Computer Modeling in Engineering & Sciences

Tech Science Press

DOI: 10.32604/cmes.2022.023022

EDITORIAL

Introduction to the Special Issue on Hybrid Intelligent Methods for Forecasting in Resources and Energy Field

Wei-Chiang Hong[1,*] **and Yi Liang**[2]

[1]Department of Information Management, Asia Eastern University of Science and Technology, New Taipei, 22061, Taiwan

[2]School of Management, Hebei GEO University, Shijiazhuang, 050031, China

*Corresponding Author: Wei-Chiang Hong. Email: samuelsonhong@gmail.com

Received: 06 April 2022 Accepted: 08 April 2022

Precise resources and energy forecasting are important to facilitate the decision-making process in order to achieve higher efficiency and reliability in energy system planning, maintenance, operation, security, and so on. In the past decades, many resources and energy forecasting models have been continuously proposed to increase the forecasting accuracy, especially intelligence models (e.g., artificial neural networks, support vector regression, evolutionary computation models, etc.). Meanwhile, due to the great development of optimization methods (e.g., quadratic programming method, differential empirical mode method, evolutionary algorithms, etc.), many novel hybrid methods combined with the above-mentioned intelligent-optimization-based methods have also been proposed to achieve satisfactory forecasting accuracy levels. It is worthwhile to explore the tendency and development of intelligent-optimization-based hybrid methodologies and to enrich their practical performances, particularly for resources and energy forecasting.

A total of 45 manuscripts were submitted and 13 were selected based on a robust peer-reviewed process. The 13 articles are authored by researchers from world-wide universities, and reflect a state of the research developments and initiatives in accurate resources and energy forecasting.

The first paper "Comparative Study on Deformation Prediction Models of Wuqiangxi Concrete Gravity Dam Based on Monitoring Data" by Yang et al. [1] develops the deformation prediction models of Wuqiangxi concrete gravity dam, including two statistical models and a deep learning model. From the results of case study, they conclude that in the deformation prediction of concrete gravity dam, the LSTM model is suggested with sufficient training data, else, the partial least squares regression method is suggested.

The second paper "A Novel Indoor Positioning Framework" by Chen et al. [2] uses Bluetooth wireless signals to build a novel indoor positioning framework to avoid the high manufacturing costs involved in the Ultra Wide Band (UWB) technology. The Bluetooth signals are combined with the results from artificial intelligence algorithms to improve accuracy. During laboratory indoor location tracking, the accuracy rate is 96%, which provides effective indoor tracking for the movement of people.

The third paper "Sustainable Investment Forecasting of Power Grids Based on the Deep Restricted Boltzmann Machine Optimized by the Lion Algorithm" by Wang et al. [3] proposes a new power grid investment prediction model based on the deep restricted Boltzmann machine (DRBM) optimized by the Lion algorithm (LA). The LA-DRBM model is used to predict the investment of a power

grid enterprise, and the final prediction result is obtained by modifying the initial result with the modifying factors. A comparison with the RBM, support vector machine (SVM), back propagation neural network (BPNN), and regression model is conducted to verify the superiority of the model.

The fourth paper "Quantification of Urban Sprawl for Past-To-Future in Abha City, Saudi Arabia" by AlQadhi et al. [4] applies the support vector machine (SVM) classifier to classify the land use and land cover (LULC) maps for 1990, 2000, and 2018. The LULC dynamics between 1990–2000, 2000–2018, and 1990–2018 have been analyzed using delta change and the Markovian transitional probability matrix. The future LULC map for 2028 is predicted by using the artificial neural network-cellular automata model (ANN-CA).

The fifth paper "Code Transform Model Producing High-Performance Program" by Chang et al. [5] introduces a novel transform method to produce the newly generated programs through code transform model reasonably, improving the program execution performance significantly, which can help the voice assistant machine resolve the problem of inefficient execution of application code. In addition, this study develops the variational Simhash algorithm to check the code similarity between the sample program and the newly generated program, and conceives the piecewise longest common subsequence algorithm to examine the execution's conformity from the two programs mentioned above. As a result, the newly generated program outperforms the sample program significantly because the number of code lines reduces 27.21%, and the program execution time shortens 24.62%.

