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Editorial

Related Theories and Practical Applications of Soft Computing in the Manufacturing Process of Industry 4.0 2021

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Soft computing includes machine learning, computer science, and computing technologies in certain engineering disciplines. Soft computing enables research, simulation, and analysis of complex problems and phenomena. Moreover, related developmental theories can be applied and used to solve problems that occurred in the manufacturing process of Industry 4.0.

Industry 4.0 is also known as industrial internet, smart factory, or advanced manufacturing. With the assistance of new technologies such as the Internet of Things (IoT) and the wide applications of mobile technologies, organizations generate large amounts of data in different formats at a faster rate than before. In addition, data content, process, analytical model, and management of big data transformation have also developed huge challenges and opportunities. Hence, advanced soft computing methods and decision-making techniques can be used to extract useful information and obtain effective manufacturing intelligence. They combine the algorithms with related decision-making techniques from the big data to make equipment automation. In addition, they are able to detect potential failures in the early stage under certain circumstances, diagnose defects, control advanced equipment/process, decrease cycle time and costs, and increase productive rate. The aim and scope can cover wide ranges of fields such as artificial intelligence (AI), robotics, Internet of Things (IoT), autonomous vehicle, 3D printing, nanotechnology, materials science, and energy storage.

The aim of this special issue is to bring together original research and review articles regarding the latest developments, problems, and challenges of the applications of soft computing in the manufacturing process of Industry 4.0. Many papers were submitted to this special issue; however, through a strict peer review process, only 14 articles were accepted in this special issue. We summarize these 14 papers as follows.

In the research article "An Adaptive Location-Based Tracking Algorithm Using Wireless Sensor Network for Smart Factory Environment," the authors Chiu et al. combined the Kalman filter and the adaptive network based on the fuzzy inference system to present a new adaptive location base service algorithm for the smart factory environment. Chiu et al. applied Kalman filter characteristics to eliminate noise in the signal transmission process in order to improve the stability and accuracy of localization. Moreover, the authors used the adaptive network based on the fuzzy inference system to obtain the environment parameter of the target.

In the research article "Evaluate the Consumer Acceptance of AIoT-Based Unmanned Convenience Stores Based on Perceived Risks and Technological Acceptance Models," Wang et al. combined the technology acceptance model and the perceived risks of customers and used multivariate analysis of variance to evaluate the consumer acceptance of unmanned convenience stores. Their method were easy to use, in addition, the results showed that behavioral intentions and positive attitude of male consumers are all significantly higher than female consumers for the unmanned convenience stores based on the artificial intelligence Internet of Things. Conversely, male consumers had a lower perceived risk than female consumers.

In the research article "Establishing an AI Model on Data Sensing and Prediction for Smart Home Environment Control Based on LabVIEW," the authors Yao et al. used laboratory virtual instrument engineering workbench as the main architecture for smart home systems to achieve the intelligent control at home environment. Furthermore, they utilized Python to construct the artificial neural network intelligence model to collect information and forecast data.

In the research article "A Deep Learning Model of Dual-Stage License Plate Recognition Applicable to the Data Processing Industry," Tung et al. presented the dual-stage license plate recognition model to confirm the license plate detection. They combined the convolutional recurrent neural network and the connectionist temporal classification to conduct training loss function for automatic recognition of the license plate.

In the research article "A Novel Contractor Selection Technique Using the Extended PROMETHEE II Method," the author Chang combined the soft set concept and the PROMETHEE II method to propose the novel contractor selection technique. For incomplete information, the author used the weighted arithmetic averaging method to fill in the data and used the PROMETHEE II method to deal with the experts' subjective preferences and relative importance of criteria.

In the research article "In a Stressful Social Environment, Can Using Sports Apps Relieve the Physical and Mental Stress of the Elderly? From the Perspective of Industry 4.0," Huan et al. explored whether using sport apps can relieve elderlies' physical and mental stress when facing COVID-19 pandemic. Their research confirmed that the lower the intensity of leisure exercise, the more the negative emotions they may produce from the elderlies. In the research article "Effects of Output Quality and Result Demonstrability on the Perceived Usefulness of GPS Sports Watches from the Perspective of Industry 4.0," Yuan et al. used the concept of Industry 4.0 to explore the impact of GPS sports watches on the perceived usefulness of users. In the research article "Uplink Spectrum Overlay Coverage Enhancement Algorithm in 5G Network," Jiang and Ding proposed the 5G network-based uplink coverage enhancement algorithm to handle the uplink and downlink coverage issues of 5G network.

Pannakkong et al. used the artificial neural network, support vector machine, and deep belief network to perform the hyperparameter tuning in machine learning algorithms.

Chen et al. combined the decision-making and trial evaluation laboratory (DEMATEL) and the DEMATEL analytic network process (DANP) method to explore the business model in affiliated restaurants. Tripathi et al. proposed a new smart production management system to handle the complex shop-floor problems in Industry 4.0. Chang integrated the hesitant fuzzy linguistic term sets and minimal variance ordered weighted average (MVOWA) to handle the supplier selection issues of hesitant information. Guo et al. proposed the time-delayed feedback control algorithm strategy for the vehicle semiactive suspension system. Tripathi et al. proposed the data-driven decision-making system to regulate the shop floor management of uncertain production conditions in Industry 4.0.

Although the papers published in this special issue is very limited for the field of soft computing in the manufacturing process of Industry 4.0, we still believe that the 14 papers of these special issues will provide positive contributions in the manufacturing process of Industry 4.0. We are looking forward to provide follow-up researchers with more ideas and research directions in related research fields.

Data Availability

All data were obtained from the published studies.

Conflicts of Interest

The Guest Editors declare that they have no conflicts of interest regarding the publication of this special issue.

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