UNIVERSITI TEKNOLOGI MARA
Cawangan Melaka

# ICECoT 2021

## International Conference on Emerging Computational Technologies

*"Future Trends of Emerging Computational Technologies in the 21st Century"*
*"Strategizing IR4.0 in Conquering Covid-19 and Beyond"*

**In Partnership With**




**Vol. 1, 2021**
International Conference on Emerging Computational Technologies

UNIVERSITI TEKNOLOGI MARA | Cawangan Melaka

# INTERNATIONAL CONFERENCE ON EMERGING COMPUTATIONAL TECHNOLOGIES (ICECoT 2021)

## 24 - 25 August 2021



978-967-15337©ICECoT2021

# First Edition 2021



**Published by:**

**Universiti Teknologi MARA Melaka Kampus Jasin**



978-967-15337©ICECoT2021

# Preface

This e-book describes the research papers presented at the International Conference on Emerging Computational Technologies (ICECoT 2021), organised by Faculty of Computer and Mathematical Sciences (FSKM), UiTM Cawangan Melaka. The main discussions of the conference is on the technological advances that help shape the skills that are required to cope with the Fourth Industrial Revolution (IR 4.0). Considering that this is our first attempt at organising a conference, we are therefore greatly honoured that the Universitas Negeri Semarang (UNNES), Indonesia, Mahasarakham University (MSU), Thailand and University of Hail (UoH), Saudi Arabia have all agreed to become our partners by contributing several reseach papers as well as providing reviewers to assess the quality of the papers.

Out of the numerous research works that had been submitted and reviewed, the Editorial Board have selected 22 papers to be published in the e-book. The discussions of these papers pertain to the use of technologies within the broad spectrum of Computer Science, Computer Networking, Multimedia, Information Systems Engineering, Mathematical Sciences and Educational Technology. It is hoped that the research findings that are shared in this e-book can benefit those who are interested in the various areas of computational technologies; such as graduate students, researchers, academicians and the industrial players, to name a few.

As the Project Manager, I would like to thank all of the committee members from the bottom of my heart for their tireless efforts in ensuring the success of ICECoT 2021. Without their continual support and excellent teamwork, this conference would not have come to fruition. In fact, holding this major event has been a good learning experience for us all, and I sincerely believe that our future conferences will become more outstanding if the same spirit is maintained.

**Dr. Noor Aishikin Adam**
Faculty of Computer and Mathematical Sciences
Universiti Teknologi MARA Cawangan Melaka Kampus Jasin



978-967-15337©ICECoT2021

# INTERNATIONAL CONFERENCE ON EMERGING COMPUTATIONAL TECHNOLOGIES (ICECoT 2021)

# COMMITTEE

**GENERAL CHAIR**

NOR FADILAH TAHAR @ YUSOFF

**PROJECT MANAGER**

DR. NOOR AISHIKIN ADAM

**DEPUTY PROJECT MANAGER**

ZAINAL FIKRI ZAMZURI

**SECRETARY**

FADHLINA IZZAH SAMAN

DR. RAIHAH AMINUDDIN

**TREASURER**

UMMU MARDHIAH ABDUL JALIL

ANIS AFIQAH SHARIP

MOHD AZRIL SHAH ABDULLAH

NURUL AIMI MD NOR

**INTERNATIONAL RELATION**

DR. ELIN ELIANA ABDUL RAHIM *(Leader)*

NORBAHIYAH AWANG

NURULHUDA ZAINUDDIN

ZUHRI ARAFAH ZULKIFLI

SITI FATIMAH MOHD RUM

NOOR WAHIDA JAMIL

MOHAMMAD BAKRI CHE HARON

MUHAMMAD HAMIZ MOHD RADZI

**DESIGN /MULTIMEDIA/MONTAGE/E-CERTIFICATE**

DR. AHMAD FIRDAUS AHMAD FADZIL *(Leader)*

NORSHAHIDATUL HASANA ISHAK

MOHD NABIL ZULHEMAY

NUR FARAHIN MOHD JOHARI

NURAZIAN MIOR DAHALAN
NOR INTAN SHAFINI NASIRUDDIN
HAZRATI ZAINI
ZAINAB OTHMAN
FAIQAH HAFIDZAH HALIM

## SPONSORSHIP

DR. NURUL HUDA NIK ZULKIPLI *(Leader)*
Ts. DR. SITI RAHAYU ABDUL AZIZ
MOHD RAHMAT MOHD NORDIN
NORZATUL BAZAMAH AZMAN SHAH
NOR AIMUNI MD RASHID

