

Applying Artificial Intelligence in Forecasting the Output of Industrial Solar Power Plant in Vietnam

Ninh Nguyen Quang^{1,*}, Linh Bui Duy¹, Binh Doan Van¹, Quang Nguyen Dinh¹

¹Institute of Energy Science, Vietnam Academy of Science and Technology, Hanoi, Vietnam

Abstract

This paper uses recurrent neural network (Long Short – Term Memory - LSTM network) to build a model to forecast short-term generation capacity of Phong Dien solar power plant, (48 MWp – 35 MWAC) located in Thua Thien Hue Province, Viet Nam, with input factors including meteorological parameters. The authors conducted experiments to find the optimal structure of the model corresponding to the conditions of the plant and the data collection. Through this model, meteorological forecast data sets from commercial suppliers were used to forecast the plant's output power. The comments about the result as well as the further study direction are analysed and suggested.

Keywords: Long Short – Term Memory, Industrial PV power plant, Forecasting PV power, Artificial Intelligence.

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*Corresponding author. Email: nqninh@ies.vast.vn

1. Introduction

Vietnam is considered to have high solar potential with a lot of sunshine hours a year as mentioned in [1]. In recent years, solar power has had a strong boom in over the world. In Vietnam, since 2019, with strong incentives from the government, total installed capacity of PV power plants has increased rapidly and reached 4500 MWp [2]. Due to the uncertainty of solar source, in operation, both electricity system operators and the owner of industrial PV power plants need to know how many electric powers will be generated in next hour, next day. A forecasting method that could predict the output of the PV power plants based on influencing factors concerned as input data, will solve the problem. Recently, many forecasting techniques for generating capacity for solar PV systems have been developed and published. In [3], the authors have used two techniques to forecast the out-put power of a 6kWp PV system installed in a university in Malaysia. The results of Math processing machine learning SVR method (Support Vector Regression) and artificial neural network NAR

method (Nonlinear Autoregressive) have been compared with the classical model. The results showed that the SVR method outperformed the NAR and the classical method in three typical weather conditions (clear, cloudy, and overcast). Jang in [4] has developed a new forecasting technique based on satellite images and SVM (Support Vector Machine). However, the results are not good enough due to the sporadic and random nature of the output power.

The statistical method is based on a set of observed values of one or more parameters measured at consecutive determined intervals [5]. This method includes many different types of prediction based on artificial intelligence algorithms (Artificial Neural Networks - ANN) such as Multilayer Perceptron (MLP) ([6], [7], [8]), Support Vector Machine (SVM) [9], Hybrid method [10], Markov string method, Fourier series, regression method... These methods rely only on data collected in the past to predict the generation capacity of solar power plants without requiring any information related to solar power plants such as panel capacity, number of panels... or location of construction area. Among the statistical-based forecasting models, ANNs forecasting models and regression models are currently the most widely used. According to many

