Appliance Energy Use Prediction


```
Author: Alexis Kaldany
Spring 2022
DATS_6313_10
Overseen by Professor Reza Jafari
```

Abstract

Introduction

Description of Data

- The data set is at 10 min for about 4.5 months. The house temperature and humidity conditions were monitored with a ZigBee wireless sensor network. Each wireless node transmitted the temperature and humidity conditions around 3.3 min. Then, the wireless data was averaged for 10 minutes periods. The energy data was logged every 10 minutes with m-bus energy meters.
- Weather from the nearest airport weather station (Chievres Airport, Belgium) was downloaded from a public data set from Reliable Prognosis (rp5.ru), and merged together with the experimental data sets using the date and time column.
- Two random variables have been included in the data set for testing the regression models and to filter out non predictive attributes (parameters).

Visualization of Variable Locations

Table of Variables

- All temperatures in Celsius
- All humidity is in % terms
- All energy use in watts per hour

Variable	Description	Variable	Description
date	10 minute intervals	Appliances	energy use of appliances
lights	energy use of light fixtures	Press_mm_hg	Pressure
RH_1	Humidity in kitchen	T1	Temp in kitchen
RH_2	Humidity in living room	T2	Temp in living room
RH_3	Humidity in laundry area	T3	Temp in laundry area
RH_4	Humidity in office room	T4	Temp in office room
RH_5	Humidity in bathroom	T5	Temp in bathroom
RH_6	Humidity in north area	T6	Temp in north area
RH_7	Humidity in ironing room	T7	Temp in ironing room
RH_8	Humidity in teenager room	T8	Temp in teenager room
RH_9	Humidity in parents room	T9	Temp in parents room
RH_out	Humidity outside	T_out	Temp outside
Windspeed	in m/s	Visibility	kilometers
rv1	random variable 1	rv2	andom variable 2
Tdewpoint	A*C		

1a

Stem Original

Stationarity

ADF Statistics vs Diff Intervals
ADF Statistics
−20
−25
−30
−35
−40
−45
0
50
100
150
200
250
300
Diff Intervals

KPSS Statistics vs Diff Intervals
KPSS Statistics
0.05
0.04
0.03
0.02
0.01
0.00
0
50
100
150
200
250
300
Diff Intervals

Decomposition

Appliances-144-diff-ACF

144_diff
0
−1000
0 2500 5000 7500 10000 12500 15000 17500
Trend
250
0
−250
0 2500 5000 7500 10000 12500 15000 17500
Season
250
0
−250
0 2500 5000 7500 10000 12500 15000 17500
150 Diff
Residual
500
0
−500
0 2500 5000 7500 10000 12500 15000 17500
Iterations

Trend, Residual, and Seasonal Plot
Electricity (Wh)
400
200
0
−200
−400
−600
Trend
Residual
Seasonal
2016-01-11 2016-02-11 2016-03-14 2016-04-14 2016-05-15
Time

Base Models

Holt-Winters

Rolling mean/var of H-W prediction Data
Rolling Mean
400
375
350
0
2000
4000
6000
8000
10000
12000
14000
16000
Rolling Variance
3000
2000
1000
0
Date

Holt-Winter Method on Data
Train Data
Test Data
Forecasting Data
Electricity (Wh)
1000
800
600
400
200
0
2016-01-11
2016-02-11
2016-03-14
2016-04-14
2016-05-15
Time

Backwards Selection and Linear Model

ARMA (3,0)

ARMA(3,3)

ARIMA(3,0,0) x (0,3,0,12)

LSTM

Model Summary

Conclusion

Citations

Appendix + Code