

Bachelor-/Master Thesis

This is the Title

**The Original Template of Prof. Dr.
Lenze was Slightly Adjusted**

Two-line subtitle
if available

At the Department of Computer Science
of the University of Applied Sciences and
Arts Dortmund

Course of study: Computer Science
Specialization: Practical Computer Science
Bachelor-/Master Thesis
for the acquisition of the degree of
Bachelor/Master of Science

by

Fredi Student

Date of Birth: xxxx-xx-xx

Matr.-No. xxx xxxx

Supervisor: Prof. Dr. Burkhard Lenze

Second Supervisor: Prof. Dr. Burkhard Lenze

Dortmund, November 13, 2024

Overview

Note: In order to compile this template without errors, the compilation settings must be adjusted for different LaTeX editors (TeXmaker, TeXstudio, etc.). Biber must be selected as the default bibliography programme instead of BibTeX.

Note: This template is a work in progress. If you have any questions or comments, please contact louise.bloch@fh-dortmund.de.

Abstract

This should be an abstract of about half a page. The purpose of the abstract is to give the reader a compact overview of the entire thesis. It usually contains a compact presentation of the motivation, the research question, the methods used and the main results. The abstract must be understandable to the reader without knowledge of the rest of the thesis. It must not contain any information that goes beyond the content of the thesis. The abstract does not contain references. As a rule, you should write the abstract after you have completed the thesis. The aim is to provide a clear and focused summary of your work. This often takes several iterations.

Abstract

Hier findet eine deutsche Übersetzung des englischen „Abstract“ statt.

Contents

1	Introduction	1
1.1	Motivation	1
1.2	Objective	2
1.3	Structure of the thesis	2
2	State of the art	3
2.1	Citation	3
2.1.1	Literal quotations	4
3	Methods	5
3.1	Formulas	5
3.2	Figures	6
3.3	Algorithms and Pseudocode	7
3.4	Tables	7
4	Design	9
4.1	Design details	9
5	Implementation	10
5.1	Software Bill of Material	10
5.2	The choice of programming language	11
5.3	Specific implementation details	11
6	Evaluation	12
7	Summary and Outlook	13
A	Diagrams and Tables	14
B	UML diagrams	15
	Bibliography	15
	Declaration of Independence	18

Chapter 1

Introduction

IMPORTANT NOTE: Everything in this **draft** concerning the aspect of **scientific work** in the preparation of a Bachelor's/Master's thesis is absolutely **binding** and must be taken into account without exception! Everything in this **draft** concerning the **layout** of a Bachelor's/Master's thesis reflects the **personal** opinion of the authors! Every student can develop their own ideas! You can find some helpful pointers here.

Now for the introduction. What should it contain, among other things?

- Explanation of the problem
- Motivation for addressing the problem
- Reference to any existing related works
- Distinction of your thesis from any existing works
- Brief summary of the resulting objectives of the thesis
- Brief outline of the structure of the thesis

1.1 Motivation

This section introduces and motivates the problem investigated in the thesis.

1.2 Objective

The reader should be given a precise description of the objective of the work in a few sentences, so that he or she can critically evaluate the author's following statements in terms of goal-oriented work and goal achievement.

1.3 Structure of the thesis

At the end of the introductory chapter, you should describe the structure of the thesis. It is useful to explain the main content of each chapter. You should reference each chapter. Make sure you always state the type of reference. For example: Chapter 2 explains how to summa-rise the state of the art in a clear and structured way. Where appropriate, particularly relevant sub-chapters may also be referenced. Make sure that the term „sections“ is used from the subchapter level onwards. The term „subsection“ should not be used as this would disrupt the flow of the text.

Chapter 2

State of the art

If necessary, a more detailed classification of the thesis in the context of current research can be made here. This is particularly necessary for Master's theses. A clear distinction is usually made between the thesis and existing research and developments in related research areas. For the sake of clarity, it is often useful to prepare a table summarising the research results described in this section. This can be used to summarise the main content and findings of previous research.

2.1 Citation

Important in this and all subsequent chapters: **Cite your sources!!!** Whenever something is taken literally or analogously from a book, a publication, a lecture or a website, this **must** be indicated by stating the source in the text (e.g., vgl. Lenz (2000), S. 23ff) and the complete source in the bibliography! It is absolutely not permitted to copy longer passages **verbatim, almost verbatim or analogously** from another document without citing this precisely, even if the reference is given in the bibliography (plagiarism, failed, no repetition possible). As part of the declaration at the end of the Bachelor's/Master's thesis, the student pledges to have complied with this fundamental obligation in the context of academic work, to have cited all sources and to have indicated quotations. Bloch et al. (2023), Bloch et al. (2023)

Remember that if you do not cite correctly, you are responsible for other people's (possibly incorrect) statements. If you cite the basis on which you have made

your statements, you show that you have worked to the best of your knowledge. On the other hand, if you do not cite other people's statements and pass them off as your own, you may be held responsible for other people's mistakes.

