KSCHOOL

RISK MANAGEMENT IN IBERIAN SPOT MARKET

TFM.

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ÍNDICE

I INTRODUCTION

Iberian power market has it's own particularity, which if managed properly can lower users invoices. How can this be done?

This particularity consists on predicting properly if the Grid is going to need more or less MWs.

So, bring it on!! Let's help RED ELECTRICA and it's agents to predict grid imbalances.

First of all, let's explain with a little rigor our issue here. If generators or consumers help RED ELECTRICA to maintain 50 Hz on the Iberian Grid, they won't be economically penalized, consequently neither their customers.

More in depth, when RED ELECTRICA needs more electricity on the grid, it will charge an extra to all those agents who are giving less than the said they would. On the other hand, those who give more electricity than forecasted won't have an extra cost. This just happens in Iberian Market. In other countries their System Operator will charge extra to all of the agents who deviate on their generation even if they are helping the grid to maintain it's balance.

Then, let's use Machine Learning and improve system balance forecasts!!

II DATA

All of the data used in our study will be obtained from:

https://www.esios.ree.es/es

Luckily RED ELECTRICA gives tons of public information about the Iberian grid and it's performance. This data is given on .json files and it can be easily downloaded through API's as we will see on our study. Data acquisition and preparation will be in our library esios.py.

From all over the 1652 public variables in RED ELECTRICA, choosing the following give us a good shot to forecast our output variable ('762' Net Energy Deviation).

Inputs:

'541' Iberian wind forecast.	'10010' wind 48 program.
'460' Daily Iberian load forecast.	'10034' solar 48 program.
'600' Spot price.	'10027' Load 48 program.
'39' Nuclear Generation forecast.	'10249' Residual Load forecast.
'82' Wind on land farms.	
'84' Photovoltaic Generation forecast.	
'85' Solar Thermal Generation forecast.	
'74' Nuclear daily program.	

RED ELECTRICA'S web page is very helpful for new curious people keen on continuing our present study and adding new variables.

III METHODOLOGY

Programming Language: Python for the whole of our project.

Data requests and brief description on RED ELECTRICAS public data regarding Iberian spot market.

Libraries used:

- Pandas
- Numpy
- Requests
- Datetime
- Json
- Esios (own made)

Modeling.

Libraries used:

- Numpy
- Sklearn

1 K NEAREST NEIGHBORS

In pattern recognition, the k-nearest neighbors algorithm (k-NN) is a non-parametric method used for classification and regression.[1] In both cases, the input consists of the k closest training examples in the feature space. The output depends on whether k-NN is used for classification or regression. *(Wikipedia)*

2 RANDOM FOREST

Ensemble learning method for classification, regression and other tasks that operates by constructing a multitude of decision trees at training time and outputting the class that is the mode of the classes (classification) or mean prediction (regression) of the individual trees. Random decision forests correct for decision trees' habit of overfitting to their training set. *(Wikipedia)*

3 GRADIENT BOOSTING

Is a machine learning technique for regression and classification problems, which produces a prediction model in the form of an ensemble of weak prediction models, typically decision trees. It builds the model in a stage-wise fashion like other boosting methods do, and it generalizes them by allowing optimization of an arbitrary differentiable loss function.

(Wikipedia)

Results obtained through this algorithm: accuracy 0.64

1. **Visualization.**

Libraries used:

- Ggplot2
- Seaborn

IV CONCLUSIONS

Power Grid is very difficult to predict but with the correct tools and input variables we have a good opportunity.

As it appears in our results Gradient Boosting happens to be the best of our regressions by having an accuracy of around 0.62, followed by Random Forest 0.58 and finally K-Neighbors 0.42.

The aim of our study has been reached. Net balance energy can be forecasted over 50%. So well used, this can be used to predict were the Iberian grid is going to need more or less electricity. Adding this to day to day increasingly manageable renewable energies the day of tomorrow electricity bills can be lowered down.

V MANUAL FRONTED

In first place ask for your personal token to download your data from RED ELECTRICA at https://api.esios.ree.es. Type it on lines 23 and 156 of esios.py library for correct running of the esios.py library.

Then type your working directory in inbox [4] of TFM.typinb , esios.py has to be saved in this same directory.

Most of the data given in public RED ELECTRICA comes in different time periods (hours, weeks, months and years) so you have to be careful, as it's seen in our data requests, working with dates is always funny.

Due temporal series are quite volatile and changeable. It's important to choose a sensible period close to the date you want to predict. Choose dates and indicators you want to use in inbox [25] TFM.typinb.

'ini' and 'fin'.

```
ini, fin = '20180801', '20181025'
```

Thanks for reading!