Solar Energy Forecasting

By: Matt Carr

Subject Matter Overview

Problem:

- Current energy sources are limited and harmful to the environment
- Renewable sources are intermittent and difficult to integrate

Solution:

- Utilize weather observations and forecasts to predict solar energy production
- Improve efficiency of grid management

Background:

- Solar panels use solar radiation to create electricity
- Time and weather influence how much solar radiation reaches panels

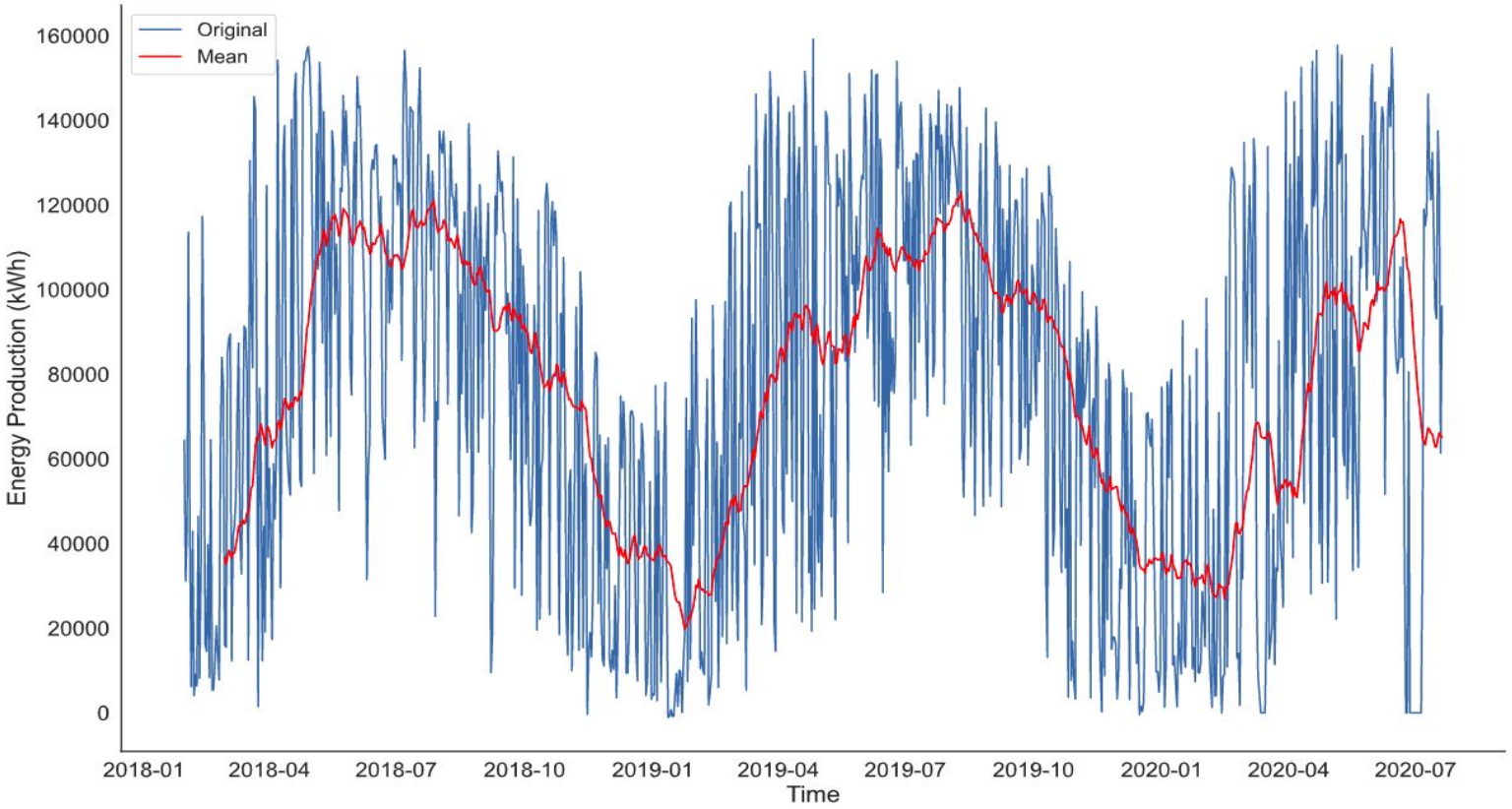
Project Overview

- Data Gathering
  - Energy data scraped from University of Illinois Solar Farm 1.0 dashboard
