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Cutting-Edge Developments in Materials Science and Nanotechnology

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DESCRIPTION

The hybrid model is proposed for forecasting humidity in sheep barns and is based on a machine learning model that combines a light gradient boosting machine with grey wolf optimization and support-vector regression. LightGBM was used to remove influencing elements with a high commitment to stickiness, reducing the complexity of the model. Required hyper parameters in SVR were enhanced by employing the CGWO calculation to avoid the local extremum problem. To ensure the healthful development of the animals and increase the financial benefits of sheep farming, it is crucial to precisely predict variations in humidity in sheep barns. To overcome the shortcomings of conventional approaches in creating precise mathematical models of dynamic changes in humidity in sheep barns, we propose a machine learning model that combines a light gradient boosting machine with grey wolf optimization and support-vector regression. In order to streamline the model, LightGBM was utilised to extract influencing elements that had a substantial impact on humidity. The local extremum problem was avoided by using the CGWO algorithm to identify the ideal hyper parameter combination and optimize the necessary hyper parameters in SVR. The combined algorithm was used by an intensive sheep breeding facility in Manas, Xinjiang, China, to predict the humidity in real time for the following 10 minutes. It obtained lowest values of 0.0662, 0.2284, 0.0521, and 0.0083, respectively, for the mean absolute error, root mean square error, mean squared error, and normalized root mean square error, and a maximum value of 0.9973 for the R2 index. In rural inland Northwest China (Xinjiang), where sheep farming for meat is a significant industry, large-scale intensive sheep farming is the main form of operation. The final simulation outcomes of the proposed LightGBM-CGWO-SVR model were compared to those of more sophisticated models, and the following conclusions were made: Without accounting for ambient elements that affect humidity, LightGBM was utilised to screen the sheep barn's environmental parameters. The 9 variables-air humidity, CO2, PM2.5, PM10, light intensity, noise, TSP, NH3 concentration, and H2 S concentration were then reduced to the three most significant influencing variables-CO2, light intensity, and air temperature and used for modelling. Remember that the data were collected in February, when Xinjiang was bitterly cold and wintery. This resulted in regular and irregular ventilation of the sheep house. It wasn't constantly well-ventilated. In other words, ventilation had little impact on the majority of the humidity values in this set. Naturally, the ventilation element should not be disregarded while building a model for the summer season, when the sheep barn would be often ventilated. This significantly improved the model's precision and computational effectiveness. This study's CGWO algorithm, obtained by introducing chaotic operators, maintained the benefits of a simple structure, few control parameters, and implementation of the GWO algorithm while enhancing the traditional GWO algorithm's global search capability and resolving the issue of randomness and empirically in the selection of SVR parameters. In terms of prediction accuracy and generalizability.

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CONFLICT OF INTEREST

None.

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