Master Thesis Proposal

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Proposed Topic:

Prediction of Daily Volatility on Financial Markets Using Neural Networks.

Topic Characteristics:

Following the frail notion from the McNelis book concerning the possible usefulness of volatility prediction, the thesis will attempt to do so exploiting the Neural networks concept. Neural networks constitute framework for estimating non-linear systems. If designed carefully, neural network should give an analyst a comparative advantage on a given market. The downside of using neural network is that, due to its structure, even a „perfect" network in terms of predictions, gives little or – more commonly – no insight whatsoever into the estimated problem (just as any other statistical approach, for that matter).

While the concept of neural networks is not exactly new, it still hasn't penetrated into general awareness of economists, perhaps and most probably due to its computer skills requirements. However, many procedures are now available pre-programmed for commonly used software such as MATLAB, allowing this appealing concept to be used by a broader analytic community.

This paper will attempt to explain (or even promote) the basic concept behind neural networks as clearly as possible, followed by the effort to design, or only choose, if readily available, a suitable concrete network predicting the volatility for a given market on daily basis. The performance of the network will be challenged by traditional Linear regression and GARCH model.

Hypotheses:

There are at least two important questions that this work would like to address;

Firstly, the effort put into this work arises from the belief that the use of neural networks represents an advatage in precision of predicting financial markets behavior. This thesis will attempt to test this hypothesis on the real-life data, possibly on an arbitrary exchange rate pair.

Secondly, one cannot simply ignore the computational complexity of neural networks. Even perfect prediction is useless if it does not come in good time, sufficiently in advance. Therefore not only precision but also speed of convergence and adaptation should be tested against reasonable benchmark.

Methodology:

To test the above-mentioned problems, it is crucial to design an adequate neural network. Forunately, there exists a number of pre-programmed code e.g. for MATLAB sotftware. Effort will be made to find one that would be suitable for predicting volatility. However, there is still a possibility of writing a code and designing a network from the scratch. After the network is designed and trained (estimated), there will be a series of benchmark tests among different mutations of the network and traditional statistical methods such as linear regression and GARCH model.

Outline:

I. Introduction to neural networks
II. Volatility as a measure of risk
III. Specific neural network design
IV. Testing performance on arbitrary financial market
V. Benchmark tests
VI. Summary of results
VII. References

Core Bibliography:

McNelis, Paul D. – Neural Networks in Finance
2005 Elsevier Academic Press, ISBN: 0-12-485967-4

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1995 Journal of Applied Econometrics 10, p. 347-364

Qi, Min – Nonlinear Predictability of Stock Returns Using Financial and Economic Variables
1999 Journal of Business and Economics Statistics 17, p. 419-429

Walczak, S. – An Empirical Analysis of Data Requirements for Financial Forecasting with Neural Networks
2001 Journal of Management Information Systems 17 (4), p. 203-222

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