Machine Learning for Time Series
Time warp invariant kSVD:
Sparse coding and dictionary learning for time series under time warp

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I. Introduction

We're gonna talk about [1].

II. Models

II.1. Sparse coding

II.1.1 Orthogonal Matching Pursuit

II.1.2 TWI Orthogonal Matching Pursuit

II.2. Dictionnary learning

II.2.1 k-SVD

II.2.2 TWI k-SVD

III. Experimental setup

III.1. BME Dataset

III.2. DIGITS Dataset

III.3. Evaluation metrics

IV. Results

IV.1. BME dataset

IV.2. DIGITS dataset

V. Conclusion

VI. Appendix

References

[1] SAEED, V. Y., AND DOUZAL-CHOUAKRIAA, A. Time warp invariant ksvd: Sparse coding and dictionary learning for time series under time warp. 1

Sparsity/Models	kSVD	TWI-kSVD
2	0.25889	0.17313
5	0.19553	0.12301
10	0.14806	**0.08559**

Table 1. Reconstruction L_2 errors on the BME dataset (lower is better)

Sparsity/Models	kSVD	TWI-kSVD
2	**0.20**	0.58
5	0.30	0.58
10	0.42	0.47

Table 2. Original classification strategy

Sparsity/Models	kSVD	TWI-kSVD
2	**0.12**	0.53
5	**0.12**	0.53
10	0.18	0.62

Table 3. Our classification strategy

Table 4. Classification error rates on the BME dataset (lower is better)

Sparsity/Models	kSVD	TWI-kSVD
2	0.50032	0.53786
5	0.30314	0.32883
10	**0.20322**	0.21764

Table 5. Reconstruction L_2 errors on the DIGITS dataset (lower is better)

Sparsity/Models	kSVD	TWI-kSVD
2	**0.26**	0.73
5	0.50	0.66
10	0.65	0.92

Table 6. Original classification strategy

Sparsity/Models	kSVD	TWI-kSVD
2	**0.14**	0.81
5	0.24	0.76
10	0.30	0.88

Table 7. Our classification strategy

Table 8. Classification error rates on the DIGITS dataset (lower is better)

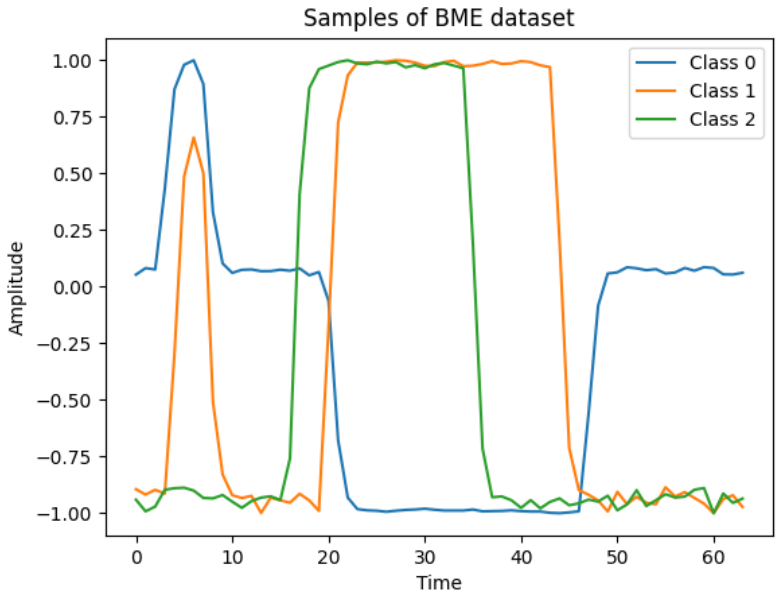
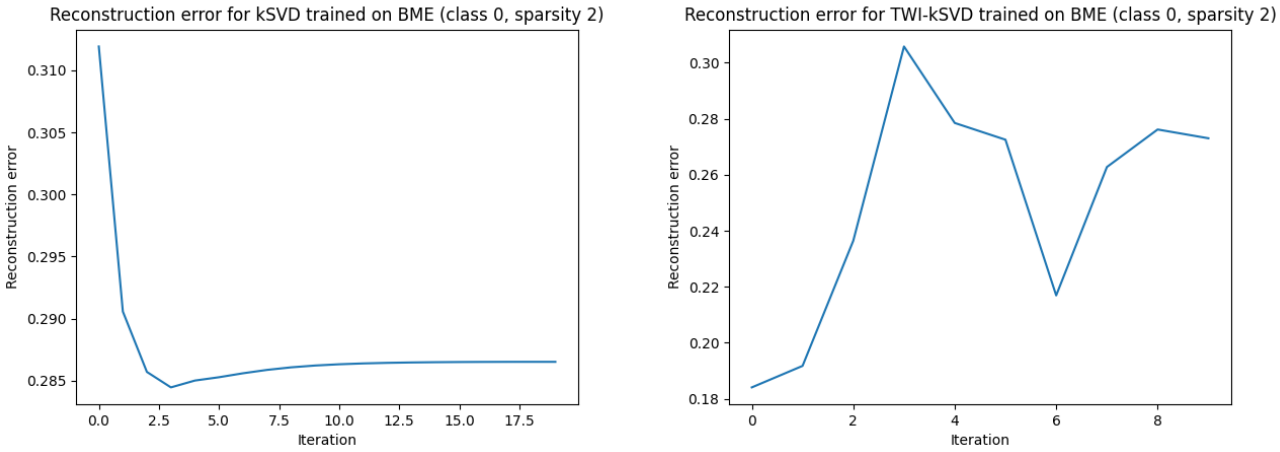


