Fintech Pitch

- About me: Zulfikar Moinuddin Ahmed. Princeton math, worked at Lehman, a commodity fund Gresham Investment Mgmt, a pharma biotech (Predicant), a tech startup Babel Research
- I have Medium frequency price prediction for currencies and commodities (1m-15m) using AI techniques with spectacular results with retail transaction costs
- This is a plan to capture the medium frequency sector for alpha strategies via a technology company rather than traditional hedge fund

Medium Frequency High Capacity Algorithmic Strategies

- High Frequency Trading (HFT) in equities and forex depend on hardware colocation for sub-15 microsecond execution
- Total HFT profits peaked at $7.2 billion in 2006 and dropped to $1 billion in 2012
- Medium Frequency may be defined in the 1 min – 1h range
- Machine Learning is effective in HFT range and extends to Medium Frequency

Executive Summary

These are backtest results for 4000 most recent periods (5m/1m/15m depending on asset). I use R package 'mlr' for machine learning since it allows me to tune the hyperparameters without fuss. What is interesting about my approach is that there is a universality; all these results use the exact same algorithm without any change. The graphs are of equity curves with initial investment equal to notional for the asset. MLR package allows one to sweep through a large number of machine learning algorithms for regression/classification. I use glmnet but I plan to test an array of machine learning algorithms. The novelty of my approach is wavelet analysis to translate the nebulous and vague ideas of chartist traders who have intuitive ways of describing combination of trends at different scales into precise quantities (wavelet details at different scales). This allows a solid approach to strategy discovery for medium frequency on data that is easy to acquire rather than hoping to gather possibly useful data whose relation to price changes can at best be too noisy to make useful trading decisions at medium frequency.

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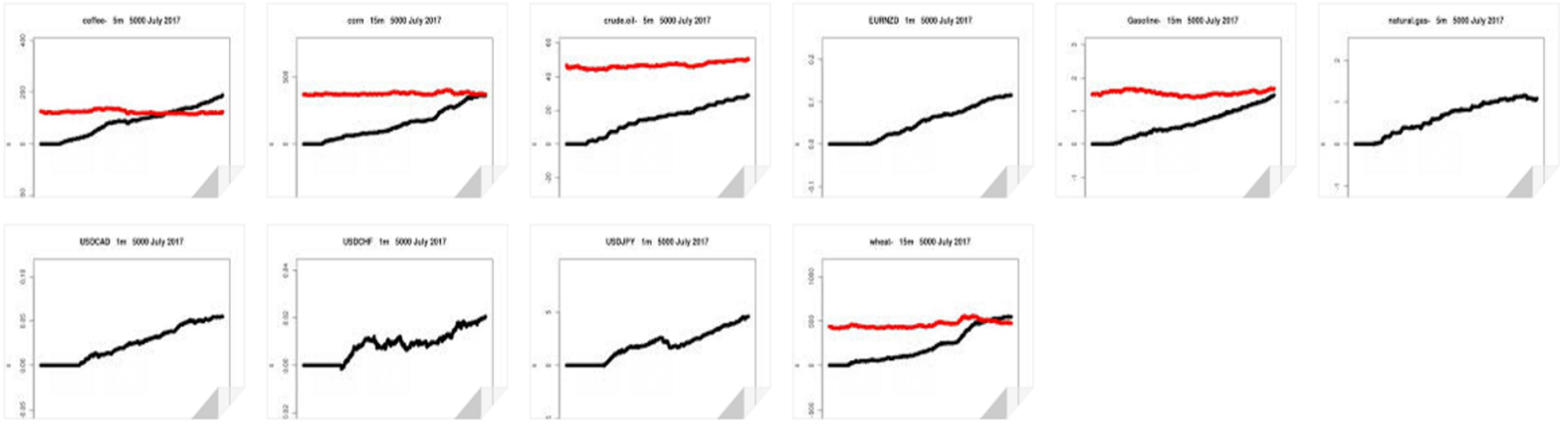
10 Attachments

