

IMPROVED PARTICLE SWARM OPTIMIZATION FOR FUZZY BASED
STOCK MARKET TURNING POINTS PREDICTION

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To my beloved family

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ABSTRACT

Stock prices usually appear as a series of zigzag patterns that move in upward and downward trends. These zigzag patterns are learned as a tool for predicting the stock market turning points. Identification of these zigzag patterns is a challenge because they occur in multi-resolutions and are hidden in the stock prices. Furthermore, learning from these zigzag patterns for prediction of stock market turning points involves vagueness or imprecision. To address these problems, this research proposed the swarm-based stock market turning points prediction model which is a combination of a zigzag patterns extraction method, and a mutation-capable particle swarm optimization method. This model also includes the stepwise regression analysis, adaptive neuro-fuzzy classifier, and subtractive clustering method. This study explores the benefits of the zigzag-based multi-ways search tree data structure to manage the zigzag patterns for extracting interesting zigzag patterns. Furthermore, the mutation capable particle swarm optimization method is used to optimize the parameters of subtractive clustering method for finding the optimal number of fuzzy rules of adaptive neuro-fuzzy classifier. Stepwise regression analysis is used to select the important features from the curse of input dimensions. Finally, adaptive neuro-fuzzy classifier is used for learning the historical turning points from the selected input features and the extracted zigzag patterns to predict stock market turning points. The proposed turning points prediction model is tested using stock market datasets which are the historical data of stocks listed as components of S&P500 index of New York Stock Exchange. These data are stock prices that are either moving upward, downward, or sideways. From the findings, the proposed turning points prediction model has the potential to improve the predictive accuracy, and the performance of stock market trading simulation.

ABSTRAK

Pasaran saham selalunya muncul sebagai siri dalam corak zigzag yang bergerak sama ada dalam bentuk indeks meningkat atau indeks menurun. Corak zigzag ini dikenalpasti sebagai salah satu alat untuk meramal titik perubahan pasaran saham. Untuk mengenalpasti corak zigzag adalah merupakan satu cabaran kerana kerana ianya berada dalam pelbagai resolusi dan tersembunyi di dalam nilai pasaran saham. Tambahan pula, pola pembelajaran di dalam meramal titik perubahan pasaran saham melibatkan kesamaran dan ketidaktepatan terhadap corak, dan kajian ini mencadangkan teknik titik perubahan pasaran saham secara kelompok melalui kombinasi di antara kaedah pengekstrakan corak zigzag dan pengoptimuman kerumunan partikel boleh mutasi. Model ini juga merangkumi analisis regresi berperingkat, pengkelas neuro kabur, dan juga pengklusteran penolakan. Kajian ini mengkaji kelebihan struktur data zigzag berdasarkan pelbagai kaedah carian yang mempunyai ciri-ciri yang menampung corak zigzag yang mengekstrak corak zigzag yang menarik. Kaedah pengoptimuman kerumunan partikel boleh mutasi digunakan untuk mengoptimum nilai parameter daripada kaedah pengklusteran penolakan untuk mencari nilai optimum bagi pengkelas neuro kabur. Analisis regresi berperingkat digunakan untuk memilih ciri-ciri yang penting daripada dimensi input. Bagi pengkelas neuro kabur pula, kefahaman mengenai statistik titik perubahan pasaran saham yang di ekstrak dari corak zigzag dan ciri-ciri input yang terpilih digunakan bagi meramal titik perubahan di masa akan datang. Ramalan titik perubahan pasaran saham yang telah diuji dengan set data pasaran saham yang terdahulu yang tersenarai sebagai komponen indeks S&P500 yang terdapat dalam Bursa Saham New York di mana data pasaran saham yang diuji adalah merangkumi statistik pasaran saham yang meningkat, menurun dan pergerakan sisi. Melalui kajian ini, model titik perubahan saham yang telah diusulkan mempunyai potensi bagi meningkatkan ketepatan ramalan dan juga prestasi simulasi perdagangan pasaran saham.