

A GIS–Machine Learning Framework for Optimal Solar Farm Siting Using Solar Irradiance Data

(MT2024011: Aishwarya J Panampilly, IMT2023034: Nainika Agrawal, IMT2023035: Harshita Bansal)

Background of the problem

Solar energy is vital for sustainable development, but selecting suitable sites for large-scale installations is challenging due to environmental, technical, and infrastructural constraints.

Problem statement

The aim is to develop a GIS–Machine Learning framework that predicts solar energy potential using irradiance data and integrates it with spatial, environmental, and infrastructural layers to generate an optimized Solar Farm Suitability Map.

Objectives

- To acquire and process all necessary GIS thematic layers,
- To design, train, and validate a machine learning model to accurately predict solar energy potential.

Research questions

- Which environmental, climatic, and infrastructural factors most influence solar farm suitability?
- What combination of GIS thematic layers provides the highest precision in identifying optimal solar sites?

Possible datasets to be used

- [Time Series Solar Irradiance for Indian Cities](#)
- [OpenStreetMap](#)

Possible methods to be adopted

- **Machine Learning:** XGBoost, LSTM, etc (for energy prediction)
- **GIS Software:** QGIS
- **GIS Techniques:** Raster Analysis, Buffer, Reclassification, Weighted Overlay
- **Integration Framework:** Multi-Criteria Decision Analysis (MCDA), etc

Expected results

The expected result is a high-accuracy Solar Farm Suitability Map that identifies optimal locations for solar energy development by integrating machine learning predictions with GIS-based spatial factors.

Keywords

GIS, ML, Solar Irradiance, Time Series Analysis, Renewable Energy, Smart Grid, Geospatial Forecasting

Research Papers

- [Assessment of solar power potential in a hill state of India using remote sensing and GIS](#)
- [A multi-criteria gis based analytical hierarchical approach for solar photovoltaic farm site selection](#)