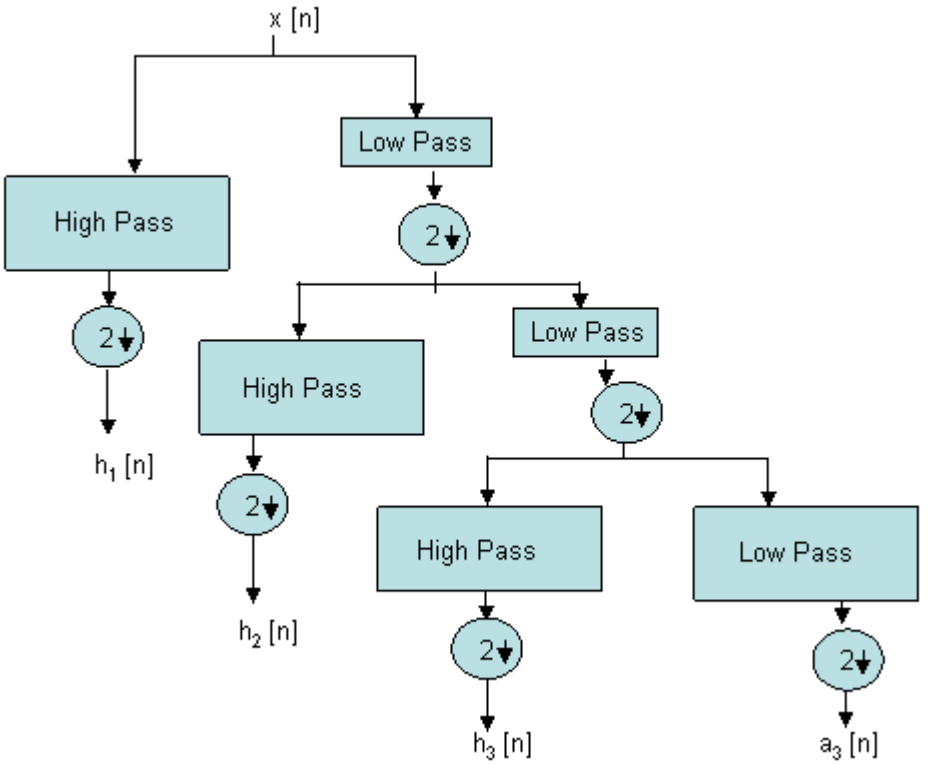


Trends in Multiple Scales

- Technical Analysis Traders/Chartists are intuitively aware of price behaviour at multiple time scales, 1 second, 1 minute, 5 minutes etc.
- Technical trading rules therefore often involve multiple indicators such as MACD, RSI etc. where buy/sell signals are generated by combination of overbought and momentum
- Technical indicators for a single scale do not automatically produce measures at multiple scales
- Signal decomposition to multiple time scales is naturally handled by Discrete Wavelet Transforms
- Trading Strategies that do not address multiple scales lead to increased probability of inaccurate price change direction prediction

Wavelet Decomposition Basics

- Discrete Wavelet Transforms have been used successfully in signal and image processing for feature extraction at multiple size scales. The basic structure is repeated high/low pass filters



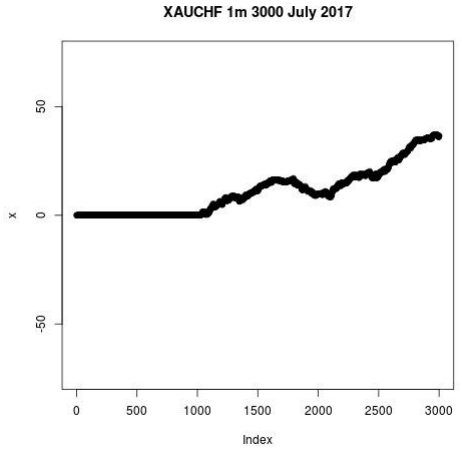
Technical Indicators and Machine Learning Simultaneously at Multiple Scales

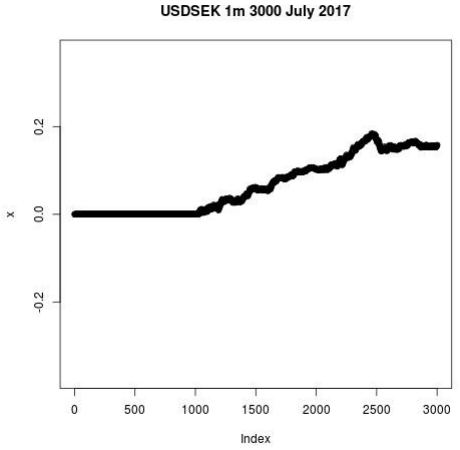
- Machine Learning algorithm are naturally applied to learn future price changes based on a series of past data and indicators
- Data: (x,y) where x is an qxp matrix of past prices and other variables (e.g. technical indicators) and y is the future price change
- Supervised learning algorithms train an algorithm on {(x_1,y_1), …,(x_N,y_N)} and is used to predict (x',y') on new data x' to predict y'
- These algorithms applied directly to prices at a given frequency, say 1 day, lead to very noisy predictions. They could be useful in higher frequencies but are generally not extremely satisfactory

