Use Case

Solar Power Plant Inverter Anomaly Detection
Solar Power Plant - Inverter Anomaly Detection

Objective

- Prediction of the power generation for next couple of days? - this allows for better grid management
- Identify the need for panel cleaning/maintenance?
- Identify faulty or sub-optimally performing equipment?

Data Aggregated – Power Generation Dataset (Plant 1&2)

- Datetime
- Plant ID
- Inverter ID
- DC power Generated
- AC power Generated
- Daily Yield
- Total Yield

Data Aggregated – Weather Sensor dataset(Plant 1&2)

- Datetime
- Plant ID
- Panel ID
- Ambient Temperature
- Module Temperature
- Irradiation
Typically the factors that determine the performance of a solar power plant are:

- Temperature
- Dirtiness
- Inverters Efficiency
- Inverters or panels seniority
Exploratory Data Analysis:

Solar Power Plant - Inverter Anomaly Detection
Identify faulty Inverter:

- Loss = AC Power/DC Power * 100
- 22 Inverters are Present
- Distribution of the DC power generated

The Distribution for all the inverter tends to behave normally over the period of time during the day hours
- Most of Inverters start to generate the power by morning 6AM and ends by Evening 6 PM during the day
- The productivity of the Inverters for converting the DC to AC should be considered in this time frame
Identify faulty Inverter:

- The average of DC power from the source Inverter over the period of time indicates that Inverter with ID ~1BY6.. & ~bvBOh.. are anomalous.
- The maintenance requirement for the inverter is identified and should be scheduled appropriately.
Identify the need for panel cleaning/maintenance

- **Daily behavior of the plant:**
- It is evident that from 19\textsuperscript{th} to 21\textsuperscript{st} May the plant is behaving abnormally due to no Power Generation
- Module Temperature seems to be heavily dependent on the Ambient Temperature
- Module overload happens when Temp > 50 deg. It was observed for the Inverter to be non-performing because of this reason

**DC power Generated**

**Module Temperature**

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Confidential
Forecasting the DC power Generation and Yield:

SARIMAX Results

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<tr>
<td>Model:</td>
<td>SARIMAX(4, 1, 0)x(0, 1, [1], 96)</td>
<td>Log Likelihood</td>
<td>-757.647</td>
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<tr>
<td>Date:</td>
<td>Tue, 15 Sep 2020</td>
<td>AIC</td>
<td>1527.294</td>
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<td>Time:</td>
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<td>BIC</td>
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<tr>
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<td>opg</td>
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| coef | std err | z | P>|z| | [0.025 | 0.975 |
|------|---------|---|-----------------|--------|--------|
| ar.L1 | -0.2318 | 0.025 | -9.315 | 0.000 | -0.281 | -0.183 |
| ar.L2 | 0.0985 | 0.058 | 1.699 | 0.089 | -0.015 | 0.212 |
| ar.L3 | 0.0988 | 0.041 | 2.434 | 0.015 | 0.019 | 0.178 |
| ar.L4 | 0.0265 | 0.068 | 0.389 | 0.697 | -0.107 | 0.160 |
| ma.S.L96 | -0.1111 | 0.053 | -2.100 | 0.036 | -0.215 | 0.007 |
| sigma2 | 5.751e+05 | 6.5e+04 | 8.852 | 0.000 | 4.48e+05 | 7.02e+05 |

Ljung-Box (Q): 92.31
Prob(Q): 0.00
Heteroskedasticity (H): 5.49
Prob(H) (two-sided): 0.00

Jarque-Bera (JB): 27.18
Skew: 0.21
Kurtosis: 5.59