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Editorial: Artificial intelligence applications in reduction of carbon emissions: Step towards sustainable environment

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Editorial on the Research Topic
Artificial intelligence applications in reduction of carbon emissions: Step towards sustainable environment

Pollution control is one of the major issues encountered by environmental and sustainable development and artificial intelligence (AI) research. Increasing carbon dioxide (CO_2) levels in the atmosphere threaten the global climate, biology, and resource status. Monitoring the variables of different AI approaches is very important, as this affects the system's efficiency. Many studies have discussed the relationship between greenhouse gases such as CO_2 and the ongoing global warming. Carbon dioxide is a dangerous and catastrophic greenhouse gas. In recent years, many researchers have reported rising CO_2 emissions. Ocean acidification is another catastrophe in addition to global warming, which is thought to be caused by the absorption of CO_2 in water. Therefore, reducing CO_2 is crucial. The most suitable CO_2 emission method has been proposed for each application.

Wang et al. have proposed a DRL scheduling model to solve the carbon emission-aware flexible job-shop scheduling problem without extra searching. The carbon emission-aware flexible job-shop scheduling problem lists machine operation energy consumption and coolant treatment as primary carbon emission sources. To determine the appropriate action for a state, the scheduling agent repeatedly interacts with the scheduling environment in the proposed DRL scheduling model, i.e., the temporary scheduling solution. This carbon emission-aware flexible job-shop scheduling is identified as a Markov decision process. The minimization of makepan and carbon emissions drives interactions. DRL schedulers outperform scheduling rules and GA in optimization and generalization studies. Adjusting weights tunes the DRL scheduling model. A flexible DRL framework should be used to solve future production scheduling problems by exploring more carbon emission sources and optimizing objectives.

Huang et al. have stated that trajectory prediction can detect risks, improve navigation, eliminate safety hazards, and reduce emissions. TripleConvTransformer, a deep learning ship trajectory prediction method, fuses discrete meteorological data. The main contributions are cleaning the AIS data to create a high-quality spatiotemporal trajectory

data set and fusing the track data with discretized meteorological data to dig deep into the ocean. To gather ship motion information, they designed three modules based on the simplified transformer model to capture multi-scale features: trend convolution, local convolution, and global convolution. They compared TripleConvTransformer to leading predictive models. It best predicts latitude and longitude, and it also predicts exciting trajectory results, though the current models lack confidence metrics. The captain can better assess the algorithm's position information if the algorithm provides a confidence indicator, meaning ship safety will improve greatly. To improve the trajectory prediction, the TripleConvTransformer model should be strengthened in future research.

Zeng et al. have used a rough set-based method of discretizing meteorological data features (RSFD), which has been proposed to address the issues of strong multi-attribute interaction, large noise interference, and difficulty in obtaining prior knowledge participation. This method was conducted mainly as follows: 1) To segment the interval, they calculated the information gain of each candidate breakpoint. 2) After the discrete intervals were split, they merged them using chi-square tests. 3) They used the change of unidentifiable relations in the rough set as the discretization scheme evaluation criterion. Splitting and merging the attributes sequentially yielded the best discrete feature set. They compared RSFD to modern meteorological data discretization methods, showing that RSFD has the least breakpoints and data inconsistency. All the discretized algorithms were used to train the neural network classifiers, and RSFD was classified as best, although it struggles to describe the ambiguity of meteorological data. Thus, by optimizing the model using the fuzzy theory and testing it on more meteorological data, RSFD can be stabilized.

Ye et al. have warned that high water organic matter levels endanger human and ecological safety. As water resources degrade, accurate and fast water quality parameter determination has become a research hotspot. UV spectrometry, a convenient and chemical-free method for COD detection, has become more popular in recent years. This method typically measures COD using absorbance at 254 nm. The measurement will be accurate in a simple pollutant composition, but it will be seriously impacted in a complex pollutant composition. Thus, a UV-Vis spectrometry and CNN-based COD prediction model has been proposed. Unlike other COD prediction models, this model avoids information loss by using the absorbance of all visible wavelengths and ultraviolet. This shallow CNN-based model uses convolutional layers with different step lengths instead of pooling layers to reduce computation and improve spectral feature peaks. The CNN's powerful feature extraction reduces pre-processing and improves spectral information use. Ye et al.'s model outperforms partial least squares regression, backpropagation neural networks, and principal component analysis in COD prediction experiments. Moreover, this study improves UV-Vis water quality COD detection accuracy, thus enabling real-time water quality monitoring, promoting biodiversity, and supporting the government's water resource protection policy.

Author contributions

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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