Multimodal Deep Learning

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Preface

FIGURE 1: Creative Commons License

This book is licensed under the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License[1].

[1] http://creativecommons.org/licenses/by-nc-sa/4.0/

Foreword

Author: Christoph Molnar

This book is the result of an experiment in university teaching. Each semester, students of the Statistics Master can choose from a selection of seminar topics. Usually, every student in the seminar chooses a scientific paper, gives a talk about the paper and summarizes it in the form of a seminar paper. The supervisors help the students, they listen to the talks, read the seminar papers, grade the work and then ... hide the seminar papers away in (digital) drawers. This seemed wasteful to us, given the huge amount of effort the students usually invest in seminars. An idea was born: Why not create a book with a website as the outcome of the seminar? Something that will last at least a few years after the end of the semester. In the summer term 2019, some Statistics Master students signed up for our seminar entitled "Limitations of Interpretable Machine Learning". When they came to the kick-off meeting, they had no idea that they would write a book by the end of the semester.

We were bound by the examination rules for conducting the seminar, but otherwise we could deviate from the traditional format. We deviated in several ways:

1. Each student project is part of a book, and not an isolated seminar paper.
2. We gave challenges to the students, instead of papers. The challenge was to investigate a specific limitation of interpretable machine learning methods.
3. We designed the work to live beyond the seminar.
4. We emphasized collaboration. Students wrote some chapters in teams and reviewed each others texts.

Technical Setup

The book chapters are written in the Markdown language. The simulations, data examples and visualizations were created with R (R Core Team, 2018). To

combine R-code and Markdown, we used rmarkdown. The book was compiled with the bookdown package. We collaborated using git and github. For details, head over to the book's repository[2].

[2] https://github.com/slds-lmu/seminar_multimodal_dl

1

Introduction

Author:

Supervisor:

1.1 Intro About the Seminar Topic

1.2 Outline of the Booklet

2

Introducing the modalities

Author:

Supervisor:

3

title

Author:

Supervisor:

4

title

Author:

Supervisor:

5

title

Author:

Supervisor:

6

Chapter 1

Authors: Author 1, Author 2

Supervisor: Supervisor

6.1 Lorem Ipsum

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R Core Team (2018)

6.2 Using Figures

Referencing can be done by using the chunk label e.g. `\@ref(fig:ch01-figure01)` for 6.1.

NOTE!!! Do not use underscores in chunk labels! This will crash the compilation ...

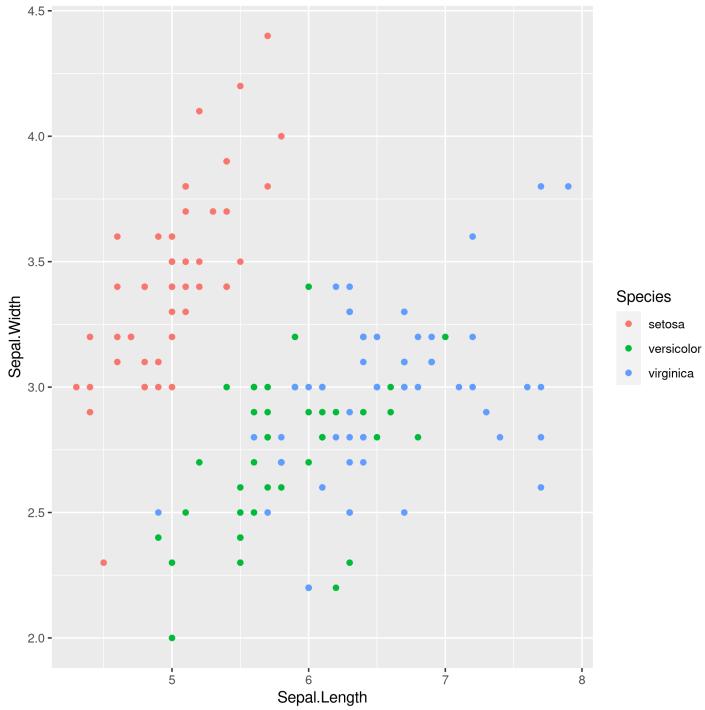

FIGURE 6.1: This is the caption of the figure!

6.3 Using Tex

HTML rendering uses MathJax while pdf rendering uses LaTeX:

$$f(x) = x^2$$

6.4 Using Stored Results

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	2.1713	0.2798	7.760	0.0000
Sepal.Width	0.4959	0.0861	5.761	0.0000
Petal.Length	0.8292	0.0685	12.101	0.0000
Petal.Width	-0.3152	0.1512	-2.084	0.0389
Speciesversicolor	-0.7236	0.2402	-3.013	0.0031
Speciesvirginica	-1.0235	0.3337	-3.067	0.0026

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Supervisor:

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Author:

Supervisor:

12

title

Author:

Supervisor:

13

Chapter 2

Authors: Author 1, Author 2

Supervisor: Supervisor

13.1 Lorem Ipsum

Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eirmod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua. At vero eos et accusam et justo duo dolores et ea rebum. Stet clita kasd gubergren, no sea takimata sanctus est Lorem ipsum dolor sit amet. Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eirmod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua. At vero eos et accusam et justo duo dolores et ea rebum. Stet clita kasd gubergren, no sea takimata sanctus est Lorem ipsum dolor sit amet.

R Core Team (2018)

14

title

Author:

Supervisor:

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title

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Supervisor:

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Epilogue

Author:

16.1 test

17

Acknowledgements

The most important contributions are from the students themselves. The success of such projects highly depends on the students. And this book is a success, so thanks a lot to all the authors! The other important role is the supervisor. Thanks to all the supervisors who participated! Special thanks to Christian Heumann[1] and Bernd Bischl[2] who enabled us to conduct the seminar in such an experimental way, supported us and gave valuable feedback for the seminar structure. Thanks a lot as well to the entire Department of Statistics[3] and the LMU Munich[4] for the infrastructure.

The authors of this work take full responsibilities for its content.

[1] https://www.misoda.statistik.uni-muenchen.de/personen/professoren/heumann/index.html

[2] https://www.statistik.uni-muenchen.de/personen/professoren/bischl/index.html

[3] https://www.statistik.uni-muenchen.de/

[4] http://www.en.uni-muenchen.de/index.html

Bibliography

R Core Team (2018). *R: A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing, Vienna, Austria.