  - Weather data collected from NOAA ISD database
- Data Prep
  - Aggregated energy and weather data to hourly time frame
  - Incorporated three hour lag between energy data and weather observations
  - Filtered for times between 5am and 8pm
- Data Split
  - Training: January 30, 2018 - October 16, 2019
  - Validation: October 17, 2019 - March 3, 2020
  - Testing: March 4, 2020 - July 2020, 2020
- Metric
  - RMSE

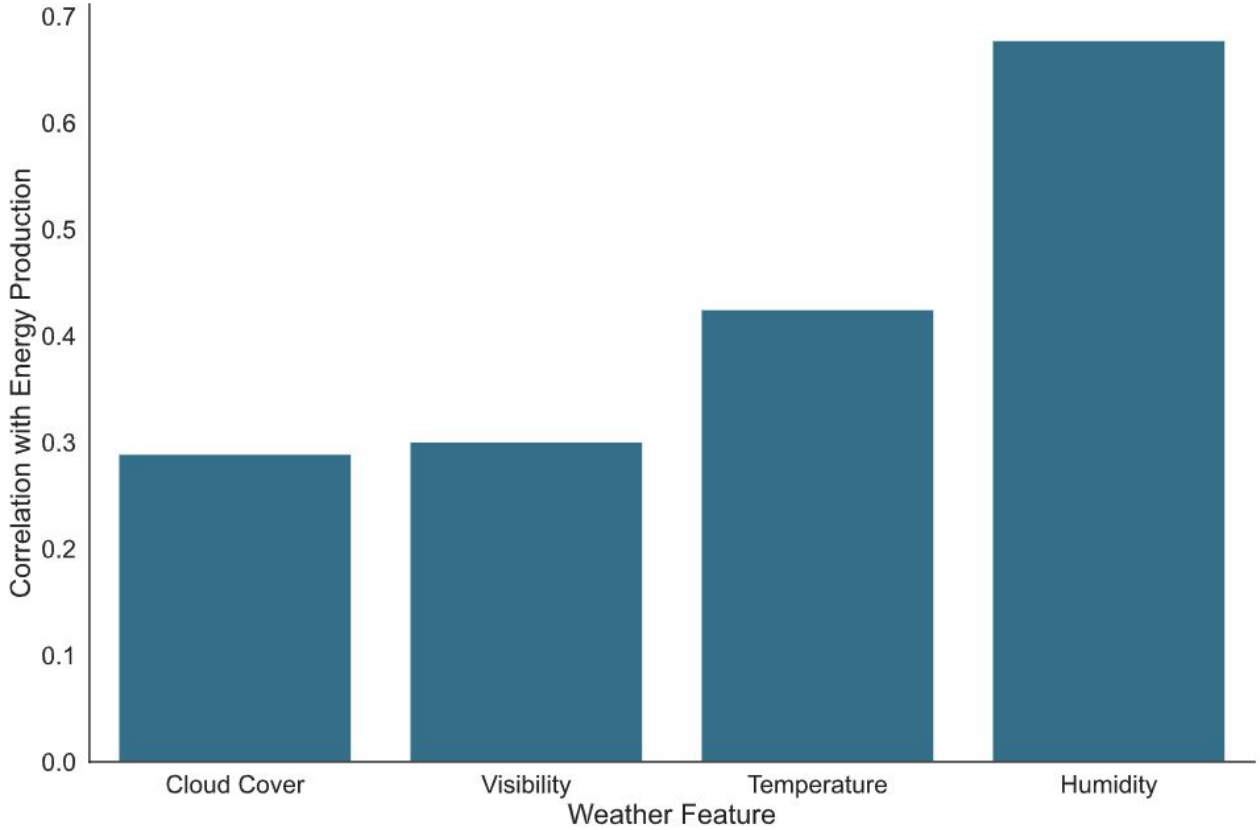
Problem

Renewable energy sources are intermittent

Energy Fluctuation



Weather Dependence



Direct:

