Exercise 6

Project Description

Title: Image Classification using CIFAR-10 dataset.

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Problem Definition: Image classification has various applications, for instance, in self-driving cars to detect and classify pedestrians, motorcycles, trees, bicycles etc; classification of features on Earth such as roads, rivers, agricultural fields etc using satellite images. With the advancements in deep learning, every year, new algorithms/ models keep on outperforming the previous ones, to achieve the best possible accuracies for image classification. One of the most popular dataset used is the CIFAR-10 dataset. In our project we propose to implement the deep learning algorithms based on a few selected studies previous studies with the aim to attain the best possible classification accuracy.

Dataset: The CIFAR-10 dataset consists of 60000 32x32 colour images in 10 classes, with 6000 images per class. There are 50000 training images and 10000 test images.
Source: https://www.cs.toronto.edu/~kriz/cifar.html

Approach: With such a large dataset, one of the main challenges of classification is diversity of the images. Our model/algorithm must be able to handle fine-grained and specific classes even when they are hard to distinguish. In other words, we need to maximize inter-class variability, while minimize intra-class variability. At the same time, attaining the best possible classification accuracy is always a challenge for any given algorithm. The predictions go wrong when you have too many false positives and false negatives.

We propose to follow the following two approaches in our image classification:

1. Training a Convolutional Neural Network (CNN) for image classification.
2. Training a linear Support Vector Machine (SVM) for image classification.
3. Generating hand-crafted features (obtained from Histogram of Gradients, HoG).
4. Comparing hand-crafted features and learned features (obtained from CNN and linear SVM)

Results and Evaluation: The results can be quantitatively evaluated by calculating the top 1 and top 5 test set error rates as done in previous studied. The qualitative evaluation can be performed by selecting 5 most probable class for a given object in an image and computing their probabilities.

Work division:
Sascha Stelling: Training a linear Support Vector Machine (SVM) for image classification, Generating hand-crafted features (obtained from Histogram of Gradients, HoG).
Shivali: Training a Convolutional Neural Network (CNN) for image classification, Comparing hand-crafted features and learned features (obtained from CNN and linear SVM).