GIS meets energy

Bachelors's Thesis of

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I declare that I have developed and written the enclosed thesis completely by myself, and have not used sources or means without declaration in the text.

PLACE, DATE

. . . .

(Marcel Herm)

Abstract

As the share of electricity from regenerative sources is growing constantly, the weather becomes an increasingly important factor in the analysis of electricity markets. Hence, this thesis uses local weather data to predict electricity spot prices. More precisely, we include wind speed and temperature from individual German weather stations into time series and statistical learning models. However, as the available weather information is vast and renewable power is not generated everywhere, we use random forests and Bayesian structural time series to perform a feature selection. Overall, we manage to improve our forecasting accuracy of the EPEX electricity prices by up to 7.69 % in terms of root mean squared error and up to 8.19 % in terms of mean absolute error.

Contents

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1. Introduction

Your thesis should start with an introduction. The introduction is supposed to motivate your thesis. Discuss the relevance of your topic, why are you looking into it, why is it relevant in the field? Cite important research related to your motivation. Briefly state the problem as in the abstract and repeat the contribution, for example in the form of research questions.

Give an outline of your thesis.

Below, you will find an example figure (Figure 1.1). Please use the caption of your figures to describe everything in the figure, additionally to what you have written about the figure in the text. Everyone should be able to understand the figure just reading its caption.
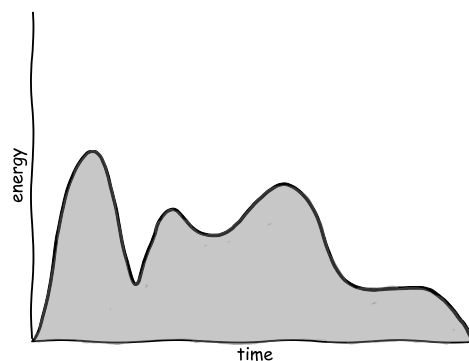
Figure 1.1. This is an example figure. It shows a fictional demand of energy (in grey) over time.

2. Related Work

This chapter is supposed to summarise previous work of other researchers related to your topic. The aim is to give an overview of existing literature while highlighting differences and similarities to this thesis.

Please choose a coherent citation style throughout the thesis. For example

- Direct citation of results, an approach or similar

- Indirect citation

  Recent research highlights the importance of this method

- Direct citation

  "*Energy optimisation in buildings is important*"

3. Methodology

Using weather data from ECMWF Copernicus Climate Change Service (C3S).

Using load data from `https://data.open-power-system-data.org/`.

First downloaded whole Datasets from 2006-2019, but as the load for germany is properly available since 2015, now reduced dataset to 2015-2019.

Also checked for non-existing values, only 2 last timestamps values for the load are missing.

3.1. Method 1

Maybe use Random Forests for variable selection as in Nicoles paper? (Ludwig et al. 2015)

You can also use equation numbering if you need to refer to an equation later e. g. Equation (3.1).

$$a^2 + b^2 = c^2 \tag{3.1}$$

Additionally, simple equations can be put inline with the text, for example, $x \in X$. Remember to set all variables in math font i. e. all x, i and so on.

3.2. Method 2

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4. Evaluation

4.1. Data

Describe the data set you are using. Use appropriate visualization (e. g. graphs, statistical summaries etc.) to help the reader get to know your data set.

Table 4.1 is an example table. Remember to use full sentences in your caption and explain everything one can see in the table there as well. You can of course also use a simpler format for your table.

Table 4.1. Example table with rotated table heads to save space and two different row colours to ease the readability.

Header 1	Header 2	Header 3
entry 1	entry 2	entry 3
entry 1	entry 2	entry 3
entry 1	entry 2	entry 3

4.2. Results

Describe the results you have obtained using your methods described above. Again use proper visualization methods.

4.2.1. Experiment 1

…

4.2.2. Experiment 2

…

5. Discussion

This chapter is supposed to discuss your results. Point out what your results mean. What are the limitations of your approach, managerial implications or future impact? Explain the broader picture but be critical with your methods.

6. Conclusion

Repeat the problem and its relevance, as well as the contribution (plus quantitative results).

Look back at what you have written in the introduction.

Provide an outlook for further research steps.

Bibliography

Ludwig, N., S. Feuerriegel, and D. Neumann (2015). *Putting Big Data analytics to work: Feature selection for forecasting electricity prices using the LASSO and random forests.* In: *Journal of Decision Systems*, Vol. 24, No. 1, pp. 19–36.

A. Appendix

A.1. First Section

Figure A.1. A figure

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