## SECRETARIAT & REGISTRATION

DR AZLAN ABDUL AZIZ *(Leader)*
DR. SITI FEIRUSZ AHMAD FESOL
FADZLIN AHMADON
MARIATHY KARIM
NUR ASYIRA NAZIRON
HAJAR IZZATI MOHD GHAZALLI
MASWATI SUFFIAN
MASTURA MANSOR
NURULHUDA GHAZALI
WANNORAINI ABDUL LATIF

## REVIEWER

Ts. DR. SHAFAF IBRAHIM *(Leader)*
DR. NOOR HASIMAH IBRAHIM TEO
Ts. DR. ALYA GEOGIANA BUJA
NUR NABILAH ABU MANGSHOR
Ts. DR. CHEW CHIOU SHENG
HAMIDAH MUHD IRPAN
BUSHRA ABDUL HALIM
NUR SYUHADA MUHAMMAT PAZIL
YUZAIMI YUNUS
NOOR SURIANA ABU BAKAR
NOORAZILAH IBRAHIM
ANIS AMILAH SHARI



978-967-15337©ICECoT2021

NORDIANAH JUSOH @ HUSSAIN
SALEHAH HAMZAH
DR SURYAEFIZA KARJANTO
ASSOC. PROF. DR. PHANG YOOK NGOR
AZLIN DAHLAN

**EDITORIAL**

Ts. DR. KHYRINA AIRIN FARIZA ABU SAMAH *(Leader)*
Ts. DR. NURUL HIDAYAH MAT ZAIN
Ts. DR. EDZREENA EDZA ODZALY
ASSOC. PROF. AISHAH AHMAD @ ABDUL MUTALIB
SITI NURAMALINA JOHARI
NOOR AFNI DERAMAN
DR. NOR AIZA MOKETAR
ANITA MOHD YASIN
FARAH NADZIRAH JAMRUS
NURUL ZAHIRAH ABD RAHIM
NOR AZYLIA AHMAD AZAM
NOR ADORA ENDUT

**PROTOCOL & INVITATION**

RAIHANA MD SAIDI *(Leader)*
Ts. DR. JAMALUDDIN JASMIS
IZNI SYAMSINA SAARI
AINON SYAZANA AB HAMID
ANWAR FARHAN ZOLKEPLAY
ANIS SHOBIRIN ABDULLAH SANI
MOHD HAFIFI MOHD SUPIR
ADI HAKIM TALIB
ZURAH ABU
NOR ADILA KEDIN
SHAHITUL BADARIAH SULAIMAN
YUSARIMA MUHAMAD

**TECHNICAL / WEBSITE / VIDEO SUBMISSION / Q&A SESSION**

SHAHADAN SAAD *(Leader)*
DR. AZMI AMINORDIN
MOHD ALI MOHD ISA

ALBIN LEMUEL KUSHAN
MOHAMMAD HAFIDZ RAHMAT
SULAIMAN MAHZAN
MOHD TAUFIK MISHAN
Ts. NOR AZLIN ROSLI
SITI FAIRUS FUZI
SITI RAMIZAH JAMA
SITI NURSYAHIRA ZAINUDIN
MOHAMAD HAFIZ KHAIRUDDIN
NORAINI HASAN
NURUL EMYZA ZAHIDI
FATIMAH HASHIM
ZAMLINA ABDULLAH
ALIAS DERAMAN

**PROMOTION & PUBLICITY**

SYAFNIDAR ABDUL HALIM *(Leader)*
NOR AZIDA MOHAMED NOH
FARIDAH SAPPAR
FADILAH EZLINA SHAHBUDIN
Ts. NURUL NAJWA ABDUL RAHID @ ABDUL RASHID
MOHAMAD ASROL ARSHAD

