

Prac W11 - Support Vector Machines

COMP4702/COMP7703 - Machine Learning

Aims:

- To complement lecture material in understanding the operation of SVMs.
- To get some insight into the trained models, including the influence of a hyperparameter in an ML model.
- To produce some assessable work for this subject.

Note that for this prac, you are not expected to implement the machine learning algorithms/models from first principles. You may use existing machine learning libraries/toolkits and refer to the documentation for those libraries. You can also choose to use tools like ChatGPT to help you. However, if you want to learn something, you will need to be able to analyse the code produced by ChatGPT to verify that it works as you intended and to be able to modify it if necessary to complete the prac questions. Your understanding of this code and the work that you do will be evaluated in the prac demos.

On blackboard you will find three datasets for use in this prac (from the UCI repository): diabetes, ionosphere and sonar. Download these datasets.

- (Q1) Train an SVM using a linear kernel and set $C = 1$ for now. Note: C is the regularization hyperparameter, which controls the influence of errors (in terms of the maximum margin hyperplane) on the overall objective function for training (see Section 8.5 of the textbook and lecture notes). Useful functions:
- **Python:** `sklearn.svm.SVC()`
 - **Matlab:** `fitcsvm()` (in this, the `BoxConstraint` parameter controls C)
- (Q2) Record the classification accuracy (hold out? cross-validation?) and confusion matrix of your model.
- (Q3) Vary the C parameter on a logarithmic scale, and show how it influences the training and testing error and the decision boundaries. Which C value results in the highest testing performance? Does this mean it has the largest margin?
- (Q4) Now experiment with different kernel functions, and show how they influence your model.