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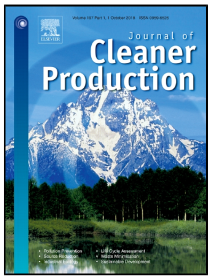

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Keyong Hu, Shihua Cao, Lidong Wang, Wenjuan Li, Mingqi Lv

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A new ultra-short-term photovoltaic power prediction model based on ground-based cloud images

Keyong Hu[a,b,*] Shihua Cao[a] Lidong Wang[a] Wenjuan Li[a] Mingqi Lv[c]

[a] *Qianjiang College, Hangzhou Normal University, Hangzhou* 310018, *China;*

[b] *College of Mechanical Engineering, Zhejiang University of Technology, Hangzhou* 310014, *China;*

[c] *College of Computer Science and Technology, Zhejiang University of Technology, Hangzhou* 310023, *China*

*E-mail: hukeyong@yeah.net

Abstract: The cloud shading on the photovoltaic (PV) power station is one of the main factors that cause random changes in the PV output power, and thereby greatly influences an ultra-short-term photovoltaic power prediction. This paper presents an ultra-short-term prediction model for photovoltaic power generation based on dynamic characteristics of the cloud that is sheltering the sun. The proposed prediction model consists of three stages. In the first stage, the moving trajectory of the cloud is predicted using the motion vector and the cloud that shelters the sun is selected. In the second stage, the dynamic characteristics of target cloud, which have a great influence on the photovoltaic power generation, are extracted using the digital image processing. In the third stage, a prediction model based on the radial basis function (RBF) neural network, which is trained with processed sample data, is designed. Finally, the performance of RBF prediction model is compared with the performance of auto regressive (AR) model. The comparison shows that the power prediction accuracy of RBF model is 7.4% and the power prediction accuracy of AR model is 13.6%. The proposed ultra-short-term PV power prediction model can significantly improve the power prediction performance, especially in cloudy weather.

Keywords: photovoltaic power generation; ultra-short-term prediction; target cloud; image processing; artificial neural network

Nomenclature

Section 1:

AR	auto regressive
MLP	multiple perceptron
NARX	non-linear auto-regressive model with exogenous inputs
NWP	numerical weather prediction
PV	photovoltaic
RBF	radial basis function
SPP	solar power prediction
SVM	support vector machine

Section 2:

SSDA	sequential similarity detection algorithm