Using machine learning models to predict the benefits of solar power generation in northern Taiwan

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In recent years, the use and development of solar power has been promoted due to climate change and energy crisis. However, solar power generation is highly dependent on local weather characteristics, since the amount of solar radiation is closely related to the atmospheric transparency, water vapor content, cloud coverage and suspended particulate content. In particular, the problem of air pollution in Taiwan is getting worse, and the aerosol in the atmosphere can reflect, scatter or absorb solar radiation, reducing the amount of solar power generation. Therefore, if we want to increase the proportion of solar power generation, it is important to develop a solar energy forecasting technology that combines environmental parameters. This study utilized meteorological data from the Banqiao, Hsinchu, and Xinwu observatories of the Central Weather Bureau, and PM2.5 observation data from the Longtan Station of the Environmental Protection Administration from July 2013 to June 2018, to analysis the relationship between various environmental factors and solar radiation. Then put the data into the mechanical learning models to obtain the solar radiation prediction value (the first half of the data is used for model training and the second half is used for model testing), and compare with the measured values of solar radiation to find the best performing parameter series and model. The results show that a series of 10 weather parameter used in the decision tree algorithm has better training and test scores on the 8th floor (training score 0.821261, test score 0.674572), and the random forest algorithm has the best training and test performance (training score 0.964738, test score 0.716649).

Keywords: Machine learning, Decision tree, Random forest, Solar radiation