Study of correlations among smart mobility and smart environment

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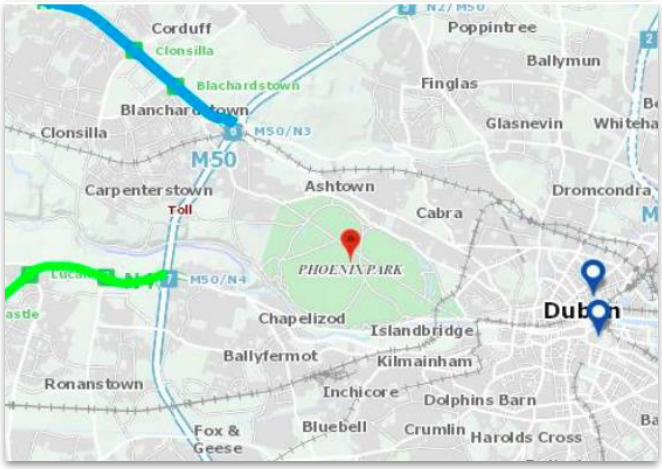
Abstract

By using the City of Dublin as a case study, data on weather conditions, traffic flow and emissions of air pollutants were collected and analyzed in order to detect any interactions/interrelationships between them and finally interpret them with a regression model.

1. Data

Hourly values between 1/1/2011 and 31/12/2011:

- Traffic flow on M3 (highlighted with blue) and M4 (highlighted with green) motorways
- Mean sea level pressure, precipitation amount, temperature, relative humidity (red pin)
- Emissions of CO_2, NO, NO_2, SO_2 (blue pins)



2. Methodology

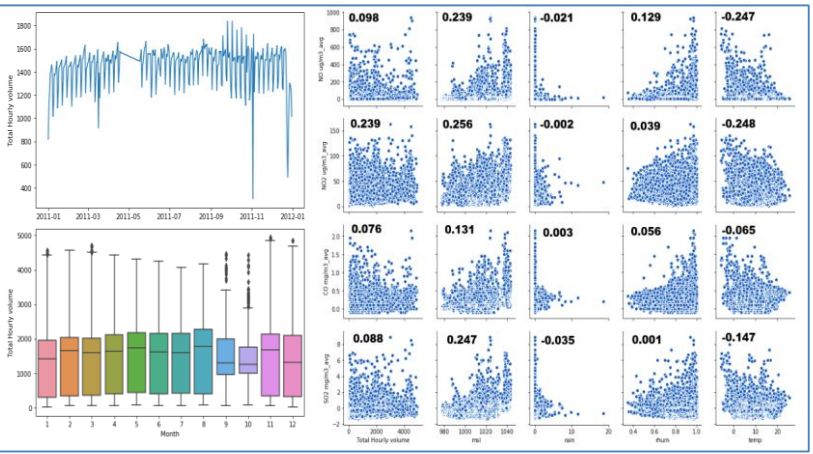
Usage of Python libraries:

NumPy and Pandas for the data cleansing

- Matplotlib and Seaborn for the visualizations
- Scikit-learn for fitting the regression model

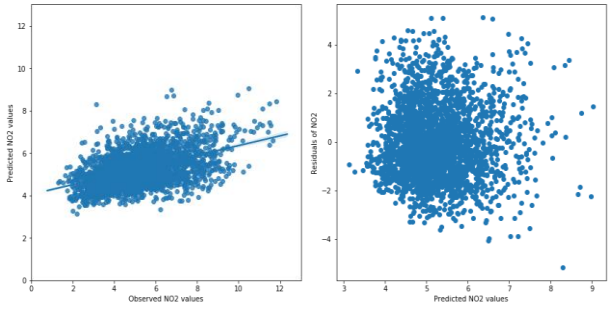
3. Exploratory data analysis

- Calculation of sample statistic measures in order to make a first interpretation of the results
- Representation of the time variation of variables over the course of the year for the discovery of motives
- Usage of boxplot in the grouped observations per day and month in order to compare distributions
- Calculation of correlations between variables



4. Multiple linear regression model

- Normalization of the dependent variable by calculating the square root of its values
- Model equation:
  $y = 0.0006\ x_1 + 0.1025\ x_2 + 0.034\ x_3 + 0.1231\ x_4 - 0.0945\ x_5 - 29.3338$
- Evaluating the model by plotting the fitted values by the observed values and by calculating the R-squared coefficient



5. Conclusion

The present study's findings can lead to valuable and useful conclusions about the interaction between the dimensions of smart mobility and intelligent environment, and consequently help decision-makers (local authorities, industries, researchers) to adopt modern techniques for identifying existing urban environmental problems and promoting suitable development plans and financial tools to effectively tackle them.