RaPower: Solar Power Plant Location Classifier

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Motivation

1. **Multiple challenges** : Climate change, sustainable growth, growing energy demand.
2. **Solutions ?** Renewable energy generation and deployment.
3. **Solar energy**: Highest electric power per unit land area used.
4. **Rooftop solar** can’t meet energy demand.
5. Need **utility-scale solar farms** (1 MW). Rapidly evolving situation!
6. **Traditional methods**: Expensive and slow manual analysis, simplified criteria.

Goals, KPIs and Stakeholders

Source: Bing AI Image Generator

Project Goals

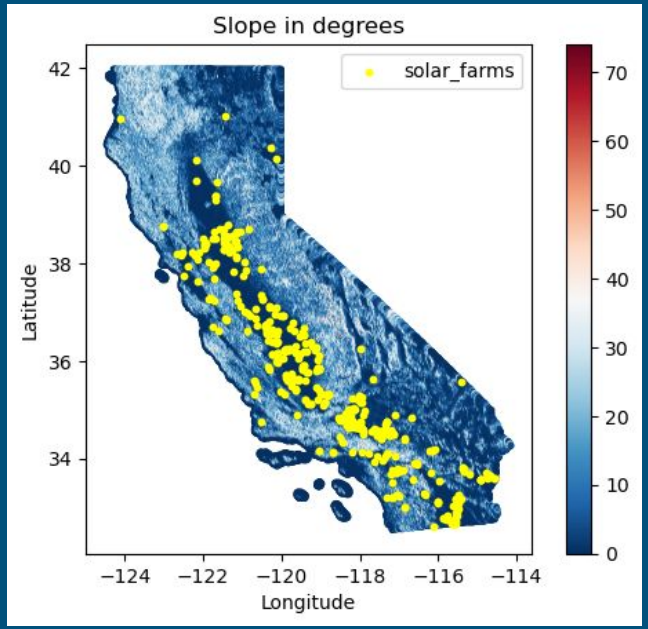
1. Classify if a given location is suitable for a utility-scale solar farm.
2. Efficiency Index : Predict existing solar farm locations.

Stakeholders: Landholders, Energy and utility firms, state and local governments, green energy companies

Data Collection and Preprocessing

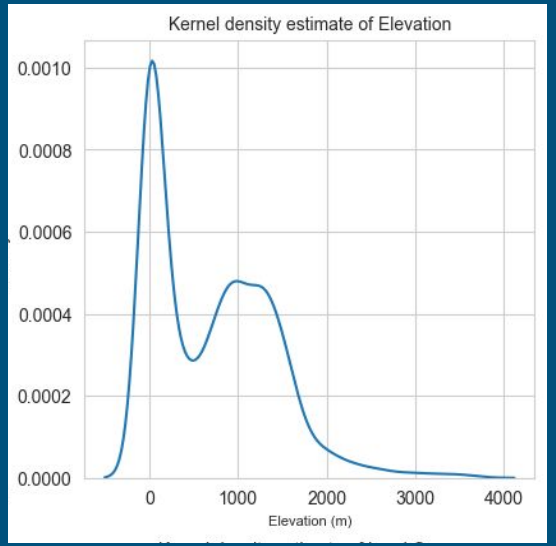
Parameters:

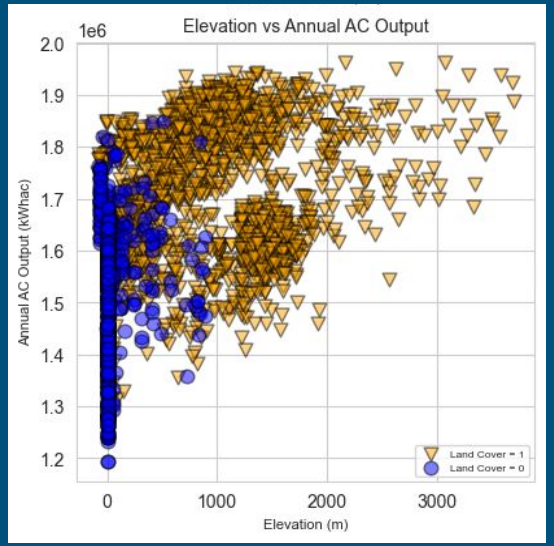
- Annual Solar Radiation
- Slope
- Elevation
- Land Cover
- Minimum Distance to a City



