman, rabbit, squirrel, tree, bicycle, bus, motorcycle, pickup truck, train, lawn mower and tractor. This involves obtaining, preparing and exploring the data sets. Different models will then be built and the hyperparameters will be adjusted based on the accuracy of the model. At the end of the project, the model with the best test accuracy will be presented.

# 2. Datasets

The underlying datasets can be downloaded from 'https://cs.toronto.edu/~kriz/cifar.html'. They consist of different classes, separated into training and test images with corresponding labels. Each training and test image is also divided into several batches.

### 2.1 CIFAR-10

The CIFAR-10 dataset consists of 50000 training and 10000 test 32x32 colour images, 10 classes with 5 training and 1 test batch. Each class contains 6000 images. Each batch contains randomly selected images from each class, while the training batches contain 10000 images each and the test batches contain 1000 images each. When the training batches are added together, there are exactly 5000 images from each class.

The following 10 classes are in the dataset:

* Airplane
* Automobile
* Bird
* Cat
* Deer
* Dog
* Frog
* Horse
* Ship
* Truck

### 2.2 CIFAR-100

Similar to the CIFAR-10 dataset, this dataset also contains classes of images. There are 100 classes of 600 images each, divided into a five-to-one split, with 500 training images and 100 test images per class. Each class is grouped into a superclass. The data set contains 20 superclasses. The images are labelled with a 'fine' label for the exact class and a 'coarse' label for the superclass.

The classes contained are shown below:

|  |  |
| --- | --- |
| **Superclass** | **Classes** |
| aquatic mammals | beaver, dolphin, otter, seal, whale |
| fish | aquarium fish, flatfish, ray, shark, trout |
| flowers | orchids, poppies, roses, sunflowers, tulips |
| food containers | bottles, bowls, cans, cups, plates |
| fruit and vegetables | apples, mushrooms, oranges, pears, sweet peppers |
| household electrical devices | clock, computer keyboard, lamp, telephone, television |
| household furniture | bed, chair, couch, table, wardrobe |
| insects | bee, beetle, butterfly, caterpillar, cockroach |
| large carnivores | bear, leopard, lion, tiger, wolf |
| large man-made outdoor things | bridge, castle, house, road, skyscraper |
| large natural outdoor scenes | cloud, forest, mountain, plain, sea |
| large omnivores and herbivores | camel, cattle, chimpanzee, elephant, kangaroo |
| medium-sized mammals | fox, porcupine, possum, raccoon, skunk |
| non-insect invertebrates | crab, lobster, snail, spider, worm |
| people | baby, boy, girl, man, woman |
| reptiles | crocodile, dinosaur, lizard, snake, turtle |
| small mammals | hamster, mouse, rabbit, shrew, squirrel |
| trees | maple, oak, palm, pine, willow |
| vehicles 1 | bicycle, bus, motorcycle, pickup truck, train |
| vehicles 2 | lawn-mower, rocket, streetcar, tank, tractor |

### 2.3. Data Details

A screenshot of a computer

Description automatically generatedA graph of loss and loss

Description automatically generatedA computer screen shot of a program code

Description automatically generated