Deep Learning

Programming Assignment – 1

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Aim : To classify the dataset of test images given in the question using KNN classifier and check the accuracy of the KNN classifier for different values of K and plot confusion matrix.

Theory and Approach : The problem statement presented 2 different datasets for which the KNN classifier was trained and tested for the given dataset. KNN classifiers mainly work on the principle of Euclidean distance between images. In one dataset 28*28 grayscale images were given which were classified using intensity of pixel values as features. In the second dataset RGB images were given in which histogram of intensities values were used for classification.
For MNIST dataset we converted 28*28 images to a 1d vector of 784 values and used that as input data to our machine learning model. For CIFAR dataset we first creating frequency list of 256 pixel values in each RGB channels and then concatenated 3 list to obtain final list of 764 values which was used as input data for our model. Confusion matrix was used from Sklearn library.

Inferences :

Q1 with K=1

Confusion Matrix of the given KNN classification with K = 1

```
[[ 8  0  0  0  0  0  0  0  0  0]
 [ 0 14  0  0  0  0  0  0  0  0]
 [ 0  0  7  1  0  0  0  0  0  0]
 [ 0  0  0  8  0  2  0  0  0  1]
 [ 0  0  0  0 10  0  0  0  0  4]
 [ 0  1  0  1  1  4  0  0  0  0]
 [ 2  0  0  0  0  0  8  0  0  0]
 [ 0  0  0  0  0  0  0 14  0  1]
 [ 0  0  1  0  0  0  0  0  1  0]
 [ 0  0  0  0  1  0  0  1  0  9]]
```

Accuracy of the above classification is 0.83

Q1 with K=3

Confusion Matrix of the given KNN classification with K = 3

```
[[ 8  0  0  0  0  0  0  0  0  0]
 [ 0 14  0  0  0  0  0  0  0  0]
 [ 1  1  6  0  0  0  0  0  0  0]
 [ 0  1  1  8  0  0  0  0  0  1]
 [ 0  0  0  0 10  0  0  0  0  4]
 [ 0  1  0  1  1  4  0  0  0  0]
 [ 2  0  0  0  0  0  8  0  0  0]
 [ 0  0  0  0  0  0  0 14  0  1]
 [ 0  0  0  0  0  0  0  0  2  0]
 [ 0  0  0  0  0  0  0  2  0  9]]
```

Accuracy of the above classification is 0.83

Q1 with K=5

Confusion Matrix of the given KNN classification with K = 5

```
[[ 8  0  0  0  0  0  0  0  0  0]
 [ 0 14  0  0  0  0  0  0  0  0]
 [ 0  1  6  0  1  0  0  0  0  0]
 [ 0  1  1  8  0  0  0  0  0  1]
 [ 0  0  0  0 11  0  0  0  0  3]
 [ 0  1  0  1  1  4  0  0  0  0]
 [ 1  0  0  0  1  0  8  0  0  0]
 [ 0  0  0  0  0  0  0 14  0  1]
 [ 0  0  0  0  0  0  0  0  2  0]
 [ 0  0  0  0  0  0  0  2  0  9]]
```

Accuracy of the above classification is 0.84

Q2 with K=1

Confusion Matrix of the given KNN classification with K = 1

```
[[3 0 0 0 0 1 0 2 1 3]
 [1 1 1 1 1 0 0 0 0 1]
 [0 1 3 1 0 0 2 0 0 1]
 [0 0 1 1 1 0 4 0 0 3]
 [1 0 2 1 0 0 2 0 0 1]
 [0 1 1 0 0 0 2 2 0 2]
 [0 1 1 1 4 1 4 3 0 1]
 [0 1 2 0 1 1 2 0 2 2]
 [3 2 0 1 0 0 1 0 4 2]
 [0 1 3 1 3 0 0 2 0 1]]
```

Accuracy of the above classification is 0.17

Q2 with K=3

Confusion Matrix of the given KNN classification with K = 3

[[4 1 1 0 1 1 1 1 0 0]
 [1 2 1 1 0 0 0 0 0 1]
 [1 2 3 0 0 0 1 0 0 1]
 [0 3 1 1 0 0 4 0 0 1]
 [2 0 2 1 1 0 1 0 0 0]
 [0 3 1 0 0 1 1 2 0 0]
 [0 1 2 4 2 3 3 1 0 0]
 [2 3 0 0 1 0 2 0 2 1]
 [4 2 1 0 0 0 0 1 3 2]
 [0 1 3 3 2 0 0 1 0 1]]

Accuracy of the above classification is 0.19

Q2 with K=5

Confusion Matrix of the given KNN classification with K = 5

[[3 1 1 0 1 0 2 1 0 1]
 [1 2 1 1 0 0 0 0 0 1]
 [1 2 1 0 1 0 1 0 0 2]
 [0 3 1 1 0 0 4 0 0 1]
 [1 0 1 2 1 1 1 0 0 0]
 [0 2 1 0 1 1 1 1 0 1]
 [0 2 0 2 2 3 5 2 0 0]
 [1 2 1 0 1 1 2 0 1 2]
 [2 3 2 2 0 0 0 0 2 2]
 [0 0 1 4 1 0 2 2 0 1]]

Accuracy of the above classification is 0.17

Results:

We observed that for MNIST dataset we got good accuracy for KNN classification using pixel intensity values as features which was around 83% but for CIFAR dataset we got only 18% accuracy for histogram features. Thus we can see the importance of choosing correct features representations for machine learning models for getting good results.

Github Repo Link →
https://github.com/bhomik96/Deep-Learning-Course