

Automating Visual Analysis for Time Series Data

Zhaoming Su

Bachelor of Science (Honours)

A dissertation submitted in partial fulfilment of the requirements

for the degree of

Bachelor of Science (Honours),

The University of Auckland, 2021.

Contents

Co	opyright notice	V
Αl	bstract	vii
Ad	cknowledgements	ix
Pr	reface	хi
1	Introduction	1
	1.1 Rmarkdown	1
	1.2 Data	1
	1.3 Figures	1
	1.4 Results from analyses	1
	1.5 Tables	1
2	Literature Review	3
	2.1 Exponential smoothing	4
A	Additional stuff	5
Bi	ibliography	7

Copyright notice

(Choose one of the following notices.)

(Notice 1)

© Zhaoming Su (2021).

The second notice certifies the appropriate use of any third-party material in the thesis. Students choosing to deposit their thesis into the restricted access section of the repository are not required to complete Notice 2.

(Notice 2)

© Zhaoming Su (2021).

I certify that I have made all reasonable efforts to secure copyright permissions for thirdparty content included in this thesis and have not knowingly added copyright content to my work without the owner's permission.

Abstract

The abstract should outline the main approach and findings of the thesis and must not be more than 500 words.

Acknowledgements

I would like to thank my pet goldfish for ...

Preface

The material in Chapter 1 has been submitted to the journal *Journal of Impossible Results* for possible publication.

The contribution in Chapter 2 of this thesis was presented in the International Symposium on Nonsense held in Dublin, Ireland, in July 2015.

Chapter 1

Introduction

Placeholder

- 1.1 Rmarkdown
- 1.2 Data
- 1.3 Figures
- 1.4 Results from analyses
- 1.5 Tables

Chapter 2

Literature Review

This chapter contains a summary of the context in which your research is set.

Imagine you are writing for your fellow PhD students. Topics that are well-known to them do not have to be included here. But things that they may not know about should be included.

Resist the temptation to discuss everything you've read in the last few years. And you are not writing a textbook either. This chapter is meant to provide the background necessary to understand the material in subsequent chapters. Stick to that.

You will need to organize the literature review around themes, and within each theme provide a story explaining the development of ideas to date. In each theme, you should get to the point where your ideas will fit in. But leave your ideas to later chapters. This way it is clear what has been done beforehand, and what new contributions you are making to the research field.

All citations should be done using markdown notation as shown below. This way, your bibliography will be compiled automatically and correctly.

2.1 Exponential smoothing

Exponential smoothing was originally developed in the late 1950s (Brown, 1959, 1963; Holt, 1957; Winters, 1960). Because of their computational simplicity and interpretability, they became widely used in practice.

Empirical studies by Makridakis and Hibon (1979) and Makridakis et al. (1982) found little difference in forecast accuracy between exponential smoothing and ARIMA models. This made the family of exponential smoothing procedures an attractive proposition (see Chatfield et al., 2001).

The methods were less popular in academic circles until Ord, Koehler, and Snyder (1997) introduced a state space formulation of some of the methods, which was extended in Hyndman et al. (2002) to cover the full range of exponential smoothing methods.

Appendix A

Additional stuff

You might put some computer output here, or maybe additional tables.

Note that line 5 must appear before your first appendix. But other appendices can just start like any other chapter.

Bibliography

- Brown, RG (1959). Statistical forecasting for inventory control. McGraw-Hill, New York.
- Brown, RG (1963). *Smoothing, forecasting and prediction of discrete time series*. Englewood Cliffs, New Jersey: Prentice Hall.
- Chatfield, C, AB Koehler, JK Ord, and RD Snyder (2001). A new look at models for exponential smoothing. *The Statistician* **50**, 147–159.
- Holt, CE (1957). Forecasting trends and seasonals by exponentially weighted averages. O.N.R. Memorandum 52/1957. Carnegie Institute of Technology.
- Hyndman, RJ, AB Koehler, RD Snyder, and S Grose (2002). A state space framework for automatic forecasting using exponential smoothing methods. *International Journal of Forecasting* **18**(3), 439–454.
- Makridakis, S, A Anderson, R Carbone, R Fildes, M Hibon, RLJ Newton, E Parzen, and R Winkler (1982). The accuracy of extrapolation (time series) methods: results of a forecasting competition. *Journal of Forecasting* **1**, 111–153.
- Makridakis, S and M Hibon (1979). Accuracy of forecasting: an empirical investigation (with discussion). *Journal of Royal Statistical Society (A)* **142**, 97–145.
- Ord, JK, AB Koehler, and RD Snyder (1997). Estimation and prediction for a class of dynamic nonlinear statistical models. *Journal of American Statistical Association* **92**, 1621–1629.
- Winters, PR (1960). Forecasting sales by exponentially weighted moving averages. *Management Science* **6**, 324–342.