CAPSTONE PROJECT BY TEAM D

A DATA SCIENCE APPROACH TO FORECASTING ELECTRICITY DEMAND IN NSW, AUSTRALIA

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Acknowledgements

All thanks must go to our families and university professors who have guided us through this Capstone Project. Without them this would not be possible.

15/06/2021.

Abstract

Forecasting electricity demand is an important requirement as there are now more interested stakeholders associated with the generation and distribution of this service. Traditionally electricity demand was just the concern of governments. However, this has now been extended to market bodies and owners and operators of the underlying infrastructure required for this service. This study aims to demonstrate how neural network (specifically LSTM neural networks) can be used to accurately forecast short-term energy demand. The focus will be on attributes such as temperature, month of the year, day of the week and time of the day as well as how past time lags can be used to predict future demand values. It is envisaged that the results of this study will provide useful insights for governments and market bodies to assist in the rules, policies and pricing that are invoked on the energy sector. Additionally, the businesses operating in this sector can use this information to guide their decision-making regarding electricity generation and distribution, as well as for the purpose of price benchmarking.

Contents

Chapter 1

Introduction

This R Markdown template can be used for the ZZSC9020 course report. You can incorporate R [1] chunks and Python chunks that will be run on the fly. You can incorporate LaTeX commands.

Before submitting the last version of your report, you might want to use https://overleaf.com to collaborate with other members of your team directly on the LaTeX version of this document (which is a byproduct you get when you Knit it from studio).

We suggest you organise your report using the following chapters but, depending on your own project, nothing prevents you to have a different organisation.

Chapter 2

Literature Review

Here are a few references that can be useful: [2] and [3]. See also https://bookdown.org/yihui/rmarkdown-cookbook/

In order to incorporate your own references in this report, we strongly advise you use BibTeX. Your references then needs to be recorded in the file `references.bib`.

Chapter 3

Material and Methods

3.1 Software

R and Python of course are great software for Data Science. Sometimes, you might want to use `bash` utilities such as `awk` or `sed`.

Of course, to ensure reproducibility, you should use something like `Git` and RMarkdown (or a Jupyter Notebook). Do **not** use Word!

3.2 Description of the Data

How are the data stored? What are the sizes of the data files? How many files? etc.

3.3 Pre-processing Steps

What did you have to do to transform the data so that they become useable?

3.4 Data Cleaning

How did you deal with missing data? etc.

3.5 Assumptions

What assumptions are you making on the data?

3.6 Modelling Methods

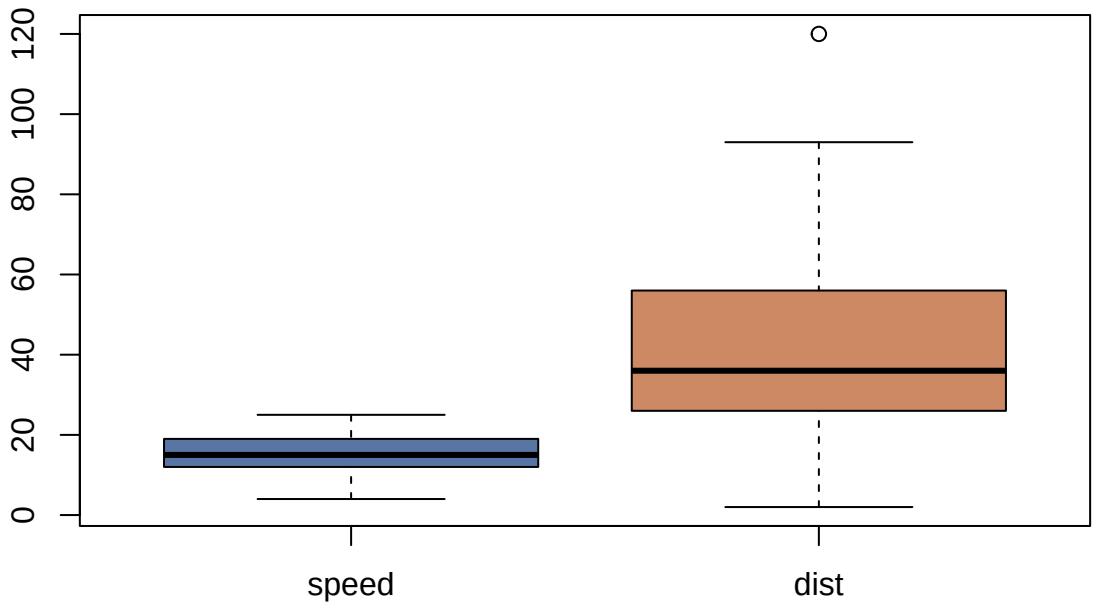
Chapter 4

Exploratory Data Analysis

This is where you explore your data using histograms, scatterplots, boxplots, numerical summaries, etc.