**LANGUAGE EDITOR**

MOHD AMIRUL ATAN
NUR AQILAH NORWAHI



978-967-15337©ICECoT2021

## COMPUTER SCIENCE





978-967-15337©ICECoT2021

## NETWORKING / NETCENTRIC



## INFORMATION SYSTEM ENGINEERING



## EDUCATIONAL TECHNOLOGY





978-967-15337©ICECoT2021

## MATHEMATICAL SCIENCES



## MULTIMEDIA





978-967-15337©ICECoT2021

# Stock Market Turning Points Rule-Based Prediction

Lersak Photong
*Mahasarakham Business School*
*Mahasarakham University*
Thailand
lersak.p@acc.msu.ac.th

Anupong Sukprasert
*Mahasarakham Business School*
*Mahasarakham University*
Thailand
anupong.s@acc.msu.ac.th

Sutana Boonlua
*Mahasarakham Business School*
*Mahasarakham University*
Thailand
sutana.t@acc.msu.ac.th

Pravi Ampant
*College of Medicine and Public Health*
*Ubon Ratchathani University*
Thailand
pravi.a@ubu.ac.th

***Abstract*—Stock market turning points can benefit stock market investors when making decisions during stock market trading. The main objective of this study is to investigate the effects of online news towards stock market turning points. This investigation involves three aspects: studying the methods of news sentiment analysis and rule-based optimisation, analysing the data and comparing the performance of models in order to obtain the most accurate prediction to provide recommendations on how to obtain the most accurate predictions for stock market turning points. Seventeen companies' data were taken from the Yahoo! Finance website. Feature extraction was used for classifying relevant vocabulary into the same category of macroeconomic factors. Feature selection was used to sort out key features for further classification. News classification into factors affecting stock market turning point was done using Naïve Bayes, Deep Learning, Generalized Linear Model (GLM) and Support Vector Machine (SVM). Simultaneously, news sentiment analysis techniques were used to discover the polarity of news according to each factor. From news classification and news sentiment, a rule-based algorithm was used to predict the stock market turning points. Finally, rule-based optimisation techniques such as Particle Swarm Optimization (PSO), Differential Evolution (DE) and Grey Wolf Optimizer (GWO) were used to minimise the amount of time employed in the stock market turning points prediction. Results show that the best feature selection is term frequency and trimming of the feature with a frequency greater than 95%. The best news classification approach is based on Deep Learning techniques that provide the most accurate classification. The study suggests that the application of rule-based optimisation to predict stock market turning points generate more accurate and time saving decision.**

***Keywords—turning point, differential evolution, particle swarm optimization, grey wolf optimizer***

## I. INTRODUCTION

Stock market prediction has attracted financial researchers and investors seeking profits from investments, and they tend to invest more in the stock market because of its attractive benefits. A stock market or equity market is a public entity for the trading of company stock (shares) and derivatives at an agreed price; these are securities listed on a stock exchange as well as those only traded privately. Thus stock market prediction is a significant act that attempts to investigate and predict the value of stocks and the economy in the future in order to guide investors to achieve higher levels of profits from investments [1].

Advanced technologies play important roles in communication and data interchange, and it is easy and quick to access data. Thus, the number of internet users has grown, along with the amount of news that is released on websites. Additionally, advanced technologies are beneficial to the economic system, as international trade and investment is more approachable and widespread [2]. Moreover, algorithms have been used to help accelerate data processing. The news from online sources is influential to investors' points of view on the stock market [3]. Consequently, in stock market prediction research, the textual data derived from online platforms such as social media and websites is collected so as to assist the investors to come to a decision on investing in the stock market with minimal risks [4].

Investors have attempted to seek ways that could help them in predicting the stock trends and reducing the risk in investment [5]. Logically, investors seek to make decisions on purchasing a stock at the lowest point and selling it at the highest point. When stock prices change their trend direction, this may be termed the 'turning points'. The turning point moves to reach the maximum of the upper point, which is called the peak, and the lowest turning point is called the trough. Turning points are associated with the behaviour of price forecasting [6], and they have been studied to identify business circles, trends, and prices [7].

To address this problem, one of the most well-known methods to assist in predicting the turning points in a stock market are news sentiments, combined with rule-based optimisation. The evaluating of sentiment in financial news articles and discovered that subjective financial news articles are useful in forecasting price direction [8]. Interestingly, the results showed that there is an inverse relationship between sentiment polarity and stock price movement. In this research, news sentiment helps create rules, and these rules are practical in optimising the rule-based approach towards turning points stock market prediction.