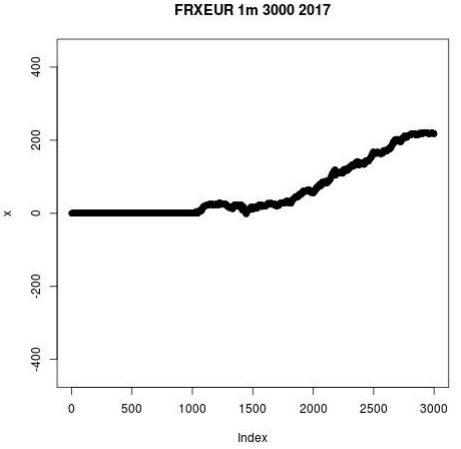
Our Solution: Combine predictions at multiple time scales

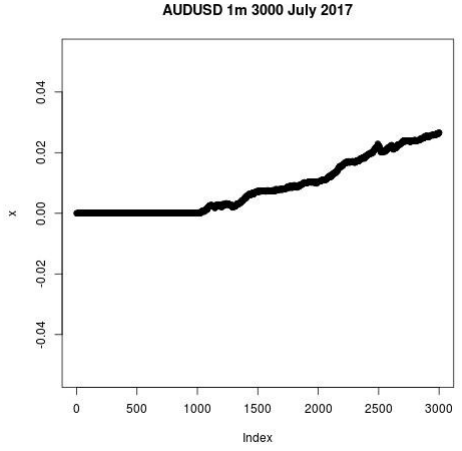
- We employ the standard machine learning prediction strategy with technical indicators as additional variables at multiple time scales simultaneously and combine the results
- Wavelet Decomposition ‘details’ at multiple scales is natural data for predictions at multiple scales
- This strategy produces sufficiently accurate price change predictions for viable trading strategies for actual data for currencies and commodity futures in the 1-minute and 5-minute time scales

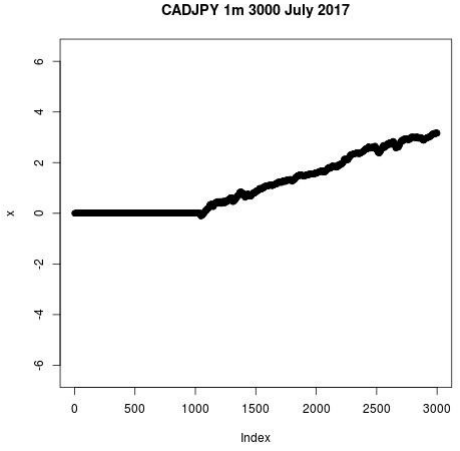
Results: Equity curves of backtests for July 2017 last 2000 minutes