Also remember that citations help you. In science, claims are usually supported by experiments or studies. You can therefore avoid doing your own research by building on the results of other scientists. You should thank the authors by citing them.

If there is a prevalence of correctly quoted, but more or less literally copied passages in a paper, this is not plagiarism in the strict sense, but it is also not proof of independent scientific and practical work as required by the examination regulations (failed, retake possible).

Sources can be cited in the document as a reference Autor (Jahr) or as a footnote¹. It is only important that one of the two types is used consistently throughout the document.

This is a citation with two authors Chui and Li (1992) and this with more than two authors Leshno et al. (1993).

Remember that when citing book sources, a page number must always be given.

2.1.1 Literal quotations

If a passage is taken verbatim from another source, it must be placed in quotation marks and accompanied by precise details of the source, including page references. It is also a good idea to italicise the quoted passage to make it stand out from your own statements. Here's an example: „It's like this: at the start of the project, you know very little about the development effort and time required. As the project progresses, however, the degree of accuracy increases until you know everything at the end of the project, because then everything has happened.“Kupper (2001)

¹Autor (Jahr)

Chapter 3

Methods

In this section, describe relevant techniques or methods. Focus on essential basics that will help the reader understand your working method, design choices, or implementation described later.

3.1 Formulas

These sections deal with the basics of the problem to be solved. Formulas can be used here. Example of a formula:

$$a^2 + b^2 = c^2 \quad (3.1)$$

shows the relationship between the side lengths of a right triangle. Again, remember to specify the type of reference (in this case, Formula). The first reference should be as close as possible to the formula being used. Also, the order of the formulas should be maintained for the reference. If possible, do not reference Formula 5 before referencing Formula 4. You should also explain any variables used in the formula. Example: In Formula 3.1 the variables a and b die Seitenlänge der beiden Katheten dar. represent the side lengths of the two legs. The variable c is the length of the hypotenuse

3.2 Figures

Figures (see Figure 3.1) can also be useful and can be integrated as well. They are used to visually illustrate process-es, results, or procedures. Overall, make sure to include them in high quality (for print quality \geq DPI if possible). Avoid using the jpg format except for photos, as artifacts can occur. For graphs and other figures that may contain text, use vector formats (svg, pdf, emf, ...) if possi-ble. Scale the width and height of images equally, otherwise distortion will occur. For color images, check that they are still visible on a black-and-white printer. Make sure that the same types of figures (e.g. box plots, scatter plots, bar charts, ...) are displayed as uniformly as possible. If possible, use colors only to support information, and use legends to clarify the meaning of colors. Also, use meaningful axis labels, including units. For accessibility rea-sons, do not use red-green or white labels in colored boxes.

Each embedded figure also requires a caption (**below** the figure), which must be meaningful and self-explanatory. The reader should be able to extract all the information from the image and the caption in order to understand it. Each caption should end with a full stop.

If you have taken the image from an external source, you must also state this in the caption (e.g. [Image source: [Quelle: Lenze (1994)]]) This also applies if you have modified the original graphic or copied it from another source ([e.g. figure based on DeVore et al. (1989)]). The source must be included in the bibliography.

If you use an online source, you must include the URL and the date of access (e.g. [source: <https://www.fh-dortmund.de>, last accessed: 2024-04-17]).

In addition, each image must be referenced in the text, otherwise it is superfluous. The text should begin with a brief description of each image (What can you see in the image?), fol-lowed by an explanation and interpretation (What do you deduce from the image?). The im-ages should be close to the first reference in the text and embedded in the text in the order of their reference.

