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Solar Radiation Time Series Prediction

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Abstract : A model was constructed to predict the amount of solar radiation that will make contact with the surface of the earth in a given location an hour into the future. This project was supported by the Southern Company to determine at what specific times during a given day of the year solar panels could be relied upon to produce energy in sufficient quantities. Due to their ability as universal function approximators, an artificial neural network was used to estimate the nonlinear pattern of solar radiation, which utilized measurements of weather conditions collected at the Griffin, Georgia weather station as inputs. A number of network configurations and training strategies were utilized, though a multilayer perceptron with a variety of hidden nodes trained with the resilient propagation algorithm consistently yielded the most accurate predictions. In addition, a modeled DNI field and adjacent weather station data were used to bolster prediction accuracy. In later trials, the solar radiation field was preprocessed with a discrete wavelet transform with the aim of removing noise from the measurements. The current model provides predictions of solar radiation with a mean square error of 0.0042, though ongoing efforts are being made to further improve the model's accuracy.

Keywords : artificial neural networks, resilient propagation, solar radiation, time series forecasting
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