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Gamma Scalping using Neural Network with Heikinashi Transformed Data and its Performance

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ABSTRACT

This research paper explores the usefulness of a neural network in portfolio management using gamma scalping. Since gamma scalping requires both stock options position as well as the underlying stock to be added or removed frequently. It becomes important to optimize such transactions. The underlying portfolio provides enough data points that may be used to calculate precise points of time to initiate stock addition or removal.

Keywords: Gamma Scalping, Heikinashi data, Neural Network, portfolio management.

I. INTRODUCTION

Electronic Portfolio management has become a key method for many investment banks or portfolio managers. Although using equity alone may expose many such institutions to high risk. So many institution create hedges with the help of options.

Gamma scalping is technique where an institution hedges its open option position with the help of stocks to create a delta neutral position. This method create profits when the underlying moves to either side. So the institution's risk for a particular position vanishes. However such position create a theta loss from the options that are being held by institution. Institution may add or remove stock in order to remain delta neutral, this creates a portfolio that is independent from direction but suffers losses with the passage of time.

However if the underlying create enough gamma, the institution can book it and overcome the theta loss that may arise from such position. But this requires precise timing as booking too early may waste future gamma gains and booking too late may result from huge theta losses.

This is where we use an artificial neutral network to understand the underlying pattern of stock movement and create hot spots where a portfolio may book its gamma value.

As it has been shown [1],[2] that neutral network perform extremely well in gauging sentiment and direction of underlying stock. Many researcher [3],[4] has demonstrated the usefulness of neural network in stock selections. The use of Markov chain [4],[5] and hidden Markov model has provided better signals for forecasting. Researcher [6] have provided enough

evidence the use of SVM and [7] genetic algorithms to be useful in chaotic systems.

Better price discoveries and stock market sentiment analysis [8],[9] has been studied for many foreign exchanges. Many researchers have used various method to transform [10],[11],12]stock market data and provide better signals using neural network.

This paper describes a system that provides action points using neural network that allows portfolio managers to book profits in a delta neutral positions.

II. METHODS AND MATERIAL

Here we discuss the basic method of delta neutral positions and Heikinashi Transformation method. We will use a Heikinashi transformed data to train network and then create a delta neutral portfolio.

Heikinashi Transformation rules:

Let $O_{current}$, $H_{current}$, $L_{current}$, $C_{current}$ represents current open, high, low, close values.

Let O_{Prev}, H_{Prev}, L_{Prev}, C_{Prev} represents Previous day/period open, high, low, close values.

Then Heikin-Ashi values (HA) are calculated as:-

$HA\text{-}_{Close} = (O_{current} + H_{current} + L_{current} + C_{current})/ 4$

$HA\text{-}_{Open} = (HA\text{-}_{OpenPrev} + HA\text{-}_{ClosePrev}) / 2$

$HA\text{-}_{High}$ = Maximum of the $H_{current}$, $HA\text{-}_{Open}$ or $HA\text{-}_{Close}$

$HA\text{-}_{Low}$ = Minimum of the $L_{Current}$, $HA\text{-}_{Open}$ or $HA\text{-}_{Close}$

A. Delta neutral position

Delta neutral position can be created by buying both call and put option , such position have positive gamma but negative theta value.

Lets say that Q represents the entire portfolio with P being Puts and C being calls. Lets say that n represents no of lots of both calls and puts.

So $Q= n(P+C)$

lets say that (P+C) has a combined daily theta value T.

So net daily theta value of entire portfolio is = nT

Lets say Gamma generated over a period of Z is G.

Net theta loss for Z days= nTZ

Net Gamma Gain is = G

Total value of stock present in portfolio = S

For a profitable portfolio we need to have G> nTZ.

If G>nTZ we can initiate to add or remove stock to again make entire portfolio delta neutral again. This is because one of the call and puts will have a greater delta value and entire portfolio will either have a positive delta or a negative delta.

Over all value of portfolio is given by

$Q=n(P+C)+S$

We measure the percentage gain or loss value of Portfolio by Q_{net} over 30 days.

For a positive delta , we sell stocks to book gamma.

For a negative delta , we add stocks to book gamma.

Our system uses a [4,3,3,1] neutral network with 2 hidden layers. The final output is a value between [0,1.0] 0 being low action point and 1being the highest action point.

III. RESULTS AND DISCUSSION

Following are the result from the system. As is evident from below diagram, we have a poor success below 30% prediction value. Above 30% prediction rate we start to see mainly positive results. The standard deviation is on the high side, which may denote a fine tuning may be needed. But over all results are vary convincing that we can fine tune such system for Gamma scalping.

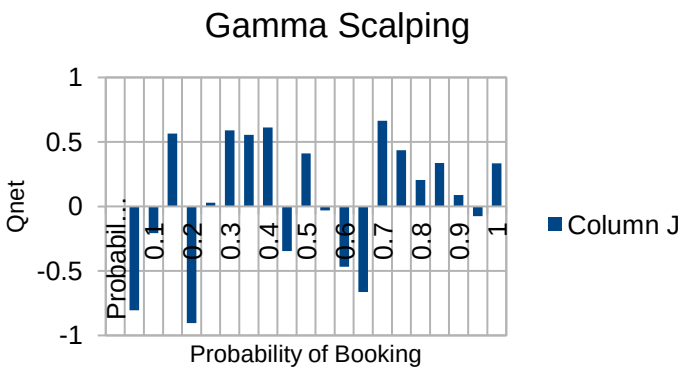

Figure 1. Results of simulation for a [4,3,3,1] neural network.

Standard Deviation	0.49
Average	0.07
Average Portfolio Return below 30% rate	-0.12
Average Portfolio Return over 30%rate	0.15

A. Structure of Neural Network

This paper doesn't test the system with different structure of neural network, which may be significant for a fine tuned performance. This also opens up the possibility of further research in above method.

B. Title and Author Details

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IV. CONCLUSION

It is evident that a gamma scalping system with neural network has potential and a further study may be needed to fine tune such system to have an acceptable profitable range.

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