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Shading Prediction Methods for Solar Arrays Using New Vision and Machine Learning Methods

Background

Despite the upward trends in the solar array industry, adoption of solar technology by main power grids has been challenged by environmental fluctuations. In particular, the shading of arrays caused by cloud cover leads to inconsistent and thus unreliable energy generation. However, effective sensing and characterization of cloud movements hold great potential in improving the predictability of array performance and aiding in dynamic optimization processes. Integration of key computer vision and machine learning technologies can enable solar energy to set a new standard in large-scale power generation.

Invention Description

Researchers at Arizona State University have developed a new fast method for cloud movement prediction using video skyline imagery. A non-parametric approach for dynamic texture synthesis, the technique employs a simple machine learning regression analysis. To improve the visual appeal and time complexity of the algorithm, locality-sensitive hashing for nearest-neighbor searching is used. Without the requirement of satellite data, which can vary in availability, this method is designed for a self-contained system of sensors and cameras. The versatility of this method can be easily extended for predicting a wide range of chaotic time series behaviors, such as human action synthesis and wind prediction.

Potential Applications

- Solar arrays
- Power grids
- Weather prediction

Benefits and Advantages

- Versatile – Can be equally valuable for many other applications involving chaotic time series

- Non-restrictive – Non-parametric approach avoids system input assumptions inherent to parametric methods
- Self-contained – Sensor-based operation moves past satellite data requirements
- Fast – Emphasis is placed on algorithm speed by locality-sensitive hashing

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