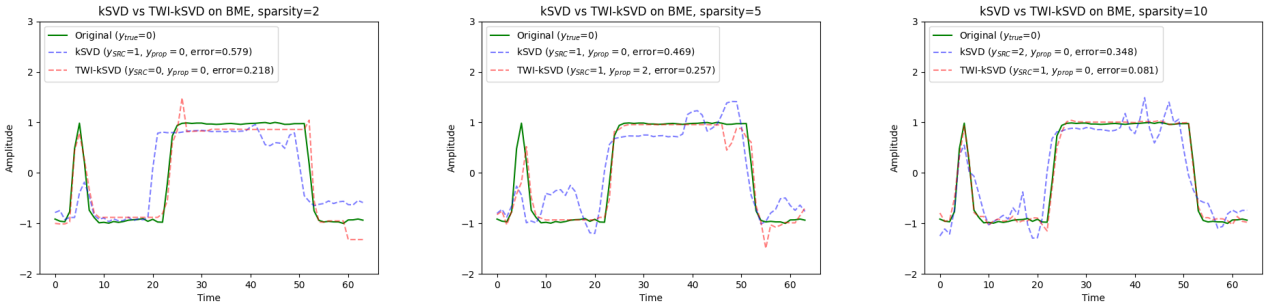
Figure 1. Samples of each class of the BME dataset



(a) kSVD

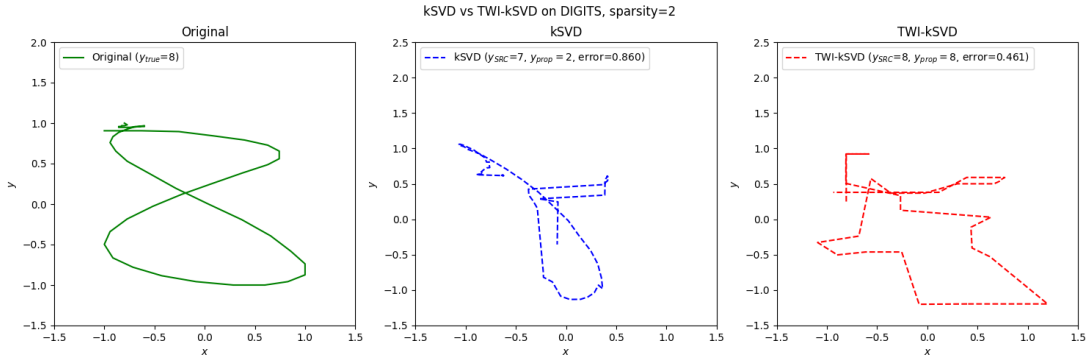
(b) TWI-kSVD

Figure 2. Evolution of reconstruction loss during training (BME dataset)

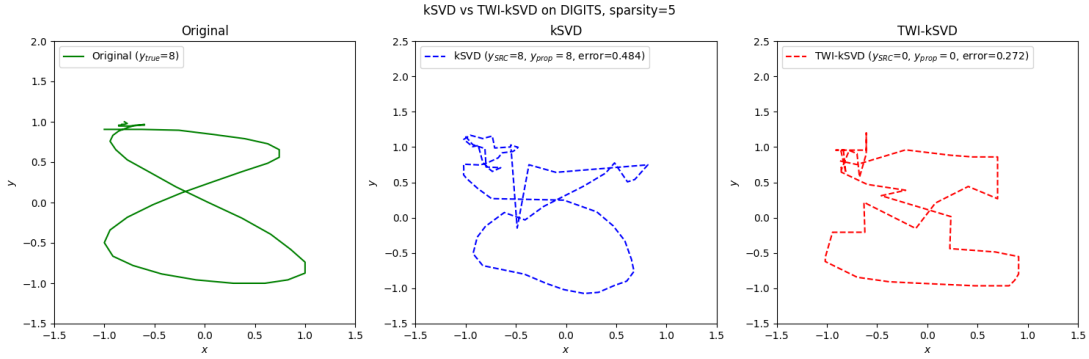


(a) Sparsity = 2 (b) Sparsity = 5 (c) Sparsity = 10

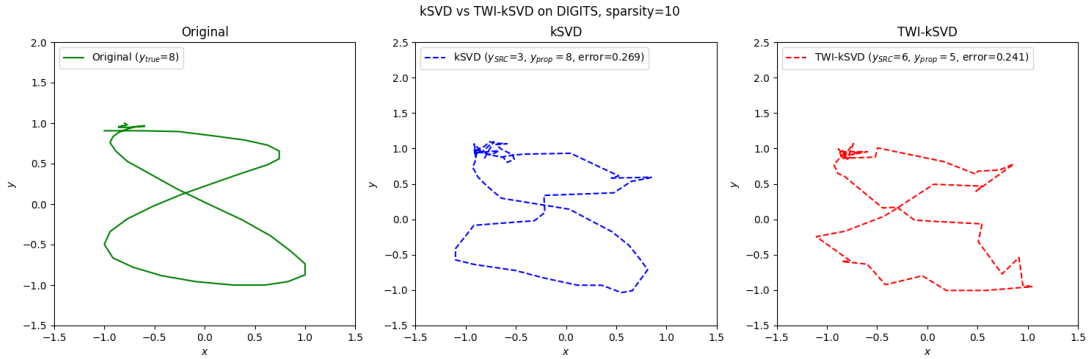
Figure 3. Example of reconstructions (BME dataset) with different sparsity levels



(a) Sparsity = 2



(b) Sparsity = 5



(c) Sparsity = 10

Figure 4. Example of reconstructions (DIGITS dataset) with different sparsity levels