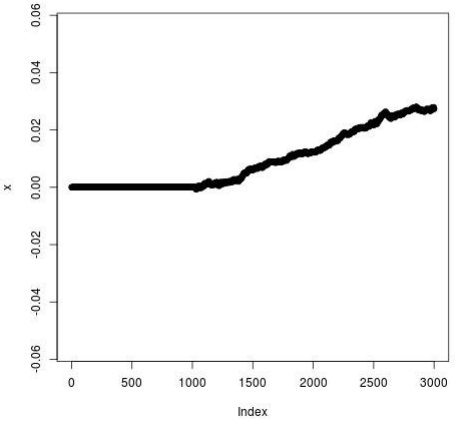




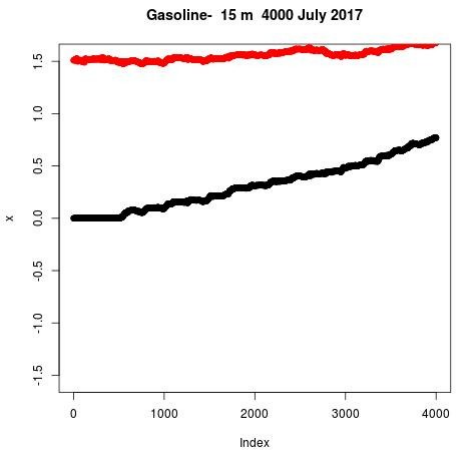


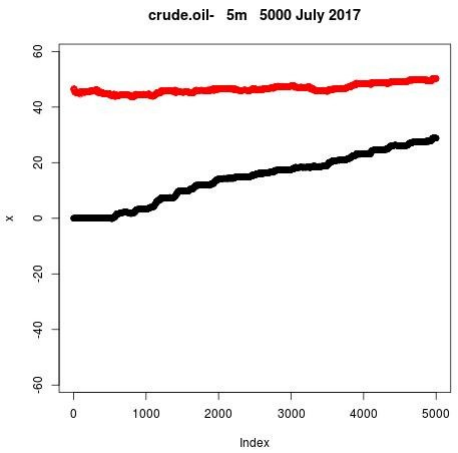


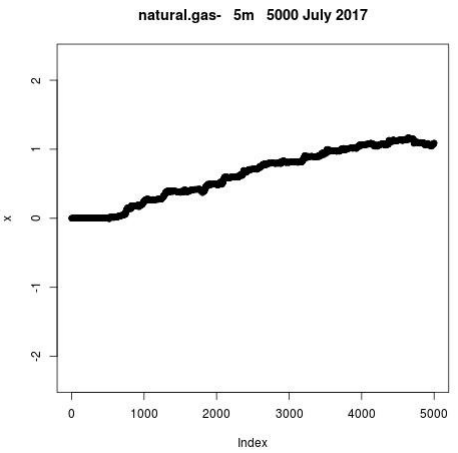




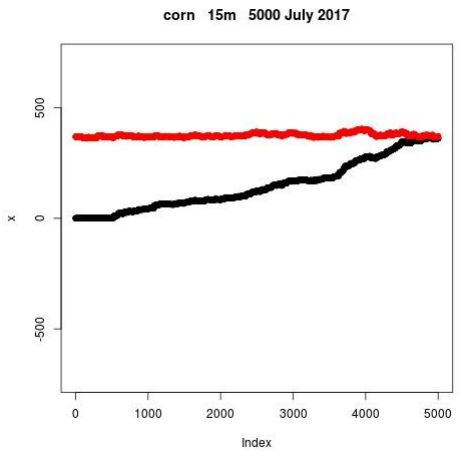
Energy Results

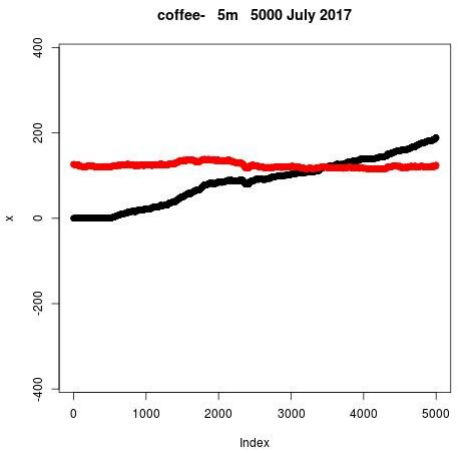


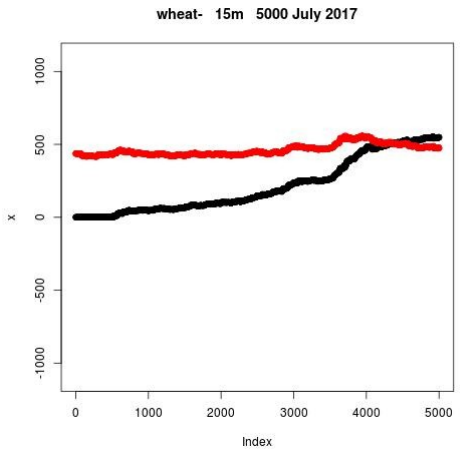


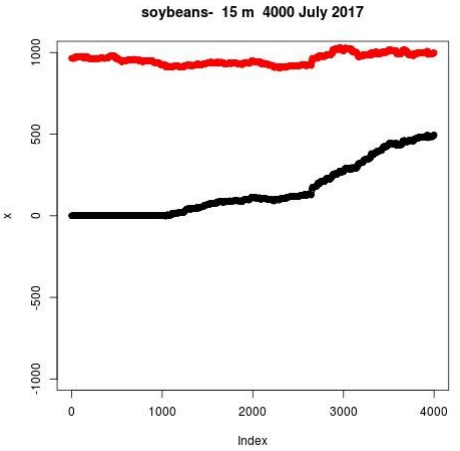


Agriculturals Results





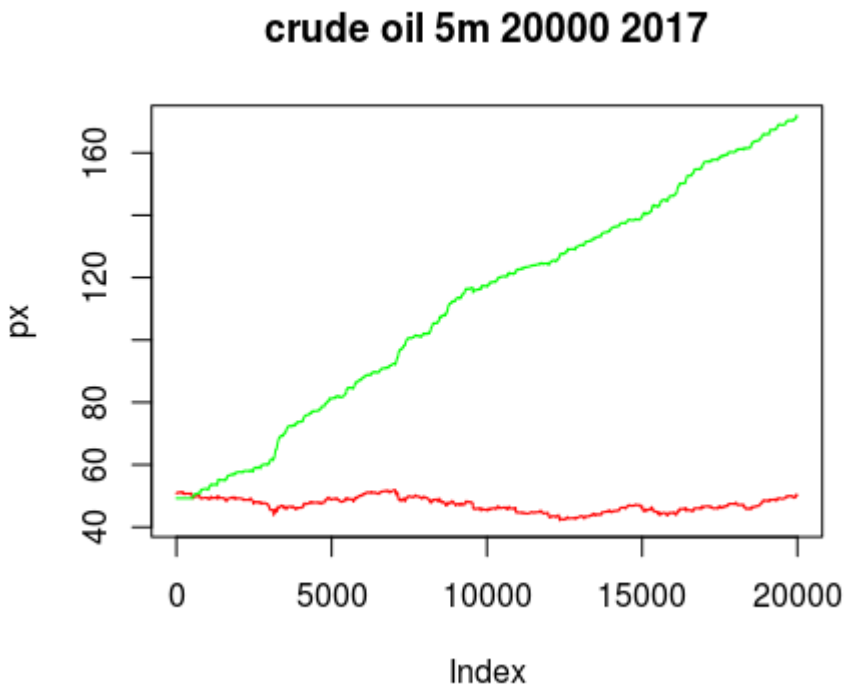


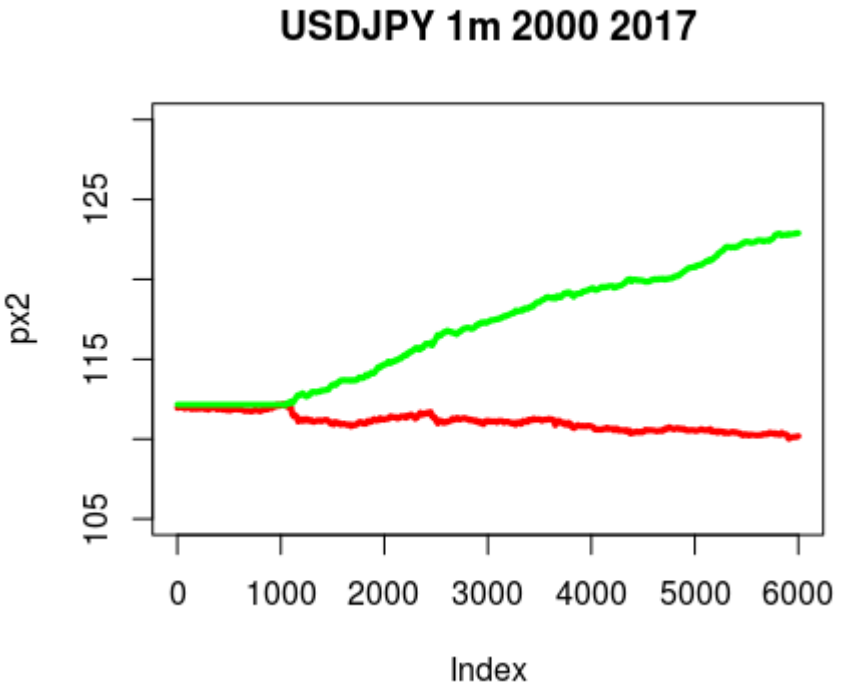


Machine Learning Algorithm

- Glmnet (but ther regression machines produce comparable results)
- Use machine learning algorithm to predict changes in wavelet details at multiple scales
- R package ‘mlr’ for tuning hyperparameters
- Plan to study possible improvements by other algorithms

Results with realistic transaction costs: $0.85 crude oil 0.1 bp USDJPY





Proposed Trade Execution Stages

- Initially automate trade execution with retail broker Interactive Brokers
- Automatic execution code is done with R package ‘Ibrokers’
- After we have pilot portfolio completed and we can scale up we can outsource order management and trade execution to a high-end platform (1.5-2.5 microsecond execution) such as Finetix iX-eCute or another off-the-shelf system

Sample Startup Plan

- Manage a portfolio of currencies and commodity futures strategy on a small scale using Interactive Brokers
- Assemble team and scale up after requisite period to show results on live trading sufficient to elicit interest of hedge fund investors (institutions/private equity)
- All focus on medium frequency AI and statistical analysis strategies
- The goal is to SATURATE the medium frequency space eventually.