TP 6 – AOS1
Kernel methods

1 Faces classification

In this hands-on session we are going to classify faces with SVM. First download the dataset with the following intructions

```
from sklearn.datasets import fetch_lfw_people
faces = fetch_lfw_people(min_faces_per_person=60)
```

(1) By looking at the fetched object `faces`, tell how many samples there is, what are their dimensionality and what are the different classes.

Before learning, we split our dataset into a test set and a train set.

(2) Use the `train_test_split` function to split our dataset into `X_train`, `X_test`, `y_train` and `y_test`.

```
from sklearn.model_selection import train_test_split
```

Next, to make the SVM learning more tractable we start by a reduction of dimension.

(3) Use a PCA to reduce the dimension to 100. What is the percentage of explained variance?

Now that the dataset is of acceptable dimension, learn a linear SVM on the train set and look at the training error and confusion matrix on the test set. You will need the following functions to do so:

```
from sklearn.svm import SVC
from sklearn.metrics import confusion_matrix
from sklearn.metrics import classification_report
from sklearn.metrics import accuracy_score
```

(4) At this point, we have only used the default values for all hyperparameters to train our model. What are those hyperparameters?

(5) Use the `GridSearchCV` object to perform a search on the 2 hyperparameters. What are the best hyperparameters?

```
from sklearn.model_selection import GridSearchCV
```

(6) Suppose we want to include the number of principal components to the set of hyperparameters. Define a scikit-learn pipeline to achieve this.

2 Problem

The paper by Burges and Schölkopf [1] is investigating a method the improve the accuracy and speed of SVM. First train a SVM with the same dataset (MNIST) with the kernel and the hyperparameter C they are suggesting.

Describe the technique they are using to improve the accuracy and implement it to see if it is working.

References

[1] Chris J.C. Burges and Bernhard Schölkopf. "Improving the Accuracy and Speed of Support Vector Machines". In: *Advances in Neural Information Processing Systems 9*. MIT Press, 1997, pp. 375–381.