Template and Guidelines for Writing a Scientific Paper

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Abstract — *The abstract should concisely summarize the contents of a paper. Since potential readers should be able to make their decision on the personal relevance based on the abstract, the abstract should clearly tell the reader what information he can expect to find in the paper. The most essential issue is the problem statement and the actual contribution of described work. The authors should always keep in mind, that the abstract is the most frequently read part of a paper. It should contain at least 70 and at most 120 words.*

1 INTRODUCTION

This document serves two purposes. First it is a template and example for a scientific paper. Second, the text in the sections contains useful information on structuring and writing your first paper. We recommend to read the following sections carefully in order to avoid common mistakes.

The introduction should consist of three parts (as paragraphs, not to be structured into multiple headings):

The first part deals with the *background* of the work and describes the field of research. It should also elaborate on the *general problem statement* and the *relevance*?

The second part should describe the focus of the paper, typically the paragraph starts with a phrase like "*The objective of this paper is ...*".

The last part should describe the structure of the paper, for example: The paper is structured as follows: Section 2 explains the overall structure for different types of scientific papers. Section 3 gives some hints on writing and covers also acronyms, figures and tables. Section 4 gives a recommendation on LaTeX and explains how to get the necessary tools. Section 5 presents a checklist of common mistakes to avoid. Section 6 concludes the paper.

2 STRUCTURE OF YOUR PAPER

2.1 RESEARCH PAPERS

The structuring of your sections heavily depends on the *type* of your paper. For example if you have done some research encompassing an experimental setup and measurements, your paper could be possibly structured as

follows:

- Abstract; Kurzfassung, Abstract
- Introduction; Einleitung
- Related Work; Verwandte Arbeiten
- Basic concepts, Concepts and Terms; Grundbegriffe, Grundkonzepte und Definitionen
- Experimental setup, Applied Method; Versuchsaufbau, Vorgangsweise
- Results; (Experimentielle) Ergebnisse
- Discussion, Proof; Diskussion, Beweis
- Conclusion (and Outlook), Summary; Schlussfolgerungen, Fazit; Zusammenfassung (und Ausblick)
- References; Literaturverzeichnis

The colons separate possible variants in naming the sections. The variants after the semicolon give the German counterparts. If some text is in brackets, this text could be optionally added to the given variant (but used without brackets).

The section on related work might also appear right before the concluding section.

The section on basic concepts should introduce the basic terms and concepts that are needed to understand the following sections of the paper. Sometimes, it is not necessary to have a separate section on basic concepts, if the basic concepts are well-known or can be covered in the introduction.

The experimental setup typically describes the used hardware, software, and the implementation. If your implementation has a fancy name, you could also name that section that way (for example *KHUFU System Description*.

Most papers you will read for your first paper will likely be such *research papers*.

2.2 SURVEY PAPERS

If you do a literature research comparing some approaches, your paper could be possibly structured as follows:

- Abstract; Kurzfassung, Abstract

- Introduction; Einleitung

- Basic concepts, Concepts and Terms; Grundbegriffe, Grundkonzepte und Definitionen

- Description of first approach

- Other approach, etc. (one section per approach)

- Comparison and Discussion

- Conclusion, Summary; Schlussfolgerungen, Fazit; Zusammenfassung

The semantic of the list is the same as above. The comparison will typically cover common features, differences, advantages, drawbacks. A comparing matrix would be nice.

The paper you will write in this course will most likely be such a *survey paper*. Depending on your special topic you might decide to split up or to combine some sections.

3 WRITING STYLE

Usually you should not use the first person singular (*I*) in your text, write *we* instead. As a general recommendation, use the first person sparsely, sometimes it can be replaced by a phrase like *This work presents....*

3.1 LANGUAGE

If you did not make a special agreement with your mentor, you may write your paper in English or German language. However please keep in mind, that most literature you will have to read for your paper will be in English language anyway.

If you use English, you might find the following hint useful: The indefinite article **a** is used as **an** before a vowel sound - for example **an** apple, **an** hour, **an** unusual thing, **an** FPGA (because the acronym is pronounced Ef-Pee-Gee-A), **an** HIL. Before a consonant sound represented by a vowel letter **a** is usual – for example **a** one, **a** unique thing, **a** historic chance[1].

3.2 FIGURES AND TABLES

A figure should always be referenced and explained in the text, for example: *Figure 1 shows a gear unit with three wheels. As depicted in the figure, the second gear wheel is larger than the other two in order two make the figure more appealing.*

Tables also should always be referenced and explained in the text, for example: *Table 1 depicts the byte index for various items. Note that the size in byte is always one except for code 5.*

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[1] According to Merriam Webster, both **a** and **an** can be used in writing before unstressed or weakly stressed syllables with initial h, thus you could also write "***an** historic chance*".
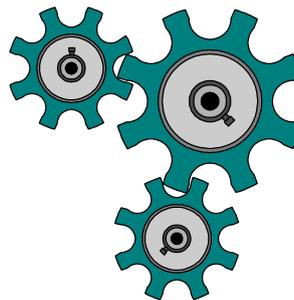

