INF264 - Homework 1

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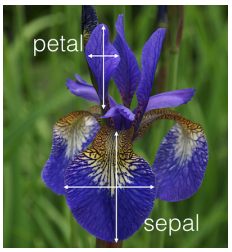
Instructions

Since it is the first exercice, instructions will be as detailed as possible. An **optional** jupyter notebook is available too with a template and hints about which functions to use.

1 k-NN for a classification problem on the Iris dataset

Iris is a small dataset consisting of 150 vectors describing iris flowers, split into three different classes representing three species of the iris family. Each vector comes with a label (the name of the species) and a set of four features which are measurements of different parts of the flower.



Left: The three species in the Iris dataset
Right: The four features in the Iris dataset (petal and sepal width and length)

Those measurements tend to differ between the different species, thus it is possible to train and evaluate a classifier from this dataset whose task is to predict the species of an iris flower represented by aforementioned set of features. In this exercice we will use k-NN classifier.

1. Iris Dataset:
   (a) Load the Iris dataset directly from sklearn. You can alternatively download the dataset here: `https://archive.ics.uci.edu/ml/datasets/iris`.
   (b) Store the first 2 features (sepal length and sepal width) in a matrix X and labels in a vector Y.
   (c) Split the dataset into 3 datasets: training set, validation set and a testing set, i.e. split X and Y into X_{train}, X_{val}, X_{test} and Y_{train}, Y_{val}, Y_{test} respectively. You can for instance use a train/validation/test ratio of 0.7/0.15/0.15.
2. Perform a k-NN classification of your dataset for each k in $1, 5, 10, 20, 30$:
   (a) Plot both training and validation Iris datapoints with respect to the two selected features. Since there are three classes, you will need three different colors.
   (b) Create an instance of the KNeighborsClassifier class
   (c) Train your instance of k-nn on your training data set
   (d) Plot the decision boundaries as decided by the trained k-nn.

(e) Compute model accuracy on training dataset and validation dataset

(f) Which model (i.e which k) would you select? Compute model accuracy on testing dataset

3. Interpretation:

(a) Plot a curve representing the training accuracy as a function of k and same for the validation accuracy.

(b) From your observations, for which values of k does k-NN overfit ?

(c) For $k = 1$, k-NN train accuracy should be equal to 1 (100% correct predictions). Explain why this is not the case here.