One-Class Slab Support Vector Machine

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Abstract: In this paper we present one-class slab SVM (OC-SSVM), a one-class classifier that aims at improving the performance of the one-class SVM. The proposed strategy reduces the false positive rate and increases the accuracy of detecting instances from novel classes.

I. INTRODUCTION

One-class classifiers are useful in applications where collecting samples from negative classes is challenging, but gathering instances from a target class is easy. An ensemble of one-class classifiers can solve the open-set recognition problem.

The one-class SVM (OCSVM) learns a hyperplane that keeps most of the instances of the target class on its positive side. However, instances from the negative class can also be on the positive side of this hyperplane.

Unlike the OCSVM, the proposed OCSSVM approach encloses the normal region of the target class in feature space by using two parallel hyperplanes. When an instance falls inside the normal region or the slab created by the hyperplanes, the OCSSVM labels it as a sample from the target class, and negative otherwise.

II. General Terms Used

1. SVM :

   SVM is a binary classification model developed by Vapnik from Structural Risk minimization theory. It uses the technique known as The Kernel trick in which it transforms the data and accordingly finds the optimal boundary between the possible outputs.

   Reasons for SVMs being so important are -

   - When a dataset is considered with a large number of features and small sample size, SVMs are very powerful.

- Using SVM, both simple and highly complex classification models can also be learned.
- SVM is helpful in avoiding the overfitting of curves by utilizing advanced mathematical principles.

III. RESULTS AND OBSERVATIONS

For Letter Dataset -

Kernel	Accuracy (in terms of Matthews correlation coefficient)
Linear	**0.067109**
RBF	**-0.18733144**
X^2	0.26520668
Polynomial	0.088485841
Hellinger	0.19836719
Intersection	0.17667648

For Pascal Dataset (worked only for 6 classes) -

Kernel	Accuracy (in terms of Matthews correlation coefficient)
Linear	**-0.05465948**
Intersection	**-0.169**
RBF	0.0
X^2	-0.054
Hellinger	-0.153370593

IV. CONCLUSION

This work presented the one-class slab support vector machine as a step towards the idealized one-class solution for open-set recognition. In contrast to the regular one-class SVM, which learns a single hyperplane for identifying target samples, instances from the positive class, the proposed classifier uses two parallel hyperplanes learned in feature space to enclose a portion of the target samples.

The proposed OCSSVM showed consistent performance improvement over the regular one-class SVM on two different datasets: letter and the PascalVOC 2012.