- Visibility
- Temperature

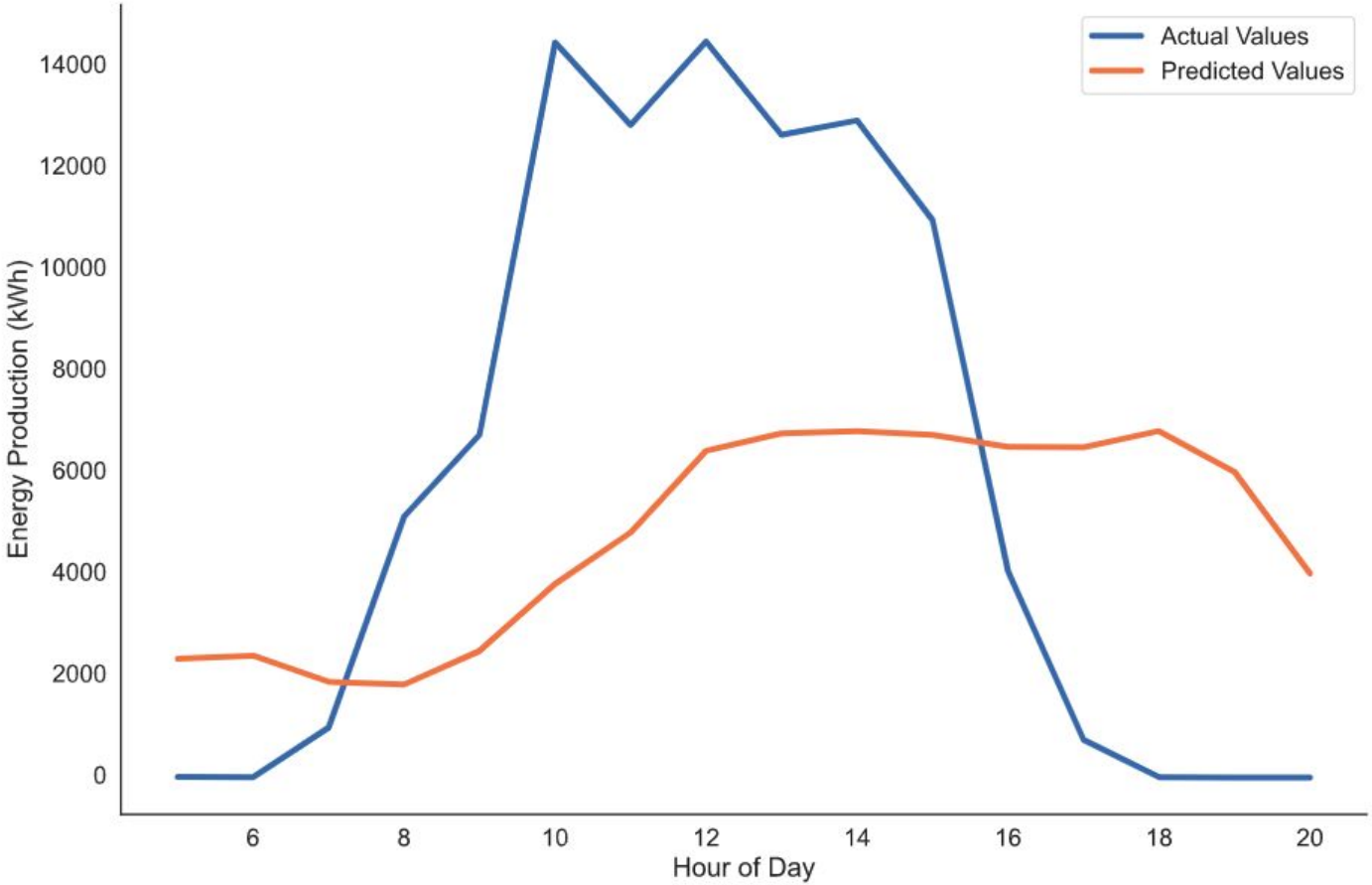
Indirect:

- Cloud Cover
- Humidity

Solution

Forecast renewable energy production

Baseline Model

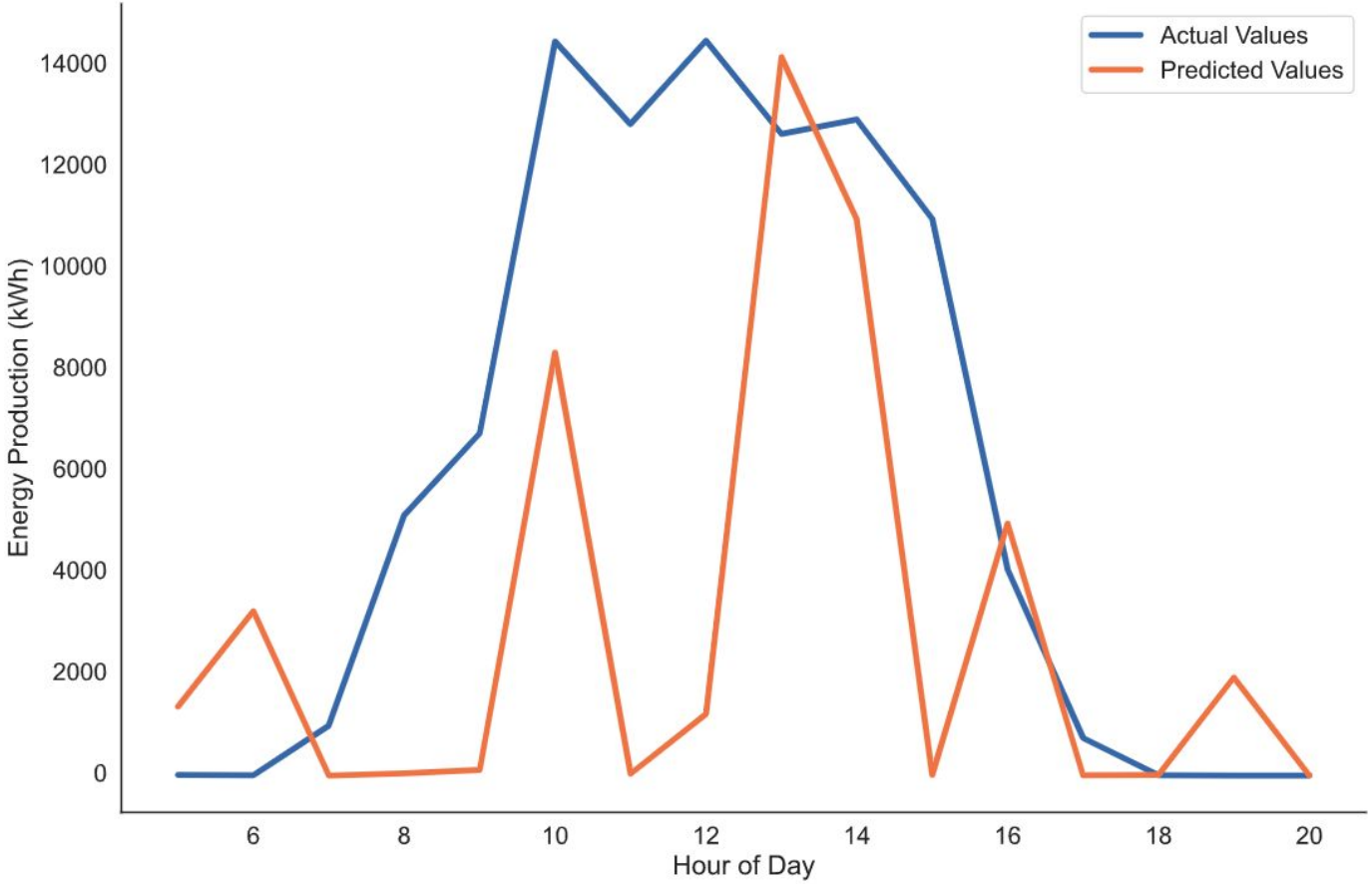


Day: October 19, 2019

Base Features

RMSE: 4484

Best Model



Day: October 19, 2019

Base Features and Time

RMSE: 2316

Next Steps

- Modeling Iterations
- Dimensionality Reduction
- Gather weather forecasts data to extend forecast capability
- Include solar radiation measurement

Stretch Goals

- Include solar elevation angle
- Deploy as flask app

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Project Repo: github.com/mattcarr17/solar_energy_prediction