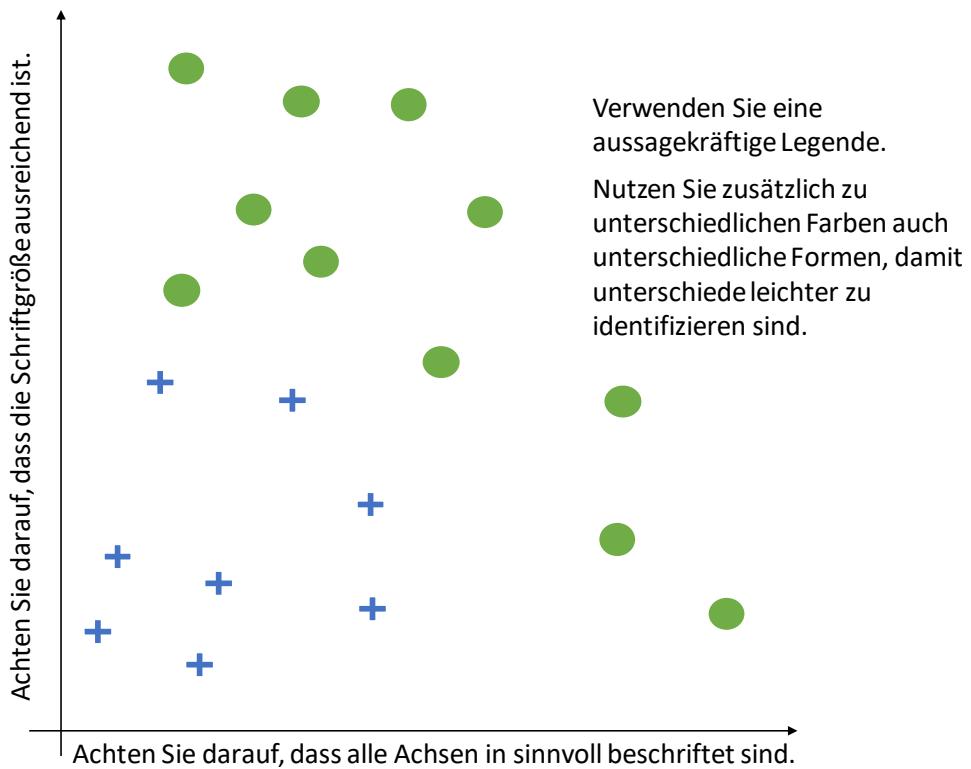


Figure 3.1: Dies ist ein Beispielbild [Quelle: Eigene Erstellung].

3.3 Algorithms and Pseudocode

It can be useful to use pseudocode to explain algorithms. An example of this Pseudocode 3.3.1, where you should also choose a meaningful caption and reference the source code in the text.

3.4 Tables

Some facts can be nicely summarised in a table. Make sure that tables are clear and do not exceed the page margins. Unlike figures, each table needs a heading **above** the table. This must also be meaningful and give all the information needed to understand the table. Each table must be referenced in the text in the order in which it appears. Example: Table 3.1. Make sure that the formatting of the table is consistent. For columns containing only numerical values, right-justification is recommended. Also ensure a consistent number of decimal places (e.g. 3).

Require: $n \geq 0 \vee x \neq 0$

Ensure: $y = x^n$

```

1:  $y \Leftarrow 1$ 
2: if  $n < 0$  then
3:    $X \Leftarrow 1/x$ 
4:    $N \Leftarrow -n$ 
5: else
6:    $X \Leftarrow x$ 
7:    $N \Leftarrow n$ 
8: end if
9: while  $N \neq 0$  do
10:   if  $N$  ist gerade then
11:      $X \Leftarrow X \times X$ 
12:      $N \Leftarrow N/2$ 
13:   else
14:      $y \Leftarrow y \times X$ 
15:      $N \Leftarrow N - 1$ 
16:   end if
17: end while

```

Pseudocode 3.3.1: Calculate $y = x^n$.

Table 3.1: This is a meaningful table heading

Name of Model	Hyper parameters	Accuracy (in %)
Modell A	$\alpha = 0.010$	77.010
Modell B	$\alpha = 0.001$	80.310
Modell C	$\alpha = 0.100$	71.050
Modell D	$\alpha = 0.050$	12.010
Modell E	$\alpha = 0.010$	60.010

Chapter 4

Design

This chapter analyzes and presents the design of the software in detail. Describe important decisions made during the design phase and give reasons for them. What requirements were identified? What requirements were rejected?

4.1 Design details

Classic approach to the design and development of a software application (OOA, OOD, OOP, etc.). In particular, the corresponding diagrams should be included here (or – if too extensive – in the appendix at the latest).

Chapter 5

Implementation

This chapter describes the implementation. Focus on describing and explaining important details and implementation choices.

5.1 Software Bill of Material

The Software Bill of Materials is a list of the software used for the implementation and its licenses. An example is shown in Table 5.1.

Table 5.1: Software used.

Name	License	Purpose	Version	URL ¹
Java	GNU GPL	Programming language	17.0.1	https://www.oracle.com/java/
Apache Tika	Apache 2.0	Java Toolkit	2.6.0	https://tika.apache.org/
Spring Framework	Apache 2.0	Java Framework	2021.0.5	https://spring.io
...				
iText	AGPL 3.0	Java toolkit for editing PDF documents	7.2.4	https://itextpdf.com/

¹ last access: 2023-02-20

5.2 The choice of programming language

Short justification for the choice of programming language. Which development tool did you use and why? Or did you work directly with the JDK? If so, why? No detailed introduction to Java; this is now standard. However: New and special libraries, packages or classes used must be justified and explained.