## II. LITERATURE REVIEWS

Rule-Based Optimisation is the process of receiving the best results under given conditions [1]. It can be stated as the process of discovering the conditions, providing the maximum or minimum of a function. In other words, optimisation means to select the best element from some sets of available alternatives. Moreover, the optimum seeking methods are known as mathematical programming techniques and are commonly studied as a part of operations research, which is a branch of mathematics involving the application of scientific methods and techniques to decision making problems in order to achieve the best or optimal solutions. The goal of optimisation is to make the best value



978-967-15337©ICECoT2021

in terms of investment, energy, utilities and safety. In this study, three optimisation techniques will be applied. The methods are illustrated in the next chapter, and the related literature is reviewed below.

In this research, rule-based optimisation has been selected in order to find out the appropriate rules by using the smallest amount of time. The principal optimisation techniques are listed.

### *A. Particle Swarm Optimisation (PSO)*

Particle Swarm Optimisation (PSO) is comparable to the genetic algorithm approach for optimisation rather than focusing on a single individual application. An individual population known as a particle swarm, updated from iteration to iteration, is considered alternatively. Instead of moving a single individual around, the algorithmic rule can move the population around, seeking a possible resolution. This can be an example of a heuristic approach, where an optimum resolution is not assured. Each individual within the swarm features a position and velocity; the algorithm detects every case to determine the best outcome exploiting the swarm, then the entire swarm moves to the new related location [9].

### *B. Differential Evolution (DE)*

This solution to solve new evolutionary problems was introduced by [10], proposing to find the global optima within continuous space. This is because evolution has a simple relation of controlled variables, but it is effective in finding and arriving at an answer. Also, the performance structure of DE is not complex and is easy to apply and use in calculations in a short time [11], so many researchers have begun to increasingly dedicate attention to DE and to apply it to solve problems, such as in the sciences, engineering and economics.

### *C. Grey Wolf Optimizer (GWO)*

The Grey Wolf Optimiser (GWO) proposed by Mirjalili et al. [12] is based on modelling the social hierarchy and hunting habits of the grey wolf towards searching for prey, illustrated by the solution to the problems of optimisation [13]. The social hierarchy is inspired by classifying the population of search agents into four types of individuals, which are alpha, beta, delta, and omega, on the basis of their fitness [12], in that they usually live in packs. The alpha is mainly accountable for making decisions, which are directed to the pack, and the pack has to follow. The alpha can be called the dominant. It does not have to be the strongest but has to be the best in managing because the organisation of the pack is more crucial. The betas are lower-position (subordinate) wolves that assist the alpha in making decisions and the other actions of the pack, and they advise and respect the alpha, but they can command the other lower-position wolves and give the reaction of the pack to the alpha. They also enforce discipline for the pack. The delta is submissive to the first two positions of the pack but dominant to the omega. It is responsible for scouts (watching and warning), sentinels (safety), elders (experienced), hunters (hunting assistants) and caretakers (caring for the weak).

## III. METHODOLOGY

The goal of this research is to propose an algorithm for the prediction of the stock market turning points using text on a news website. The best model is discovered from the news sentiment analysis selections [14] [15] [16] [17]. Finally, the rule-based approach will be optimised due to there being a lot of rules; hence, there is a need to optimise it to lessen the time used in predicting the best model (Fig. 1).

