Lab -9

PRML
AY 2020-21 Trimester - III
03 May, 2021

Support vector machine (SVM)

Problem 1 (Handwritten Digit Classification):
Your goal is to develop a Handwritten Digit Classification model. This model should take input as an image of a Handwritten Digit and classify it to one of the five classes {0,1,2,3,4}. To this end, you are supposed to work on the MNIST dataset. You were shown how the MNIST dataset is read and displayed in python in one of the labs. Now, perform the following experiments:

1. Use 70-20-10 split for training, validation and testing. Use the validation set for hyperparameter tuning by doing grid search, and report the classification accuracy on the test set.
2. Use nearest neighbour, perceptron and SVM classifiers for classifying handwritten digits of MNIST, and compare their performance.
3. Normalize the data by mean subtraction followed by standard deviation division. Redo the above experiments on normalized data and report the performance.
4. Implement any two from OVA/OVO/DAG, and compare the results.

Resource:
1. https://scikit-learn.org/stable/modules/neighbors.html
2. perceptron link
3. https://scikit-learn.org/stable/modules/svm.html

Problem 2: Use the "diabetes" dataset from the previous lab assignment. Split the dataset into training, validation and test sets (e.g., in 70:20:10 split, or 80:10:10 split).
On this dataset, evaluate the classification accuracy using the following classifiers:
1. SVM classifier (using a linear kernel)
2. SVM classifier (using a Polynomial kernel and a Gaussian kernel)
1. If your data is not linearly separable, then you may use the soft margin SVM formulation. You can use the inbuilt implementation of SVM in SciKit Learn.
2. Compare and analyze the results obtained in different cases. During cross-validation, try different values of various hyper-parameters, such as the regularization hyper-parameter 'C' (e.g., by varying it in {0.0001, 0.001, ... , 1, 10, 100, 1000}), and the kernel function hyper-parameter(s).
3. Report the number of support vectors obtained in the final model in each case.
4. Perform an experiment to visualize the separating hyper-plane (in a 2-D space).
You should submit a report along with the code.
1. https://scikit-learn.org/stable/modules/generated/sklearn.svm.SVC.html
2.https://sdsawtelle.github.io/blog/output/week7-andrew-ng-machine-learning-with-python.html