Pattern recognition using hidden Markov models in financial time series

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Automated trading systems spread in the last years due to the advances in technologies. Before, traders usually took their investment decisions looking at the prices graphs and recognizing some trading patterns. Since our aim consists in replicating the behavior of a discretionary trader, we have developed a software that can recognize trading patterns in real time using hidden Markov models (HMMs). Financial time series are strongly affected by noise. Moreover, trading patterns are defined by their shape and can occur at different time scales and have different amplitudes. Since the problem is quite similar to speech recognition, we used hidden Markov models to develop our software (see [2] for application of HMMs to speech recognition).
Let us suppose we want to recognize N trading patterns. We trained N HMMs using Baum-Welch Algorithm combined with Genetic Algorithm. Extending the idea shown in [1] to continuous observations HMMs, we trained a threshold model which can recognize all the not predefined patterns. Then, we implemented the classification algorithm to work in real time. Since a trader needs to be fast to enter the market, we have finally modified the algorithm to recognize forecasted scenario before they happen, as our brain does.

References

[1] Lee, H.-K., Kim, J.H. (1999). An HMM-based threshold model approach for gesture recognition. *IEEE Transactions on Pattern Analysis and Machine Intelligence* **21**, 961–973.

[2] Rabiner, R. (1989). A tutorial on hidden Markov models and selected application in speech recognition. *Proceedings of the IEEE* **77**, 257–286.