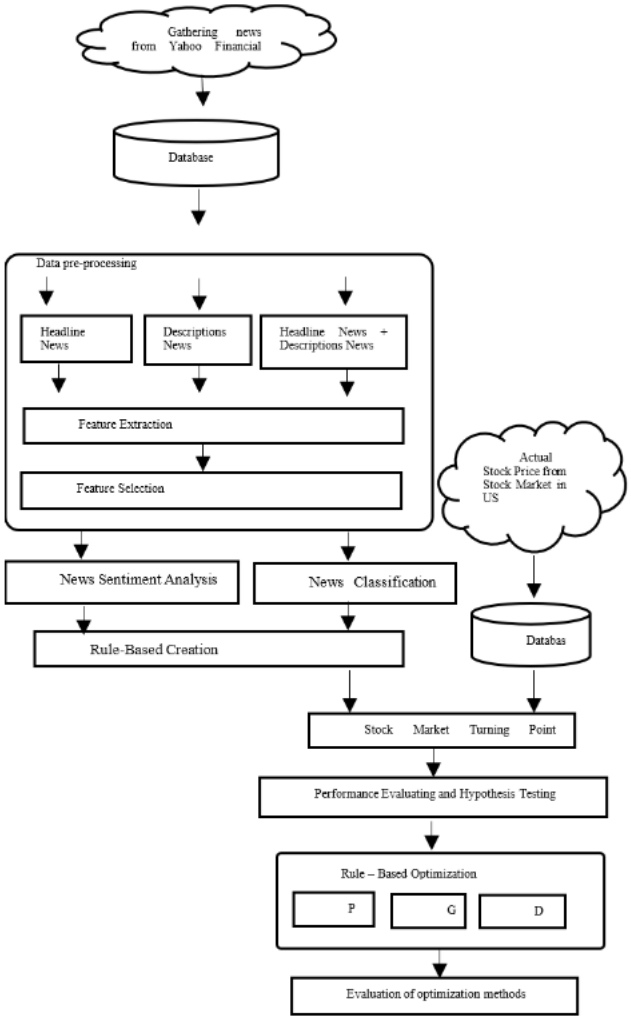


Fig. 1. Model Framework

An operational framework provides operational management in a structured manner. In order to help researchers to achieve the objectives of the research, the operational framework must be well-organized in a systematic process. Fig. 2 illustrates the flowchart of the operational framework employed in this research.

Data collection: The data for initial data analysis exists in text form on a website (http://finance.yahoo.com) that affects the stock market. High dimensionality is a challenge for news classification. In order to improve processing efficiency for the dataset used in this research, only 17 companies from two stock markets in the US, the New York Stock Exchange (NYSE) and the National Association of Securities Dealers Automated Quotation (NASDAQ), are focused on. That is to say, the companies are selected via purposive sampling, and there is a total of 17 companies from the two markets stated. The news information collected to be used in this study is directly related to the companies in how the information is classified by the Yahoo Financial website. The data was collected from 2012 to 2016 during trading days. The data selected were used as a training set and as a testing set.



978-967-15337©ICECoT2021

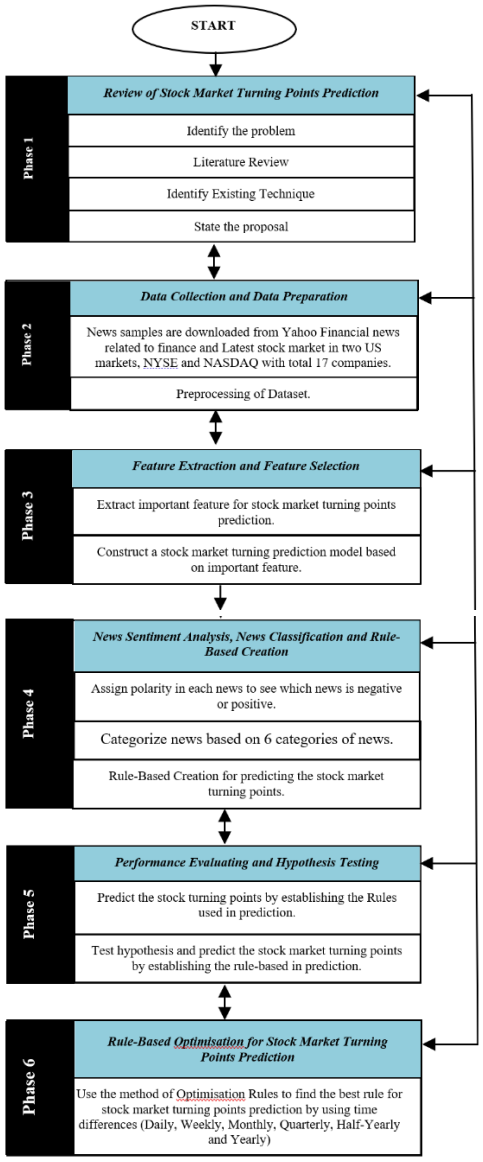


Fig. 2. Operational Framework

The process of feature selection was conducted to select the features to perform news classification. Feature selection was divided into two steps in this research. The first step was trimming the feature by cutting the feature with a frequency score less than 5% and frequency score greater than 95%.