5.3 Specific implementation details

Selected parts of the source code that are essential for the functionality of the program should be explained in detail here. In addition to demonstrating the general concepts for implementing the mathematical computation in program code, this section also deals with issues such as efficiency, parallelizability, numerical stability, etc. Problems with the implementation and their solutions can also be explained in this chapter.

Chapter 6

Evaluation

The evaluation is usually the main part of your work when writing a machine learning thesis. Show that you have learned how to perform systematic experiments. The chapter contains the results of the developed tool or workflow.

Chapter 7

Summary and Outlook

Once again, it is briefly explained what was actually done in the thesis. The author also states what he or she thinks could have been done differently. This allows you to show that you have looked beyond the scope of the actual problem. A total of 1-2 pages should be sufficient. At the end of this chapter, the bachelor/master thesis should be about 40/80 pages long! Of course, this is only a rough guide, but it should be kept in mind! Better a good 40 pages than a redundant and boring 60 pages.

Appendix A

Diagrams and Tables

One or more appendices can, but do not have to be present. As a rule of thumb, anything that disturbs the flow of reading can be included in an appendix, in particular source code listings (longer than one page), extensive tabular material, etc. The original source code of the programs must also be submitted on a digital storage medium. Executable machine code for various platforms may also be included. The medium should always include a README text file describing exactly how to run the program.

Unlike normal chapters, appendices are not numbered 1, 2, 3, ..., but A, B, C, If there is only one appendix, the numbering A can be omitted.

At the end of the appendix, the length of the Bachelor's/Master's thesis should be about 60/100 pages!

Appendix B

UML diagrams

This is where class diagrams and UML diagrams could be placed

Bibliography

Sources

- Autor, P. (Jahr). Titel des artikels. *Titel der Zeitschrift, Band*, ersteSeite–letzteSeite.
- Bloch, L., Rückert, J., & Friedrich, C. M. (2023a). Preprintresolver: Improving citation quality by resolving published versions of arxiv preprints using literature databases. In O. Alonso, H. Cousijn, G. Silvello, M. Marrero, C. Teixeira Lopes, & S. Marchesin (Eds.), *Linking theory and practice of digital libraries* Zadar, Croatia. Springer Nature Switzerland.
- Bloch, L., Rückert, J., & Friedrich, C. M. (2023b). Preprintresolver: Improving citation quality by resolving published versions of arxiv preprints using literature databases. In O. Alonso, H. Cousijn, G. Silvello, M. Marrero, C. Teixeira Lopes, & S. Marchesin (Eds.), *Linking theory and practice of digital libraries* Cham. Springer Nature Switzerland.
- Chui, C. K., & Li, X. (1992). Approximation by ridge functions and neural networks with one hidden layer. *Journal of Approximation Theory*, 70(2), 131–141. [https://doi.org/http://dx.doi.org/10.1016/0021-9045\(92\)90081-X](https://doi.org/http://dx.doi.org/10.1016/0021-9045(92)90081-X)
- DeVore, R., Howard, R., & Micchelli, C. (1989). Optimal nonlinear approximation. *manuscripta mathematica*, 63(4), 469–478. <https://doi.org/10.1007/BF01171759>
- Kupper, H. (2001). Zur kunst der projektsteuerung. qualifikation und aufgaben eines projektleiters bei dv-anwendungsentwicklung.
- Lenze, B. (1994). Note on a density question for neural networks. *Numerical Funct. Analysis and Optimiz.*, 15, 909–913.

Lenze, B. (2000). *Einführung in die fourier-analysis* (zweite Auflage). Logos Verlag.

Leshno, M., Lin, V. Y., Pinkus, A., & Schocken, S. (1993). *Multilayer feedforward networks with a nonpolynomial activation function can approximate any function* (Vol. 6). Logos Verlag.

Declaration of Independence

I hereby declare that I have written this thesis independently and have not used any outside help or sources other than those indicated. All passages taken literally or by analogy from published or unpublished writings and other sources have been marked as such. This thesis has not previously been submitted in the same or similar form to any examination authority.

Explanation of Tools Used

1. Use of the correction service of the University of Applied Sciences and Arts Dortmund or the Department of Computer Science: Yes No
2. Use of an external (commercial) proofreading service: Yes No
if so, which
3. 3) The following persons have additionally proofread the thesis:
4. Use of language models for texting (e.g. ChatGPT), Yes No
if so, which ones and in which sections:
5. Use of language translation tools (e.g., Google Translator, DeepL), Yes No
if so, which ones and in which sections:
6. Use of language correction software (e.g., Grammarly), Yes No
if so, which ones and in which sections:
7. Use of other tools:

I acknowledge that my thesis may be checked using plagiarism detection software.
I confirm that the above statements have been completed in full and to the best of my knowledge.

Dortmund, November 13, 2024

Author's Signature