Figure 1: Example figure

Code	Element name	Size in bytes
0	Status	1
1	Cluster name	1
5	Data bytes	4
9	Checksum	1

Table 1: Table example

3.3 CITATIONS AND REFERENCES

Whenever you refer to previously published work, you should set a reference to acknowledge the work you build upon. For example this is a reference to a bachelor's thesis [1]. If you literally cite a part of someone else's work, mark the respective sentence by quotes and italic letters and add the page number, where its text can be found:

"*An intelligent or* smart *transducer is the integration of an analog or digital sensor or actuator element, a processing unit, and a communication interface. In case of a sensor, the smart transducer transforms the raw sensor signal to a standardized digital representation, checks and calibrates the signal, and transmits this digital signal to its users via a standardized communication protocol.*" [2, p. 175]

Failing to explicitly mark literally cited text is a serious offense, belonging to *plagiarism.*

It is also important to keep the set of published work of high quality. For example, one problem with articles published on the internet only is that they are typically not reviewed. Thus, if you want to cite sources from the internet, you have to **ask your supervisor**. In case you really cite a source from the internet, it is important to provide beside the URL additional information about the document, see [3] as an example. As the content of sources from the internet tends to be unstable, it is important to provide detailed information about the revision. For example, in Wikipedia you can refer to a specific revision time of the content: [4].

4 USING LATEX FOR WRITING YOUR PAPER

LATEX is a type-setting system commonly used in scien-

tific publishing. Together with the tool BibteX it supports you in writing proper articles with correctly formatted citations. We recommend also to use LaTeX for your paper. LaTeX and most tools are freely available.

This template can be compiled with the `latex` command or the `pdflatex` command. While `latex` creates an intermediate file format (.dvi) that can be further processed into a `.ps` or `.pdf` file, the `pdflatex` command directly creates a `.pdf` file.

Note that with `latex` the `\includegraphics` accepts only .eps files, while with `pdflatex` accepts `.pdf`, `.png`, or `.jpg`. Luckily, the file extension can be omitted in order that `\includegraphics{pics/example}` will look for file with name `example.eps` in `latex` mode and for a file with name `example.pdf`, `example.png`, or `example.jpg` in `pdflatex` mode. If you already have an `.eps` file, you may create a respective `.pdf` file with the command line conversion tool `epstopdf`.

4.1 LaTeX Tutorials

We will not give an introduction to LaTeX here, since there exist already a number of fine introductions into the subject.

A good concise introduction is given by [5]. If you are looking for a manual in German language, refer to [3, 6].

4.2 Acronyms

Explain acronyms at their first occurrence in the text. In order to achieve this consistently, we recommend to use the `acronym` package.

A new acronym is then declared by writing `\newacro{acronym}{expanded name}`. Use the macro `\ac{acronym}` as a placeholder for the acronym in the text. See file `acronym.tex` for further examples and explanations.

4.3 References with Bibtex

Bibtex is an additional program to LaTeX that creates a list of your cited references in a chapter named *Bibliography*. Bibtex works with a text file databases of references in so-called *bibfiles* (file extension `.bib`).

The *bibfiles* contain entries of several types, the most needed types are `book`, `inproceedings`, `article`, `techreport`, `mastersthesis`, and `phdthesis`. Table 2 lists templates for these types, whereas each asterisk (*) should be replaced by the respective data, if this data is not available, the whole line should be removed. The case of the element names does not matter to Bibtex, however in the examples we have used UPPERCASE for the obligatory fields and lowercase for the optional fields. To see some examples, have a look into the file `bibfile.bib`. For more information, read [7].

```
@BOOK{*,                        @INPROCEEDINGS{*,
   AUTHOR =        {*},            AUTHOR =        {*},
   editor =        {*},            TITLE =         {*},
   TITLE =         {*},            BOOKTITLE =     {*},
   PUBLISHER =     {*},            YEAR =          {*},
   YEAR =          {*},            editor =        {*},
   volume =        {*},            volume =        {*},
   number =        {*},            number =        {*},
   series =        {*},            series =        {*},
   address =       {*},            pages =         {*},
   edition =       {*},            address =       {*},
   month =         {*},            month =         {*},
   note =          {*}             organization =  {*},
}                                  publisher =     {*},
                                   note =          {*}
@ARTICLE{*,                      }
   AUTHOR =        {*},
   TITLE =         {*},          @MASTERSTHESIS{*,
   JOURNAL =       {*},            AUTHOR =        {*},
   YEAR =          {*},            TITLE =         {*},
   volume =        {*},            SCHOOL =        {*},
   number =        {*},            YEAR =          {*},
   pages =         {*},            type =          {*},
   month =         {*},            address =       {*},
   note =          {*}             month =         {*},
}                                  note =          {*}
                                 }
@TECHREPORT{*,
   AUTHOR =        {*},          @PHDTHESIS{*,
   TITLE =         {*},            AUTHOR =        {*},
   INSTITUTION =   {*},            TITLE =         {*},
   YEAR =          {*},            SCHOOL =        {*},
   type =          {*},            YEAR =          {*},
   number =        {*},            type =          {*},
   address =       {*},            address =       {*},
   month =         {*},            month =         {*},
   note =          {*}             note =          {*}
}                                }
```

Table 2: Common Bibtex templates

4.4 Recommended LaTeX Software for Windows

We recommend MikTeX, which is a an up-to-date implementation of TeX and LaTeX for all current variants of Windows on x86 systems. MikTeX is freely available at `http://www.miktex.org`.

