Electrical Energy Generation, Consumption and Price Forecasting with Long Short-Term Memory

Long Short-Term Memory

Long Short Term Memory (LSTM) networks are a special kind of artificial recurrent neural network (RNN), capable of learning long-term dependencies. They were introduced by Hochreiter & Schmidhuber (1997) . LSTMs are explicitly designed to avoid the long-term dependency problem. Unlike standard feedforward neural networks, LSTM has feedback connections. It can not only process single data points (such as images), but also entire sequences of data (such as speech or video). LSTM is applicable to tasks such as unsegmented, connected handwriting recognition, speech recognition and anomaly detection in network traffic or IDS's (intrusion detection systems).

A common LSTM unit is composed of a cell, an input gate, an output gate and a forget gate. The cell remembers values over arbitrary time intervals and the three gates regulate the flow of information into and out of the cell.

LSTM networks are well-suited to classifying, processing and making predictions based on time series data, since there can be lags of unknown duration between important events in a time series. LSTMs were developed to deal with the vanishing gradient problem that can be encountered when training traditional RNNs.

Dataset

This dataset contains 4 years of electrical consumption, generation, pricing for Spain. Consumption and generation data was retrieved from ENTSOE a public portal for Transmission Service Operator (TSO) data. Settlement prices were obtained from the Spanish TSO Red Electric España.

Data Source: https://www.kaggle.com/nicholasjhana/energy-consumption-generation-prices-and-weather/data#energy_dataset.csv

Columns

time: Datetime index localized to CET
generation biomass: biomass generation in MW
generation fossil brown coal/lignite: coal/lignite generation in MW
generation fossil coal-derived gas: coal gas generation in MW
generation fossil gas: gas generation in MW
generation fossil hard coal: coal generation in MW
generation fossil oil: oil generation in MW
generation fossil oil shale: shale oil generation in MW
generation fossil peat: peat generation in MW
generation geothermal: geothermal generation in MW
generation hydro pumped storage aggregated: hydro1 generation in MW

generation hydro pumped storage consumption: hydro2 generation in MW
generation hydro run-of-river and poundage: hydro3 generation in MW
generation hydro water reservoir: hydro4 generation in MW
generation marine: sea generation in MW
generation nuclear: nuclear generation in MW
generation other: other generation in MW
generation other renewable: other renewable generation in MW
generation solar: solar generation in MW
generation waste: waste generation in MW
generation wind offshore: wind offshore generation in MW
generation wind onshore: wind onshore generation in MW
forecast solar day ahead: forecasted solar generation
forecast wind offshore day ahead: forecasted offshore wind generation
forecast wind onshore day ahead: forecasted onshore wind generation
total load forecast: forecasted electrical demand
total load actual: actual electrical demand
price day ahead: forecasted price EUR/MWh
price actual: price in EUR/MWh