The sixth paper "Evaluation and Forecasting of Wind Energy Investment Risk along the Belt and Road Based on a Novel Hybrid Intelligent Model" by Yan et al. [6] constructs a novel hybrid intelligent model based on an improved cloud model combined with GRA-TOPSIS and MBA-WLSSVM. Finally, an example is given to verify the scientificity and accuracy of the model, which is helpful for investors to make fast and effective investment risk forecasting of wind energy along the Belt and Road.

The seventh paper "Improve the Accuracy of Fall Detection Based on Artificial Intelligence Algorithm" by Chen et al. [7] presents a fall detection system based on artificial intelligence. The system gathers the differential data collected by the gyroscope and accelerometer, applies artificial intelligence algorithms for model training and constructs an effective model for fall detection. Experiment results have shown that the accuracy of the proposed fall detection model is up to 98%, demonstrating the effectiveness of the model in real-life fall detection.

The eighth paper "Forecasting Model of Photovoltaic Power Based on KPCA-MCS-DCNN" by Gou et al. [8] proposes a prediction model based on kernel principal component analysis (KPCA), modified cuckoo search algorithm (MCS) and deep convolutional neural networks (DCNN). In order to verify the prediction performance of the proposed model, this paper selects a photovoltaic power station in China for example analysis. The results show that the new hybrid KPCA-MCS-DCNN model has higher prediction accuracy and better robustness.

The ninth paper "Effect Evaluation and Intelligent Prediction of Power Substation Project Considering New Energy" by Wu et al. [9] proposes a novel hybrid intelligent evaluation and prediction model based on improved TOPSIS and Long Short-Term Memory (LSTM) optimized by a Sperm whale Algorithm (SWA) to ensure the accuracy and real-time of evaluation of the implementation effect for the power substation project. The scientificity and accuracy of the proposed model are verified by empirical analysis, and the important factors affecting the implementation effect of power substation projects are pointed out.

The tenth paper "Optimizing Big Data Retrieval and Job Scheduling Using Deep Learning Approaches" by Chang et al. [10] optimizes data retrieval and job scheduling for improving big data

analytics to overcome the aforementioned problems, by applying a deep neural network (DNN) to predicting the approximate execution time of a job gives prioritized scheduling based on the shortest job first (SJF), which is called DNNSJF scheduling. As a result, the proposed SSAE-ES searching outperforms the DAE-SOLR searching, significantly increasing the efficiency by about 40%. On the other hand, the proposed DNNSJF scheduling algorithm defeats FIFO and MSHEFT scheduling algorithms, effectively shortening the average waiting time of job execution by about 3%∼5% and 1%∼3%, respectively.

The eleventh paper "Metal Corrosion Rate Prediction of Small Samples Using an Ensemble Technique" by Yang et al. [11] uses the bagging and boosting ensemble learning methods to conduct a comparative analysis of the prediction performance on a small sample of laboratory corrosion data. The result suggests that the bagging algorithm outperforms the boosting algorithm in scenarios where small samples of discrete data are used, and that the number, dimensionality, and dispersion of the training samples all have an impact on the prediction results. Further, the prediction error values obtained via ensemble learning methods are smaller compared to the results obtained using traditional empirical models.

The twelfth paper "An Improved Hyperplane Assisted Multi-Objective Optimization Algorithm for Distributed Hybrid Flow Shop Scheduling Problem in Glass Manufacturing Systems" by Geng et al. [12] proposes an improved hyperplane assisted evolutionary algorithm (IhpaEA) to solve the distributed hybrid flow shop scheduling problem (DHFSP) in raw glass manufacturing systems. Two objectives are simultaneously considered, namely, the maximum completion time and the total energy consumptions. The experimental results demonstrate that the proposed algorithm is efficient than the other three stat-of-the-art algorithms, which show that the Pareto optimal solution set obtained by the improved algorithm is superior to that by the traditional multi-objective algorithm in terms of diversity and convergence of the solution.

The thirteenth paper "Detecting Icing on the Blades of a Wind Turbine Using a Deep Neural Network" by Li et al. [13] proposes a method to build a universal model based on a deep neural network (DNN) by using the data of supervisory control and data acquisition system (SCADA). This paper provides a universal icing detection model based on DNN. Also, it proposes a method to present the relation between continuous transferred features and binary icing status with the help of the middle feature variable. This paper shows that an integrated indicator system is more reasonable than a single accuracy indicator when evaluating a prediction model, which can help get a better model.

