

HW 5:

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1. Two Class SVM and Locally Deep SVM:

a) Description:

- i. Two-Class SVM : Two-Class SVM is the standard Support Vector Machine model where we try to find the best separation between the two classes with a hyper plane. A kernel is used to measure the similarity between points and the kernels are applied globally to all points.
- ii. Locally Deep SVM: Locally deep SVM is a modification to the two class SVM where the Kernels used for measuring similarity are composed of a local and global kernel. The method tries to learn the local embeddings that are high dimensional, sparse and computationally deep; which allows the SVM method to decouple the cost from the calculation from the number of support vectors. Locally Deep SVM is faster than two class SVM but might make a sacrifice for accuracy.

b) Differences:

- i. **Cost/Performance:** In Two Class SVM, the cost of calculating the separating hyper planes depends on the number of support vectors which could increase linearly with training data. Hence the cost of calculating the hyper plane is linearly proportional to the training data.

Locally Deep SVM was designed such that for non-linear data, the cost of calculating separating hyperplanes does not increase linearly with training data.

- ii. **Kernels:**

In two-class SVM the same kernel is used for all the data points.

Locally Deep SVM is based on Localized Multiple Kernel Learning approach where the algorithm tries to learn a different kernel for each data point.

c) When to use Locally Deep SVM or Two Class SVM:

- If the data is linearly separable, use standard Two-Class SVM.
- If cost/performance of completing the classification problem needs to be optimized then Locally Deep SVM should be used.
- If high classification accuracy is required, Two-Class SVM should be used.

2. SVM on Vehicle Data

Best results were with the cost parameter = 5

Training Set accuracy: 100%

Test Set accuracy: 96%

a) Training Set Prediction:

Predicted	Car	Non-Car
Truth		
Car	343	0

Non-Car	0	333
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b) Test Set Prediction:

Predicted Truth	Car	Non-Car
Car	83	3
Non-Car	7	77