4.1 Using R

```
boxplot(cars, col = c("#5975a4", "#cc8963"))
```



4.2 Using Python

See https://cran.r-project.org/web/packages/reticulate/vignettes/r_markdown.html for more details.

You need to install the R package `reticulate`.

```
print("Python can be used with MATHxxxx!")
```

```
## Python can be used with MATHxxxx!
```

```
import sys
print(sys.version)
```

```
## 3.6.12 |Anaconda, Inc.| (default, Sep  9 2020, 00:29:25) [MSC v.1916 64 bit
```

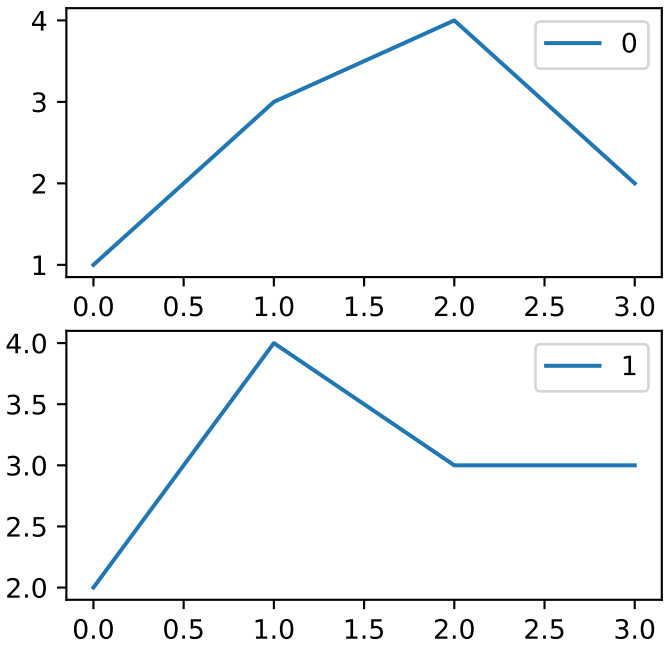
```
import numpy as np
np.random.seed(1)
np.random.normal(0.0, 1.0, size=10)
```

```
## array([ 1.62434536, -0.61175641, -0.52817175, -1.07296862,  0.86540763,
##        -2.3015387 ,  1.74481176, -0.7612069 ,  0.3190391 , -0.24937038])
```

```
import pandas as pd
import matplotlib.pyplot as plt
df=pd.DataFrame([[1, 2], [3, 4], [4, 3], [2, 3]])
fig = plt.figure(figsize=(4, 4))
for i in df.columns:
    ax=plt.subplot(2,1,i+1)
    df[[i]].plot(ax=ax)
    print(i)
```

```
## <AxesSubplot:>
## 0
## <AxesSubplot:>
## 1
```

```
plt.show()
```



Chapter 5

Analysis and Results

5.1 A First Model

Having a very simple model is always good so that you can benchmark any result you would obtain with a more elaborate model.

For example, one can use the linear regression model

$$Y_i = \beta_0 + \beta_1 x_{1i} + \cdots \beta_p x_{pi} + \epsilon_i, \qquad i = 1, \ldots, n.$$

where it is assumed that the ϵ_i's are i.i.d. $N(0, 1)$.

Chapter 6

Discussion

Put the results you got in the previous chapter in perspective with respect to the problem studied.

Chapter 7

Conclusion and Further Issues

What are the main conclusions? What are your recommendations for the "client"? What further analysis could be done in the future?

A figure:

Figure 7.1: A caption

In the text, see Figure 7.1.

References

[1] R Core Team, R: A Language and Environment for Statistical Computing, R Foundation for Statistical Computing, Vienna, Austria (2017).
URL https://www.R-project.org/

[2] Y. Xie, J. Allaire, G. Grolemund, R Markdown, The Definitive Guide, Chapman and Hall/CRC, 2018.
URL https://bookdown.org/yihui/rmarkdown/

[3] P. Lafaye de Micheaux, R. Drouilhet, B. Liquet, The R Software: Fundamentals of Programming and Statistical Analysis, Statistics and Computing, Springer New York, 2013.
URL https://books.google.fr/books?id=Ji-8BAAAQBAJ

Appendix

Codes

Add you codes here.

Tables

If you have tables, you can add them here.

Use https://www.tablesgenerator.com/markdown_tables to crete very simple markdown tables, otherwise use LaTeX.

Tables	Are	Cool
col 1 is	left-aligned	$1600
col 2 is	centered	$12
col 3 is	right-aligned	$1