ELECTRIC MOBILITY IN THE ENERGY FRAMEWORK: EVALUATING THE PREDICTABILITY OF FUTURE ENERGY CONSUMPTION.

Models for charging points in the Netherlands.

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Introduction

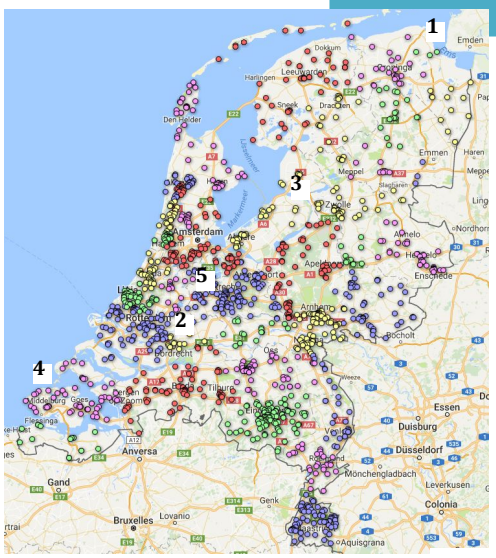
The transport sector is the main factor responsible for air pollution in European cities. Electromobility and renewable sources of energy are technologies with significant potential to solve this issue.

In this work, we undertake an analysis of electric mobility, in order to evaluate the predictability of future energy consumption. Our case study has focused on the Netherlands, which was chosen as it is one of the European countries with the greatest developments in electric mobility in the past years.

The Netherlands
- **High development in electric mobility**
- **Collaboration with Dutch company**

Dataset analysis
- **Studying the users behaviour**
- **Find relevant variables for prediction methods**

Models
Implementing classification methods to predict the trend of electrical energy consumption

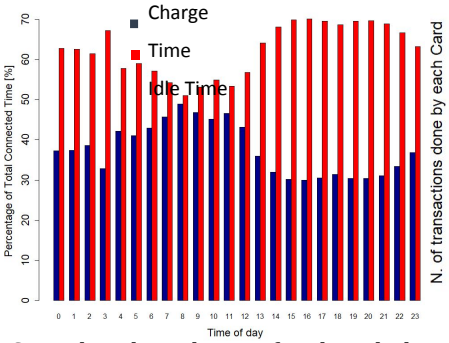


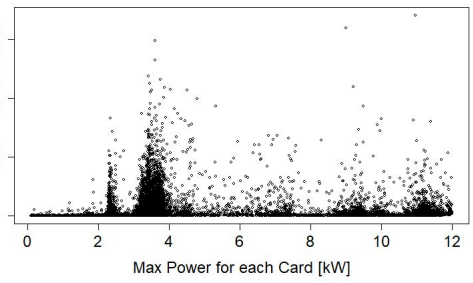
Research Goals:

Scientific literature has focused widely on the electric mobility in recent year. In particular, researches can be found about vehicle energy consumption based on external condition, with data simulation, on the optimum position of the charging points or on the energy consumption forecasting at a single charging point level.

Our research focused on a big dataset that is not so common as electric mobility is a young technology. Then classification methods were applied considering the charging points at an aggregated level that wasn't considered in previous studies.

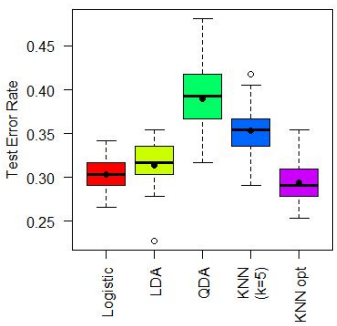
We first analysed the data recorded in the dataset by Elaad, it included an overview of historic transactions from January 2012 until March 2016. The dataset contained detailed information of more than one million charging sessions that took place at 1,747 charging points scattered in the Netherlands.

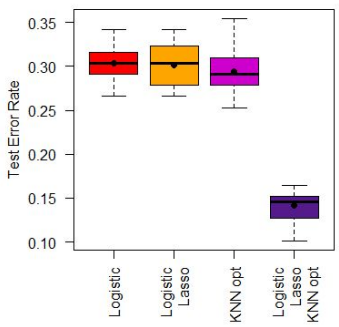


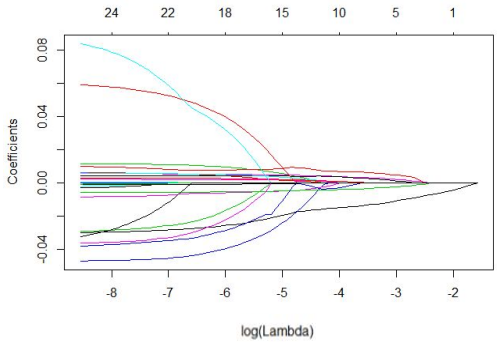


We focused on predicting the energy consumption trend. We considered data from January 2014 to March 2016 because there was at least one transaction recorded for each day. We calculated 25 variables for each day recorded and we used them to predict the trend of the energy consumption for the next day.

Considered predictors for the whole region were: total energy consumed, total charge and idle time in the previous 7 days; total users and transactions done in the previous 2 days. The classification methods used those predictors to return a 1 if it predicted an increase or a 0 for a decrease in the energy consumption of the next day. Then we compared results among the different methods and tried to improve performance with shrinkage methods.







- **Predictability strongly depends on the region**
- **Models fit very differently** on each region
- **Best results** came **from smallest and biggest regions**
- **Different improvements** through **shrinkage method**

Future Developments

- Introduce multi-class classification
- Hourly level analysis