DEEP LEARNING FOR VISUAL COMPUTING

Report 1st Assignment:

**Group 4:**

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*November 11.11.2018, Vienna*

**What is image classification:**

M. K.:

In image classification is a process of assigning images to different classes (labelling) based on information extracted from this images. For this task one of the Machine Learning algorithm could be used, where classification is based on the information extracted from set of images used in training process.

“””In image classification an ML algorithm learns to predict the class of unseen samples and assigns a class value called label. In classification the number of class label values is finite and discrete.”””

**What is the purpose of the training, validation and test sets and why do we need all of them?**

M.K.:

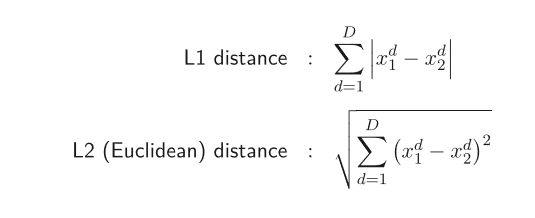
The training set is used to train classifier, that mean to learn classifier how should perform classification. Validation set is used to estimate the performance of classifier during the training process and test set to estimate final performance of classifier (after training).

Effectiveness of the classifier is based on ability of predicting label for unseen data. According to that observation present in the training set should not be present in validation and test sets. Because validation is used to maximize performance of classification, we expect that it would be maximize for the whole population of observations instead of this present in validation set, respectively observation present in validation set should not be included in test set. Not respecting that rules could leads to overfitting.

“””The training set is used for classifier training. Hyperparameters are tested and selected using a validation set. Test set is used for the final estimate of performance. The performance estimate is not valid, if the test set is used during training or validation. We get overfitting. “””

**How do knn classifiers work?**

The knn classifier computes the distance between a sample and its k closest neighbours. To identify the k closest neighbours of one sample x, the distance (either L1 or L2) to all other samples has to be calculated. As a distance measure either L1 or L2 (Euclidian) can be used. The distance is computed over all dimensions.



Then the classifier looks at the label of the k nearest neighbours and assigns the most frequent label to sample x. [If one wants to know how certain the classifier is,] (it is not really clear I guess we do not need that?) the frequency of each class label can be calculated among the k closest samples. Additionally, the largest value could be emphasized using the softmax function.

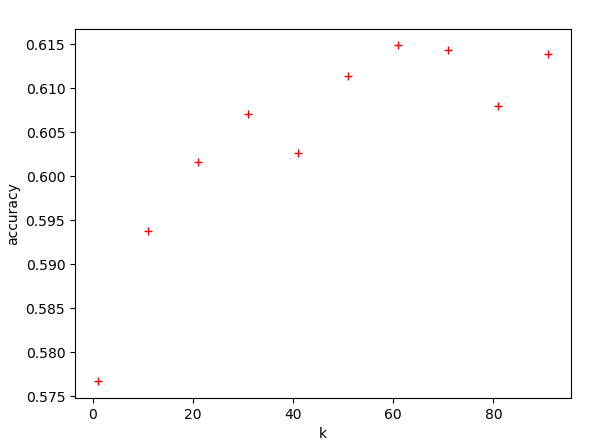
I think we do not need that, is out of topic: [

There are also other functions to make w (vector of label frequencies) a valid probability mass function. Different k values – so the number of neighbours to be considered for classification - can be tested using a validation set. The final estimate of the accuracy is then done using a test set.

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**Results**

In the following plot the validation accuracies for different k-values can be seen:



Best accuracy using validation set is: **0.6148946594806467** for k = **61**.

Accuracy using test set is: **0.6175** using best k of validation set.

**Conclusions**

M.K.:

As we see value of the accuracy get on the validation set is close to performance of classifier get on the validation set, we assume with height probability that we could generalize that results for whole population of the observations.

The value of the accuracy is indicates that we could not strongly relay on the results of this classifier. It analyse the values of colour channels for the each pixel without analysing relations between those pixels. We could assume with high probability that higher impact for classification has background colour then features allowing recognize animal on the picture (dog could be presented on higher number of pictures outside then cats).

The performance could be probably improved, but gap between actual results and expected result is too big to use that solution for reliable image classification.

“””The knn classifier performs poorly, because it is based on average image similarity. As feature vectors we use all pixels of an image. Thus the classifier has no understanding oft he image. Dimension is large and input space is sparsely occupied, which is why distance measures become unintuitive. The solution here ist he extraction of discriminative features. “””