OPTImization for MAchine Learning (OPTIMAL) Research Lab

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Sparse pinball twin support vector machines (SPTWSVM)

- TWSVM problems are based on hinge-loss function and, hence, are sensitive to feature noise and **unstable** for re-sampling.
- To overcome the limitations of TWSVM, we propose a novel sparse pinball twin support vector machines **(SPTWSVM)** based on the ϵ-insensitive zone pinball loss function to rid the original TWSVM of its **noise insensitivity**.
- Exhaustive testing on several benchmark datasets demonstrates that our SPTWSVM is noise insensitive, retains sparsity and **outperforms TWSVM** in many cases.

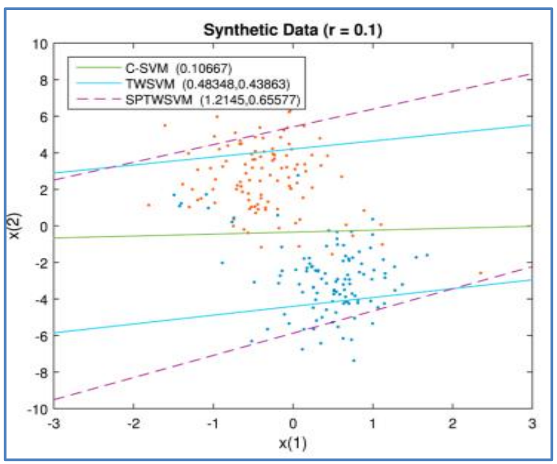

Figure 1. Plot showing noise insensitive of our SPTWSVM as compared to C-SVM and TWSVM.

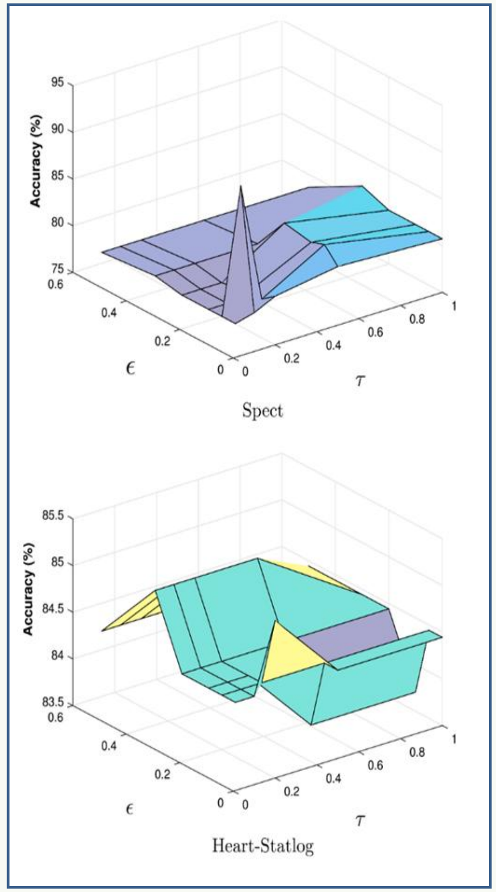

Figure 2. Insensitivity performance of proposed Pin-GTSVM for classification to the user specified parameters.

General twin support vector machine with pinball loss function

- The standard twin support vector machine (TWSVM) uses the hinge loss function which leads to **noise sensitivity** and **instability**.
- A novel general twin support vector machine with pinball loss (Pin-GTSVM) is proposed for classification problems.
- The proposed Pin-GTSVM is noise insensitive and more **stable for re-sampling**.
- Further, the **computational complexity** of the proposed Pin-GTSVM is similar to that of the TWSVM.
- Numerical experiments with different noise are performed on benchmark **real-world datasets.** and the results are compared with other baseline methods.
- The comparisons clearly show that the proposed Pin-GTSVM has **better generalization performance** for noise corrupted datasets.

Dataset	TSVM	TPMSVM	Pin-TSVM	Pin-GTSVM ($\tau = 0.5$)
	Accuracy± sd *Time(s)*	*Accuracy± sd* *Time(s)*	*Accuracy± sd* *Time(s)*	*Accuracy± sd* *Time(s)*
Fertility	**96.66±10.54**	**96.66±10.54**	**96.66±10.54**	**96.66±10.54**
(100×9×2)	0.026	0.006	0.027	0.025
$r = 0.05$	**96.66±10.54**	**96.66±10.54**	**96.66±10.54**	**96.66±10.54**
	0.025	0.006	0.028	0.025
$r = 0.1$	**96.66±10.54**	**96.66±10.54**	**96.66±10.54**	**96.66±10.54**
	0.025	0.007	0.027	0.025
Banknote	36.446±7.30	**42.44±3.04**	41.26±5.88	36.92±7.44
(1372×5×2)	0.027	0.02	0.026	0.025
$r = 0.05$	38.13±7.58	42.23±4.17	42.23±4.90	**42.26±8.81**
	0.027	0.02	0.026	0.025
$r = 0.1$	41.53±8.47	42.33±4.03	**42.47±4.86**	42.02±8.98
	0.026	0.02	0.027	0.026

Figure 3. Performance comparison of binary-class algorithms.

Publications

1. M. Tanveer, A. Tiwari, R. Choudhary, S. Jalan, Sparse pinball twin support vector machines, Applied Soft Computing 78 (2019) 164-175, Elsevier (**SCI Indexed with Impact Factor: 3.907**).
2. M. Tanveer, A. Sharma, P.N. Suganthan, General twin support vector machine with pinball loss function, Information Sciences (2019), Elsevier (**SCI Indexed with Impact Factor: 4.305**)