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FORECASTING LONG TERM PRECIPITATION USING CUCKOO SEARCH OPTIMIZATION NEURAL NETWORK MODELS

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Abstract

With anticipation of global warming and climate change, quantitative prediction of future precipitation trend is more important than ever. Global circulation models (GCMs) are widely used as the base for simulating climate change. However, due to their coarse resolution, researchers have been using various downscaling techniques to produce finer model for regional use. Recent advancements in metaheuristic algorithms have provided an alternative approach in downscaling. This paper introduces the application of a novel optimization algorithm, named as Cuckoo Search Optimization (CSO), to train Feedforward and Recurrent neural network to forecast long term precipitation. As benchmark, CSO was compared with Scaled Conjugate Gradient (SCG) and Levenberg-Marquardt (LM) methods. The models were evaluated through validation with historical precipitation; as well as their performance in Pearson correlation (r), root mean square error (RMSE), mean absolute error (MAE), and mean bias (MB). Results showed that CSO is capable of forecasting precipitation up to 90%~100% confidence level with an overall lower mean absolute error, root mean square error and mean bias; outperforming SCG and LM. Future precipitation forecasts revealed that the city will experience an increase of mean annual precipitation by 6~7% over Year 2071-2100. A regional climate model (RCM) with finer resolution was also investigated. Preliminary results revealed an underperformance of the regional climate model due to weaker correlation link between the predictors and historical precipitation.

Key words: climate change, cuckoo search optimization, neural network, precipitation forecasting, statistical downscaling

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