

Global irradiation interval forecasts based on artificial neural network

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Abstract

Solar radiation is one of the principal energy sources for physical, biological and chemical processes, occupying the most important role in many engineering applications. The process of converting sunlight to electricity without combustion allows to create power without pollution. The major problem of such energy source is its intermittence and its stochastic character which make difficult their management into an electrical network; Thereby, the development of forecasting models is necessary to use ideally this technology. By considering their effectiveness, it will be possible for example to identify the most optimal locations for developing a solar power project or to maintain the grid stability and security of a power management system. Thus the solar energy forecasting is a process used to predict the amount of solar energy available for various time horizons. Several methods have been developed by experts around the world and the mathematical formalism of Times Series has been often used for the short term forecasting (among 6 hours ahead). TS is a set of ordered numbers that measures some activities over time. It is the historical record of global horizontal irradiance with measurements taken at equally spaced intervals with a consistency in the activity and the method of measurement. Some of the best predictors found in literature are Autoregressive and moving average, Bayesian inferences, Markov chains, k-Nearest-Neighbors predictors, support vector machine, regression tree, or artificial neural network. All these approaches are related to the machine learning application. The most often used is the last presented method: the artificial neural network and particularly the multilayer perceptron. In the present study, we focus on this prediction method, the goal being to detail the uncertainties related to the global radiation prediction. These uncertainties can be decomposed into several components that will be explained and developed.

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