

**Dennis Voigt is the developer of the BMJ Fractal Analysis Indicator Set for NeuroShell Trader. The indicators can produce a filtered time series that is theoretically stripped of most of the noise in the data. The result is a highly responsive smoothing filter of any data series. He writes about how he combines his indicators in a successful ChaosHunter trading formula that he further enhances in NeuroShell Trader.**

I have been a ChaosHunter (CH) user since it first came out. My interest in CH was to try to learn new relationships about various data series. I was hoping to find a predictive relationship that would be generalizable to other data series. And I was optimistic that I would be able to find such a relationship using CH. The ideal result would be a simple formula that could be adapted to various securities in various time periods.

Over the years I tried various approaches using various securities with mixed results. I found some promising formulas for individual securities, but I was not successful finding relationships that could be applied to other securities. Recently I tried a different approach with very different results.

I started by opening a daily chart of SPY in NeuroShell starting at the beginning of 1996. I inserted three of my BMJ Software fractal filter indicators. I created three separate predictions for each of the three indicators. I used the default prediction of percent change in open 10 days in the future. And I optimized over all of the data from 1/1/1996 through 2/28/12. The idea was to find the parameters of my indicators that would be the best predictors of the data series. In other words they would, ideally, be fractal filtered versions of the data series.

Next I exported the data from the chart to a .csv file for import into CH. I exported open, high, low, close, volume. I also included my three indicators - selecting the versions that were listed as inputs to the three predictions. In this way I was using the versions of the indicators with the parameters that were selected by the predictions.

I opened the .csv file in CH and selected all available rows for optimizing. In the input section I selected open, high, low, close, volume, and my three indicators as inputs. I selected open to be used as output. On the optimization tab, I selected evolution strategy, and buy/sell cutoff

with a threshold of +/- 10. I selected 300 shares with a commission per side of \$8.00. I checked the boxes for Smooth Equity Curve and True reversal. On the Formula tab, I used the default setting for Formula parameters. I checked the box for Chaos Input and used an initial value of .618. In the operations section, I selected all of the Arithmetic operations and all of the Technical Indicators. For potential technical indicator time series, I selected the same open, high, low, close, volume, and my three indicators.

When I optimized the model, the results progressed through some fairly simple arithmetic relationships and settled on a very simple calculation using one of the standard inputs and one of my indicators. The result was a very simple calculation based on a very simple relationship that I would never have thought of on my own. This produced a significant number of trades and a very smooth equity curve.

When I inserted the formula in a NeuroShell chart, the results were very promising. However, I was more interested in using the power of NeuroShell to create a trading strategy that could be applied to multiple symbols. So I decided to create a new trading strategy in NeuroShell based on the relationships identified by CH. CH creates one formula that's used for both long and short trades. I decided that the formula that CH created made the most sense for short trades. So I built a trading strategy in NeuroShell so that the long entry was based on conceptually similar but different inputs than the short entry. By developing a new trading strategy in NeuroShell, I was able to optimize all of the parameters, including the parameters of my fractal filter indicators. The results appeared to be more robust and generalized better than the results from the CH model. If this were true, I could apply this trading strategy to multiple symbols and optimize the parameters to tailor the model for individual symbols in NeuroShell. Based on my testing of the new trading strategy on various symbols, I was able to develop two additional versions of the trading strategy with slight modifications of the inputs. And then I combined the three versions into an ensemble trading strategy by averaging the results of the three versions.

To test the results I created a new chart of daily bars of SPY going back to 1/1/1993. I optimized the ensemble trading strategy on the data from 1/1/1993 to 9/4/2004. And

I held the data from 9/7/2004 through 3/16/2012 out of sample. The results were very good for both the optimization period and the out-of-sample period, beating the buy and hold by greater than 8 to 1 in the optimization period and greater than 14 to 1 in the out-of-sample period. The profit factor (ratio of gross profit/loss) was greater than 1.4 in both periods; the percent profitable was close to 60% in both periods and the ratio of average win to average loss was slightly better than 1.00.

I have since tested this trading strategy with multiple symbols from E-minis to commodities to Forex to individual stocks with similar results, in various time frames from daily to weekly to monthly bars as well as intraday. I have one chart with all 30 of the DJIA stocks and monthly bars with data back to 1/1/2004. I optimized 1/3, paper traded 1/3, and left 1/3 out of sample. The results are reasonably good in all time frames, even though the shapes of the data series are somewhat different in each of the 3 time frames. I included an equity curve on the chart that is based on the Chart Page Sum of the Equity Curves of the individual symbols. The result (when I sum the equity curves for all 30 symbols together) is a very smooth equity curve in all three time periods. Not all of the securities were profitable in all 3 time frames, but in this case, the trading strategy takes advantage of the diversification of the symbols. The most profitable time frame is the one that includes the decline from 2007 through March of 2009.

To try to be sure that the model is working in a fashion that is consistent with the original modeling accomplished by CH, I created 5 charts for 5 of the components of the DJIA - AA, CVX, MRK, UTX, and DIS. I optimized for the period from 1/1/2004 through 2/28/2012 (the end point for the original NeuroShell and CH optimizations) and held the data from 3/1/2012 through 4/7/2012 out of sample. The results beat the buy and hold strategy by a substantial margin for all 5 symbols in both the optimization period and the out-of-sample period.

I have a test system running the five E-minis (DJIA, S&P 500, NASDAQ 100, Russell 2000, and S&P Midcap 400) using NeuroShell automated trading with an InteractiveBrokers simulated account. So far the results seem very promising.

My conclusion at this stage is that CH was able to find a relationship that I would never have dreamed of, a relationship that is repeatable in various time frames with various price patterns, and a relationship that is generalizable to various securities. And I was able to use the powerful features of NeuroShell to preprocess the data for CH and then to improve on and test the relationships that were suggested by CH by creating a sophisticated ensemble trading strategy in NeuroShell.

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