As a final remark, it is hoped that the presented topics will give this special issue a much more lasting value and make it appealing to a broad audience of researchers, practitioners, and students who are interested in intelligent methods for forecasting, and each reader can find in this special issue something useful or inspiring.

Acknowledgement: We would like to thank the authors for their contributions to this Special Issue. We also thank the journal of CMES for the supports for publications of this Special Issue.

Funding Statement: The editorial work was supported by the Ministry of Science and Technology, Taiwan (MOST 110-2410-H-161-001), Science Foundation of Ministry of Education of China (21YJC630072), and Natural Science Foundation of Hebei Province, China (G2020403008).

Conflicts of Interest: The authors declare that they have no conflicts of interest to report regarding the present study.

References

1. Yang, S., Han, X., Kuang, C., Fang, W., Zhang, J. et al. (2022). Comparative study on deformation prediction models of Wuqiangxi concrete gravity dam based on monitoring data. *Computer Modeling in Engineering & Sciences, 131(1),* 49–72. DOI 10.32604/cmes.2022.018325.
2. Chen, M., Cheng, Y., Chen, R. (2022). A novel indoor positioning framework. *Computer Modeling in Engineering & Sciences, 130(3),* 1459–1477. DOI 10.32604/cmes.2022.015636.
3. Wang, Q., Yang, X., Pu, D., Fan, Y. (2022). Sustainable investment forecasting of power grids based on the deep restricted Boltzmann machine optimized by the lion algorithm. *Computer Modeling in Engineering & Sciences, 130(1),* 269–286. DOI 10.32604/cmes.2022.016437.
4. AlQadhi, S., Mallick, J., Talukdar, S., Bindajam, A. A., Ali, A. et al. (2021). Quantification of urban sprawl for past-to-future in Abha City, Saudi Arabia. *Computer Modeling in Engineering & Sciences, 129(2),* 755–786. DOI 10.32604/cmes.2021.016640.
5. Chang, B. R., Tsai, H., Su, P. (2021). Code transform model producing high-performance program. *Computer Modeling in Engineering & Sciences, 129(1),* 253–277. DOI 10.32604/cmes.2021.015673.
6. Yan, L., Hong, W. (2021). Evaluation and forecasting of wind energy investment risk along the belt and road based on a novel hybrid intelligent model. *Computer Modeling in Engineering & Sciences, 128(3),* 1069–1102. DOI 10.32604/cmes.2021.016499.
7. Chen, M., Cheng, Y., Chen, R. (2021). Improve the accuracy of fall detection based on artificial intelligence algorithm. *Computer Modeling in Engineering & Sciences, 128(3),* 1103–1119. DOI 10.32604/cmes.2021.015589.
8. Gou, H., Ning, Y. (2021). Forecasting model of photovoltaic power based on KPCA-MCS-DCNN. *Computer Modeling in Engineering & Sciences, 128(2),* 803–822. DOI 10.32604/cmes.2021.015922.
9. Wu, H., Zou, M., Ke, Y., Ou, W., Li, Y. et al. (2022). Effect evaluation and intelligent prediction of power substation project considering new energy. *Computer Modeling in Engineering & Sciences, 132(3),* 739–761. DOI 10.32604/cmes.2022.019714.
10. Chang, B., Tsai, H., Lin, Y. (2022). Optimizing big data retrieval and job scheduling using deep learning approaches. *Computer Modeling in Engineering & Sciences, 134(2),* 783–815. DOI 10.32604/cmes.2022.020128.
11. Yang, Y., Zheng, P. F., Zeng, F. R., Xin, P., He, G. et al. (2022). Metal corrosion rate prediction of small samples using an ensemble technique. *Computer Modeling in Engineering & Sciences, 134(1),* 267–291. DOI 10.32604/cmes.2022.020220.
12. Geng, Y. D., Li, J. Q. (2022). An improved hyperplane assisted multiobjective optimization algorithm for distributed hybrid flow shop scheduling problem in glass manufacturing systems. *Computer Modeling in Engineering & Sciences, 134(1),* 241–266. DOI 10.32604/cmes.2022.020307.
13. Li, T., Xu, J., Liu, Z., Wang, D., Tan, W. (2022). Detecting icing on the blades of a wind turbine using a deep neural network. *Computer Modeling in Engineering & Sciences, 134(2),* 767–782. DOI 10.32604/cmes.2022.020702.