After standardization: 971 points

Model Selection



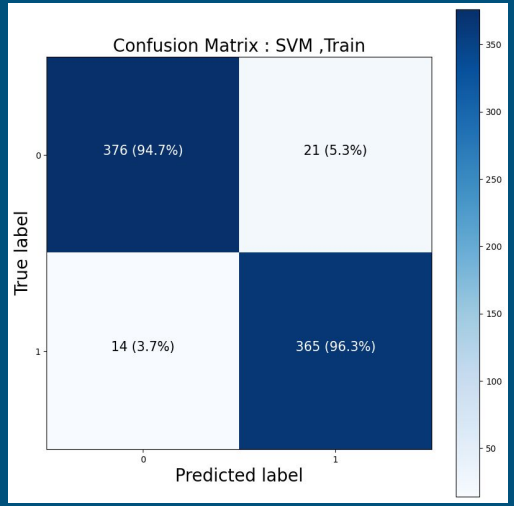


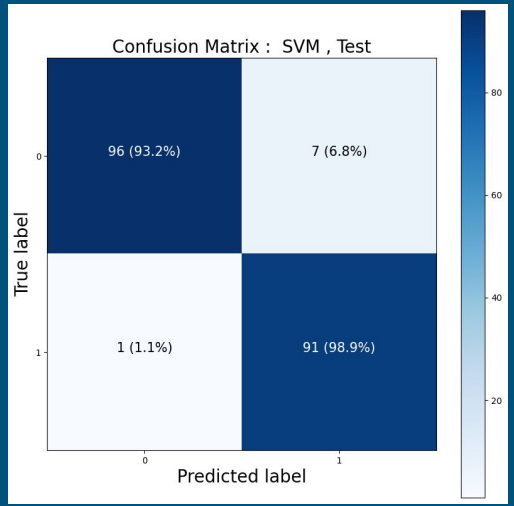
Models Chosen:

1. Logistic Regression
2. SVM
3. Decision Tree
4. XGBoost
5. Neural Network

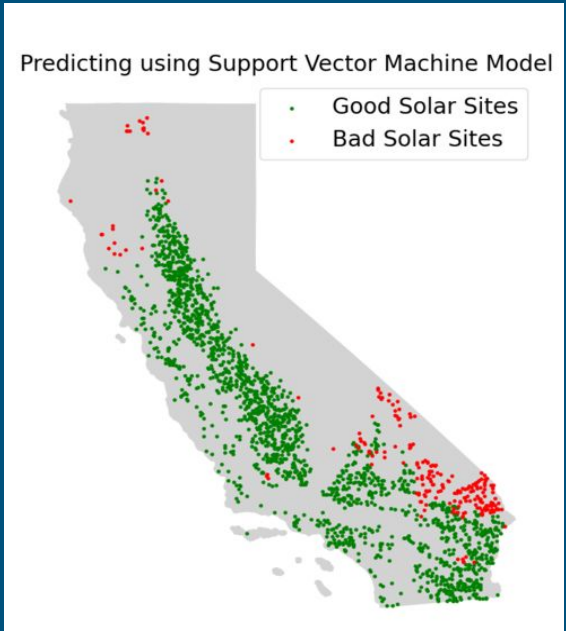
Model Results

Model	Training Set (Accuracy)	Testing Set (Accuracy)
Logistic Regression	94.9%	93.8%
Decision Tree	93.2%	94.8%
SVM	95.4%	95.8%
XGBoost	96.3%	95.3%
Two-Layer NN	95.4%	94.8%





Conclusions



Future Iterations

1. Adding Features.
    a. Demand Data
    b. Cost of Installation Data
2. Including more locations.

Benefits

1. Saves resources
    a. No costly initial surveys
    b. No need to wait for results
2. Model informed decisions

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Data Sources:

1. NREL: https://developer.nrel.gov/docs/solar/pvwatts/v8/
2. USGS Land Use, Topography and Geological Factors Data Sets
3. Approximate AC Output: https://developer.nrel.gov/docs/solar/pvwatts/v8/
4. Google Earth Project SunRoof: https://sunroof.withgoogle.com
5. Open Source Routing Machine: http://project-osrm.org/
6. Harmonised global dataset of solar farms: https://www.nature.com/articles/s41597-020-0469-8