FGP: A Genetic Programming Tool for Financial Prediction

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Financial prediction is extremely difficult due to the complexity of the domain. Many factors could directly or indirectly affect the future price of an investment. In search terms, any given set of factors and their interaction define the size and shape of the search space. Evolutionary computation has been found to be efficient and effective in exploring the search space in certain applications. The aim of my dissertation research is to apply genetic programming, a branch of evolutionary computation, to help users to search their space of hypotheses efficiently and effectively.

We have developed FGP (Financial Genetic Programming) system. Users can channel into FGP factors that they believe are relevant to the forecasting that they are interested in. Such factors may include expert predictions, fundamental factors, or/and technical factors which may have predictability. Encouraging and favourable results have been demonstrated via our FGP system. Some of them have been reported. They are listed below.

1) **FGP can be a useful tool for combining and improving individual expert predictions.**

FGP is employed to combine ordinal forecast from different sources in order to make better predictions. We tested on two examples in stock markets. The first one involves combining the opinion of nine experts in forecasting weekly movements in the Hong Kong stock market. The second example, which involves nearly 11 year's daily S&P 500 index data (2700 data cases), is to make daily buy or not-buy decisions by combining recommendations by commonly studied technical rules. In both examples, FGP generated more accurate rules than the input recommendations (Tsang & Li 98a).

2) **FGP can be a useful tool for improving technical rule predictions.**

Recent studies in finance domain suggest that technical analysis may have merit to predictability of stock. Technical rules are widely used for market assessment and timing (Li & Tsang 98). FGP uses the power of genetic programming to generate decision trees through efficient combination of technical rules with self-adjusted thresholds. The generated rules are more accurate for the prediction problem at hand. FGP was tested extensively on both historical DJIA (Dow Jones Industrial Average) and S&P 500 index data through a specific prediction problem that r% return or more is achievable within n period. Results show that it outperforms commonly used, non-adaptive, individual technical rules (Li & Tsang 99), random decisions (Tsang et al 98) and C4.5 rulesets (Li &

Tsang 99a) with respect to prediction accuracy and average annualised rate of return.

3) **FGP can be a useful tool to generate GP rules that are able to satisfy the preferences of investors.**

Apart from the prediction accuracy, users may be much more interesting in a low rate of failure or a low rate of missing chance, etc. To satisfy these demands, we proposed a novel constraint step fitness function that combines the aforementioned three factors and also involves a constraint to limit FGP search space. Preliminary results are quite encouraging and promising. (Li & Tsang 99b) We are still in the progress of testing the robustness and versatility of the novel fitness function.

Genetic Programming has been applied to financial markets for quite some time. Our research will extend this application area and finally develop a useful Genetic Programming tool, FGP.

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