

Statistical Learning for System Identification

Statistical Learning Theory comprises a collection of techniques that have been developed in order to theoretically analyze the performance of neural network and other “learning” algorithms. In this course, a number of recent results in statistical learning theory are summarized in the context of nonlinear system identification. A top-down approach to the problem is taken, leading to the statement of a number of characterization results. Specific topics covered include many strtical methods, such as Logistic regression, Bayesian Models, EM algorithm , Support Vector Machine, Hidden Markov Models, Reinforcement Learning , for dynamic system identification.

Content (28 classes)

1. Introduction (1)
2. System identification (4)
3. Neural networks for modeling (5)
4. Support Vector Machine (3)
5. Statistical learning for system identification (8)
6. Convolution neural networks for system identification (1)
7. Reinforcement Learning for system identification (3)
8. Deep learning for system identification (3)

Statistical learning for system identification

1. linear regression for system identification
2. Bayesian Models for system identification
3. Maximum entropy model for system identification
4. Boosting methods for system identification
5. Bagging methods for for system identification
6. Hidden Markov Models for system identification
7. K nearest neighborhood for system identification
8. Kernel Smoothing for system identification

References

- [1] Hastie, T., Tibshirani, R. and Friedman, J. The Elements of Statistical Learning: Data Mining, Inference and Prediction, 2nd Edition. Springer, 2009.
- [2] V. James, G., Witten, D. Hastie, T. and Tibshirani, R. An Introduction to Statistical Learning Springer, 2014.
- [3] Vapnik, V. N., Statistical Learning Theory , Wiley-Interscience, 1998.
- [4] Vidyasagar, M., Learning and Generalization: With Applications to Neural Networks , Springer, e1: 1997, e2: 2003.
- [5] Cover, T. M. and Thomas, J. A., Elements of Information Theory , Wiley-Interscience, e1: 1991, e2: 2006.
- [6] Ljung, L., System Identification: Theory for the User , Prentice Hall, e1: 1987, e2: 1999.