ROBOT LEARNING

EXCERCISE- SUPPORT VECTOR MACHINE

SUMMER SEMESTER 2021

<https://fbe-gitlab.hs-weingarten.de/mat-iki/slam-mat/-/tree/master/svm>

**Problem 1**

In this problem you will work with different kinds of sample datasets (linear and non-linear) and train a model with Support Vector Machines algorithm using Scikit library. Look for out hints at: <https://scikit-learn.org/stable/modules/generated/sklearn.svm.SVC.html>. The dataset can be extracted from the *‚data‘* folder. User could use any programming language of their choice to solve the below problems.

1. Load the linear dataset (ex6data1) into an Input Matrix (X). Plot the dataset and comment if it looks linearly separable.
2. Use the SVM module of the Scikit library to train the model. Extract the learned weight vector and bias-term. Plot the decision boundary.
3. Scikit offers a set of datasets as toy problems which can be used to implement SVM. Generate a non-linear dataset (circulary arranged points would be good option). Plot the dataset. Feel free to explore at: <https://scikit-learn.org/stable/datasets/index.html>
4. Using SVM module, train the model for classification Plot the decision boundary. **Hint**: You may want to change the kernel used for non-linear classfication models.

**Problem 2**

In this problem you will work with a non-linear dataset and train a model with Support Vector Machines using Gaussian Kernel. We will see the effect of soft margins that can be included in the Primal Optimization problem. The dataset can be extracted from the *‚data‘* folder. User could use any programming language of their choice to solve the below problems.

1. Load the non-linar dataset (ex6data2) into an Input Matrix (X). Plot the dataset.
2. Write a function to compute the Gaussian Kernel of two given matrices **X** and **Z.** (Hint: Recall the Gram Matrix).
3. Solve the SVM dual optimization problem using Quadratic Programming module of **cvxopt,** a python library. Feel free to explore it at: <https://cvxopt.org/examples/tutorial/qp.html>. Plot the decision boundary.
4. Try changing the value of C and observe how the decision boundry tries to overfit.