DYNAMIC MODELING BY SUPPORT VECTOR MACHINES

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Kernel methods are very popular for static modeling, i.e. classification or nonlinear regression. Only few attempts have been made at extending the concepts to dynamic modeling, i.e. models where some or all variables of the model are the predictions provided by the model at previous sampling times. The feedback thus introduced results in an increased complexity; it is well known, however, that, in the presence of output noise, the optimal model is a recurrent model[1]. Therefore, for modeling processes with output noise, which is a very frequent situation, taking feedback into account during training is mandatory.

To the best of our knowledge, the first attempt at training recurrent SVMs was performed by Suykens et al.[2] in the framework of LS-SVMs. The authors made a drastic simplification by neglecting the regularization terms in the cost function, thereby losing one of the salient features of SVMs, i.e. their built-in regularization mechanism. In the present work, we show that such a simplification is not necessary, at the expense of an increased, but still manageable, complexity in the equations.

The approach is validated on various examples, academic and industrial. On academic problems, it is shown that the method does find optimal predictors, i.e. models for which the variance of the modeling error, estimated on a test set, is equal to the variance of the noise present in the training sequences.

On the negative side, it appears that the computational cost of training these models is much larger than that of recurrent neural networks, without any gain in accuracy in the examples investigated so far.

Topics: estimation, prediction, and sequence modeling
Preference: poster

[1] O. Nerrand, D. Urbani, P. Roussel-Ragot, L. Personnaz, G. Dreyfus (1994), *Training Recurrent Neural Networks : Why and How ? An Illustration in Process Modeling* , IEEE Transactions on Neural Networks , 5, 178-184.
[2] J.A.K. Suykens and J. Vandewalle (2000), *Recurrent least squares support vector machines*, IEEE Transactions on circuits and systems-Fundamental theory and applications, 47, 1109-1114.