As an editor, we recommend the free *TeXnicCenter* (available at `http://www.toolscenter.org`). Both, MikTeX and TeXnicCenter are published under the Gnu Public License (GPL). *TeXnicCenter* comes with an integrated spell checker, otherwise you are recommended to install the Windows version of *aspell*, an open source spell checker under the GPL is available at `http://aspell.net/win32/`.

Alternatively, you can use LateX within Cygwin, which provides you a Unix-like working environment for Windows. Cygwin is freely available under the GPL at `http://www.cygwin.com`. Cygwin also allows you to use the software packages described in Section 4.5.

4.5 Recommended LaTeX Software for Linux and BSDs

The standard distributions for Linux already come with a LaTeX system (typically `tetex`).

As an editor, we recommend the Kile editor (available at `http://kile.sourceforge.net/` under GPL). As spell checker we recommend *aspell*, an open source spell checker that replaces the older *ispell* checker. *aspell* is included in most distributions, otherwise it can be downloaded from `http://www.gnu.org/software/aspell/`.

4.6 RECOMMENDED LATEX SOFTWARE FOR APPLE MAC OS X

The *darwin ports* (`http://darwinports.opendarwin.org/`) provide a port of *teTeX* that can be installed under Apple Mac OS X.

As an editor, we recommend TeXShop (available at `http://www.uoregon.edu/~koch/texshop/` under GPL). As spell and grammar checker we recommend Excalibur (`http://www.eg.bucknell.edu/~excalibr/`).

5 COMMON MISTAKES TO AVOID

The following checklist should help in avoiding some frequently made mistakes, if any of the following propositions apply for your paper, there is a problem:

- Your abstract has a heading enumeration

- You have citations in your abstract

- The introduction does not cover the three parts as described above

- The introduction contains subheadings

- You refer to chapters instead of sections (chapters is only for books or theses)

- You described different aspects than promised in the title. For example your paper is on modular robotics and you elaborate on robot control.

- You described different aspects for the compared approaches. For example you elaborate on communication speed for system A, then you write about the code size of system B (better: describe both aspects for all three systems)

- You copied some parts of the text from other work without proper referencing and citing

- You used automatic translation tools to produce text by translating it from another language

- Your paper contains many typos and grammatical errors (Use an electronic spell checker. Please!)

- You work in a team and did not spend time for reading and integrating the parts of the team members.

- You used color in your figures and refer to the "blue" line (assume that your readers use a monochrome printer)

- You mainly used web sites and other unrefereed material as your sources

- You cite some in your conclusion which you have not mentioned before

- Some forenames in the references are abbreviated, some not

- Some references miss a publishing date

6 CONCLUSION

The conclusion should briefly summarize the problem statement and the general content of the work and the emphasize on the main contribution of the work.

When writing the conclusion keep in mind that some readers may not have gone through the whole paper, but have jumped directly to the conclusion after having read the abstract in order the decide on the personal relevance of the paper. Therefore, the conclusion should be self-contained, which means that a reader should be able to understand the essence of the conclusion without having to read the whole paper.

The conclusion typically ends with an outlook that describes possible extensions of the presented approaches and of planned future work.

REFERENCES

[1] H. Kraut. Signalverarbeitung mittels eines Neuronalen Netzwerkes für einen Smart Sensor. Bachelor's thesis, Technische Universität Wien, Institut für Technische Informatik, 2003.

[2] W. Elmenreich and S. Pitzek. Smart transducers – principles, communications, and configuration. In Elmenreich, Machado, and Rudas, editors, *Intelligent Systems at the Service of Mankind*, volume II, pages 175–186. Ubooks, December 2005.

[3] M. Jürgens. *LaTeX - eine Enführung und ein bißchen mehr...* FernUniversität Hagen, 2000. available at `http://www.fernuni-hagen.de/URZ/urzbib/ls_broschueren.html.`

[4] Wikipedia. Worst-case execution time. Online encyclopedia: `http://en.wikipedia.org/wiki/Worst_case_execution_time`, 2005. revision 7:18, October 18th.

[5] T. Oetiker, H. Partl, I. Hyna, and E. Schlegl. *The Not So Short Introduction to LATEX 2ε or LATEX 2ε in 133 minutes*, 2005. available at `http://www.ctan.org/tex-archive/info/lshort/english/lshort.pdf.`

[6] M. Jürgens. *LaTeX - Fortgeschrittene Anwendungen*. FernUniversität Hagen, 1995. available at `http://www.fernuni-hagen.de/URZ/urzbib/ls_broschueren.html.`

[7] O. Patashnik. *BibTeXing*, 1988.