## IV. Research Results

For the rule-based prediction for stock market turning points, if- statements are used in the steps of rule-based techniques, and the condition checking of if-statements is utilised in order to calculate how much time each condition takes. Thus, this step is a procedure to optimise time usage. All the rules are encoded and optimised by using three optimisation techniques, namely Differential Evolution (DE), Particle Swarm Optimisation (PSO) and Grey Wolf Optimiser (GWO) by applying the concepts received from all the rules of stock market turning points prediction in order to encode the six factors of macroeconomics and polarity of factor.

Label, Predict(0=unchanged,1=moving up, -1=moving down), Factors(1, 2, 3, 4, 5, 6 or 0=does not have), Case(1=Positive,-1=Negative, 0=does not have)

Which are:

Label = Rule number; Predict = Up/Down/Unchanged; Factors = 6 Factors; Case = Positive News/Negative News

The example below is the news that happens in a day comprising six factors, and all factors have positive words, which has the following rule-based if- statement:

if in same day = (factor1, positive news) and (factor2, positive news) and (factor3, positive news) and (factor4, positive news) and (factor5, positive news) and (factor6, positive news) then stock price moving up

Based on the analysis, it can be concluded that the result of the accuracy means for time usage obtained from the three optimisation techniques are not all equal when the level of significance is 0.05 or accuracy level of 95% [1]. Then, the comparisons of column means are tested in order to discover what optimisation techniques give the minimum time usage result, as shown below.

The Particle Swarm Optimisation (PSO) technique gives the minimum mean average time usage which can help to find the stock market turning points prediction rule which is the most accurate (Table I). Hence, PSO is selected to optimise the rule-based encoding for predicting the stock market turning points.

TABLE VI. TABLE I. TEST COMPARISONS OF COLUMN MEANS

| | **Optimization Techniques** | | |
|---|---|---|---|
| | **Particle Swarm Optimization (PSO)** | **Differential Evolution (DE)** | **Grey Wolf Optimizer (GWO)** |
| **Time usage** | Mean | Mean | Mean |
| | 0.11 | 0.20 | 0.40 |

Stock market turning points prediction is not only related to the rule for predicting the stock market turning points that has the highest levels of prediction but is also are related to time used for prediction [18]. When investors need to buy or sell stocks, they benefit when they can expend shorter time for making decisions. Hence, applying rule-based optimisation for predicting stock market turning points benefits investors tin that they have the information necessary to help make decisions more accurately and rapidly.

## V. Conclusion

The rule-based optimisation, which was selected from the most convenient and compatible approaches, which are Particle Swarm Optimisation (PSO), Grey Wolf Optimiser (GWO), and Differential Evolution (DE). The findings suggest that Particle Swarm Optimisation (PSO) technique gives the minimum mean average of time usage to discover the most accurate stock market turning points prediction rule, a finding consistent with Bhandari and Ghosh.

This research has achieved the research objectives. The research objective is to analyse data and compare the performance of models to attain the most accurate prediction of turning points for a stock market, and upon analysing and comparing the performance of models, the results suggest the best ones for predicting the stock market turning points. The research objective also provides recommendation on how to obtain the highest accuracy for predicting stock market turning points, and the findings recommend that News



978-967-15337©ICECoT2021

Sentiment and Rule-Based Optimisation are the most valuable approaches for assisting investors to attain the highest levels of accuracy in accessing sources of information, and simultaneously, those approaches help optimise time usage in order to make the best use of valuable time. In particular, the research findings in this research serve investors at the individual level; hence, the advantages obtained by applying these two approaches, i.e., News Sentiment and Rule-Based Optimisation, may be dependent upon individuals' judgments.

Suggestion for future research, when collecting data from websites to build a model, the sources should be more varied. This research only used news appearing on Yahoo! Finance. Therefore, data should be updated and data pre-processing be carried out effectively before it is employed to develop models. It is to make news classification more accuracy and trustworthy as possible.

