Image Classification using different datasets on Convolutional Neural Networks

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***Abstract*— In this paper, we examine CNN models employing a variety of datasets, including Cifar 10, Cifar 100, and Fashion MNIST. Finally, we attempt to compare the data and draw a conclusion.**

I. Introduction

This document explains why we chose this problem description and discusses some potential solutions. So we'll start with the CNN Model before moving on to the problem statement and other topics.

The most prevalent neural network model for image categorization is convolutional neural networks(CNNs). CNNs' main premise is that a local knowledge of an image is sufficient.The practical benefit is that having fewer parameters speeds up learning and minimizes th e amount of data needed to train the model.A CNN has just enough weights to look at a tiny portion of the image instead of a fully connected network of weights from each pixel.It's like reading a book with a magnifying glass: you eventually read the entire page, but you only look at a small portion of it at a time.

II. Problem Statement

The Image Classification issue is as follows:given a group of photographs all classified with the same category,we are asked to forecast these categories for a new set of test images and quantify the accuracy of our predictions. This assignment has a number of problems, which we attempt to address in order to produce a good model with reasonable accuracy.

III. Related Work

The CNN model is favoured over the other models, according to this section of the paper. It also depends on a variety of elements such as parameters, network, and so on. The basic principle behind CNN is that the filters work together to scan the entire feature matrix while also reducing the dimensions. One of the main reasons why CNN is a good fit for picture classification and processing is because of this.

Later, we determined that CNNs are effective for image classification since the dimensionality reduction idea is well suited to the large number of parameters in an image.

IV. Datasets

We employed three different types of datasets in this project: Cifar 10, Cifar 100, and Fashion MNIT databases. We'll go over this in more detail below:

A. *Cifar 10:*

The CIFAR10 dataset contains 60000 32x32 color images divided into ten classes,each with 6000 images.There are 50000 photos for training and 10,000 images for testing.

Each of the 10000 photos in the dataset is separated into five training batches and one test batc h. The test batch contains exactly 1000 photos from each class,chosen at random. The remaining photographs are randomly distributed among the training batches, however certain training batches may contain more images from one class than others.The training batche s contain exactly 5000 photos from each class between them.

The classes are absolutely incompatible. Automobiles and trucks are not interchangeable. Automobiles include sedans, SUVs, and similar vehicles. Only large trucks are classified as "trucks." Both do not include pickup trucks.

B. *Cifar 100:*

The CIFAR-100 dataset contains 60000 32x32 color images divided into 100 classes, each with 600 images. Each class has 500 training photos and 100 assessment images. There are 50000 photos for training and 10,000 images for testing. Twenty super classes are formed from the 100 classes. Each image has two labels: a fine label (real class) and a coarse label (superclass).

C. *Fashion-MNIST:*

Fashion-MNIST is a Zalando article picture dataset that includes a training set of 60,000 samples and a test set of 10,000 examples. Each sample is a 28x28 grayscale image with a label from one of ten categories.

Each image has a height of 28 pixels and a width of 28 pixels, for a total of 784 pixels. Each pixel has a single pixel-value that indicates its lightness or darkness, with larger numbers signifying darker pixels. This pixel value is an integer ranging from 0 to 255. There are 785 columns in the training and test data sets. The first column indicates the article of clothing and contains the class designations (see above). The pixel values of the corresponding image are cont ained in the remaining columns.

Labels of this dataset include:

- 0 T-shirt/top
- 1 Trouser
- 2 Pullover
- 3 Dress
- 4 Coat
- 5 Sandal
- 6 Shirt
- 7 Sneaker
- 8 Bag
- 9 Ankle boot

V. PREPROCESSING

We'll try to process the data before fitting it into the model in this stage.

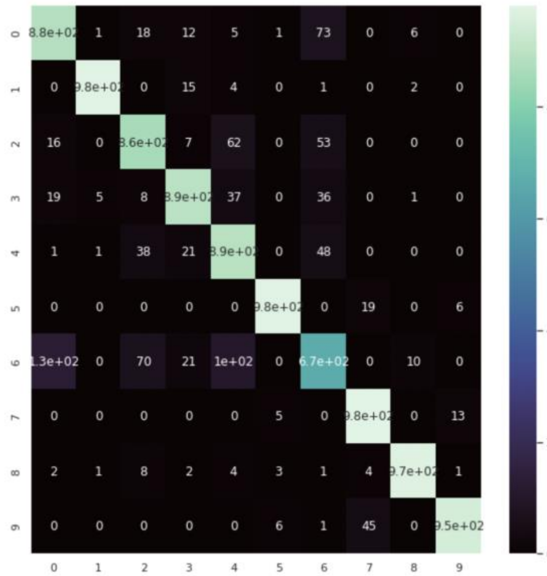
- We begin by importing the necessary libraries and dataset from the keras.
- We then separate the data into two categories: testing and training.
- Now we're trying to get the overall number of labels that have been classified as well as the unique label
- The shapes of testing and training data are now printed.
- Next part is to visualize the dataset. So, we print the 15 rows and 15 columns of images in form a matrix.
- We convert the variables y_train, y_test from the decimal values into binary i.e., one-hot encoding.
- Now, we reshape the model to have a single channel.
- We print the shape to check if it has the single channel.

We use the same procedure for all three datasets, with a few exceptions (for example we just reshape and normalize the data from the dataset cifar 100).

VI. MODEL

In this step, we will train the model, evaluate it and predict it with the testing data.

- Build the network.
- First created a Con2D to perform convolution process.
- Create 32 filters where each filter consists of 3*3 matrix with an activation function of RELU.
- Input shape is dimension of image which is 28*28 needed for Input layer.
- Increase the depth of the network by adding more layers.
- Create a fully connected artificial neural network which uses Dense
- Since we have 10 classes, and dataset has 10 classes, so output must have 10 values.
- Now, we compile model and SGD optimizer.
- Use fit method to train the model using training data.
- Final evaluation of the model using testing data and get the score.
- Feed the x_data into the model and determining what are the predicted classes going to be.
- Comparing the predicted classes to the true label(y_test)
- Returning all the binary value to decimal to compare with predicted classes.
- Reshaping x_test to plot the matrix for prediction
- Confusion Matrix to summarize all the results in one location.
- Later, we can also add more layers and do a dropout to see the prediction results.



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