Energy Trading Company / Solar Irradiation Prediction

Overview

Energy Trading Company, an organization focused on optimizing energy trading, partnered with a specialized data science team to improve the prediction of solar irradiation. Using machine learning algorithms and high-quality satellite data, they developed a system capable of predicting direct and diffusive solar radiation with high spatial and temporal accuracy.

Keywords

solar energy
irradiation forecasting
machine learning
satellite data

Situation

Traditional numerical weather models for predicting solar irradiation often fall short in terms of accuracy and resolution. This poses a significant challenge for the energy trading company, as accurate forecasting is essential for optimizing energy supply and demand.

Requirements

Improve the accuracy and reliability of solar irradiation forecasts.

Provide high spatial and temporal resolution for better decision-making.

Make the system scalable and computationally efficient.

Solution

The data science team utilized machine learning algorithms and satellite data to develop a predictive model for solar irradiation. This model was specifically designed to predict both direct and diffusive solar radiation in high spatial (3 kilometer-level) and temporal (15 min) resolution. The model is based on special combination of deep recurrent neural networks with lightweight transformer model. This approach proved to be much more accurate than traditional numerical weather models.

Benefits and Results

- The Energy Trading Company successfully implemented a machine learning-based system that significantly outperformed traditional weather models in predicting solar irradiation.
- The new system's forecasts are of high spatial and temporal resolution, making them much more useful for real-time decision-making in energy trading.
- The superior accuracy of the new system leads to better optimization of energy resources, potentially leading to cost savings and reduced waste.
- The breakthroughs achieved by this project have opened doors for further academic research and potential collaborations. Preliminary results are being prepared for submission to prestigious journals in the field of renewable energy and machine learning.