## ACKNOWLEDGMENT

This research was supported by Mahasarakham Business School, Mahasarakham University, Thailand.

## REFERENCES

[1] D. Shah, H. Isah, and F. Zulkernine, "Predicting the effects of news sentiments on the stock market," IEEE International Conference on Big Data (Big Data), pp. 4705 - 4708, December 2018.

[2] A. Hirabayashi, C. Aranha, and H. Iba, "Optimization of the trading rule in foreign exchange using genetic algorithm," 11th Annual Conference on Genetic and Evolutionary Computation, pp. 1529-1536, July 2009.

[3] I. S. Thaseen and C. A. Kumar, "Intrusion detection model using fusion of chi-square feature selection and multi class SVM," Journal of King Saud University-Computer and Information Sciences, 29(4), pp. 462-472, 2017.

[4] G. V. Attigeri, M. M. Manohara Pai, R. M. Pai, and A. Nayak, "Stock market prediction: A big data approach," IEEE Region 10 Conference, pp. 1-5, Nov 2015.

[5] R. D. Edwards, J. Magee, and W. H. C. Bassetti, Technical Analysis of Stock Trends. 9th Edition, CRC Press, 2007.

[6] V. O. Sai, C. S. Shieh, Y. C. Lin, M. F. Horng, T. T. Nguyen, Q. D. Le, and J. Y. Jiang, "Comparative study on recent development of heuristic optimization methods," Third International Conference on Computing Measurement Control and Sensor Network (CMCSN), pp. 68-71, May 2016.

[7] B. Weng, M. A. Ahmed, and F. M. Megahed, "Stock market one-day ahead movement prediction using disparate data sources," Expert Systems with Applications, 79, pp. 153-163, 2017.

[8] H. C. Wu, C. M. Tseng, P. C. Chan, S. F. Huang, W. W. Chu, and Y. F. Chen, "Evaluation of stock trading performance of students using a web-based virtual stock trading system," Computers & Mathematics with Applications, 64(5), pp. 1495-1505, 2012.

[9] C. Phetchanchai, "Improved Particle Swarm Optimization for Fuzzy Based Stock Market Turning Points Prediction," Ph.D. Dissertation, Faculty of Computing, Universiti Teknologi Malaysia, 2013.

[10] K. Price, R. M. Storn, and J. A. Lampinen, Differential evolution: A practical approach to global optimization. Springer Science & Business Media, 2006.

[11] R. El-Yaniv and A. Faynburd, "Autoregressive short-term prediction of turning points using support vector regression," arXiv:1209.0127, 2012.

[12] S. Mirjalili, S. M. Mirjalili, and A. Lewis, "Grey wolf optimizer," Advances in Engineering Software, 69, pp. 46-61, 2014.

[13] R. E. Precup, R. C. David, A. I. Szedlak-Stinean, E. M. Petriu, and F. Dragan, "An easily understandable grey wolf optimizer and its application to fuzzy controller tuning," Algorithms, 10(2), pp. 1-15, 2017.

[14] M. C. Angadi and A. P. Kulkarni, "Time Series Data Analysis for Stock Market Prediction using Data Mining Techniques," International Journal of Advanced Research in Computer Science, 6(6), pp. 104-108, 2015.

[15] R. P. Schumaker, Y. Zhang, C. N. Huang, and H. Chen, "Evaluating sentiment in financial news articles," Decision Support Systems, 53(3), pp. 458-464, 2012.

[16] S. Bhandari and S. Ghosh, "Overview of sentiment analysis: approaches and applications," International Journal of Research in Computer Science, 3(4), pp. 4-7, 2016.

[17] A. S. Manek, P. D. Shenoy, M. C. Mohan, and K. R. Venugopal, "Aspect term extraction for sentiment analysis in large movie reviews using Gini Index feature selection method and SVM classifier," World Wide Web, 20(2), pp. 135-154, 2017.

[18] B. R. Ritesh, R. Chethan, H. S. Jani, and V. A. Sheetal, "Stock market prediction using news articles," Journal of Emerging Technologies and Innovative Research, 4(3), pp. 153–155, 2017.



978-967-15337©ICECoT2021