

Accepted Manuscript

Hyperparameter Selection of One-class Support Vector Machine by Self-adaptive Data Shifting

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PII: S0031-3203(17)30356-4
DOI: [10.1016/j.patcog.2017.09.012](https://doi.org/10.1016/j.patcog.2017.09.012)
Reference: PR 6279



To appear in: *Pattern Recognition*

Received date: 13 April 2017
Revised date: 29 June 2017
Accepted date: 6 September 2017

Please cite this article as: Siqi Wang, Qiang Liu, En Zhu, Fatih Porikli, Jianping Yin, Hyperparameter Selection of One-class Support Vector Machine by Self-adaptive Data Shifting, *Pattern Recognition* (2017), doi: [10.1016/j.patcog.2017.09.012](https://doi.org/10.1016/j.patcog.2017.09.012)

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Highlights

- We propose a novel self-adaptive data shifting based method for one-class SVM (OCSVM) hyperparameter selection, which has a significant influence on OCSVM performance.
- The proposed method is able to generate a controllable number of high-quality pseudo outlier data around target data by efficient edge pattern detection and a “negative shifting” mechanism, which can effectively regulate the OCSVM decision boundary for an accurate target data description. Meanwhile, negative shifting soundly addresses two major difficulties of previous pseudo outlier generation based hyperparameter selection methods.
- The proposed method also generates pseudo target data for OCSVM model validation on target class by a “positive shifting” mechanism, which provides an efficient alternative to the time-consuming cross-validation or leave-one-out (LOO) process. More importantly, positive shifting can encourage robustness to noise in the given target data during hyperparameter selection, by generating non-noise pseudo target data for validation from original noise.
- The proposed method is able to yield superior performance when compared with other state-of-the-art OCSVM hyperparameter selection methods, on both synthetic 2-D datasets and various benchmark datasets.
- Unlike many previous methods that introduce additional hyperparameters into OCSVM hyperparameter selection, the proposed method is fully automatic and self-adaptive, leaving no additional hyperparameter for users to tune. Besides, the application of the proposed method is not restricted to certain kernel functions like Gaussian kernel.

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