

Guidelines for the execution, preparation and presentation of master theses at the Institute of Biomedical Imaging

1 TYPES OF MASTER THESES

Basically, there are four classes of master theses which have slightly different requirements:

1.1 LITERATURE REVIEWS

Compact review of a special topic in biomedical engineering (see details in the appendix).

1.2 SOFTWARE DEVELOPMENT

Software work consists of creating programs or parts of programs, testing them, and writing documentation (software manual).

1.3 HARDWARE-PROJECTS:

Hardware projects involve designing, building and testing specific hardware (electronics, optics, mechanics or combinations thereof) needed for research projects or laboratory setups.

1.4 EXPERIMENTAL WORK:

Planning and execution of experiments, involving the necessary hard- and software. Analysis of the data, using appropriate methods (signal analysis, image analysis, statistics, ...)

2 STRUCTURE OF THE THESIS

Usually the thesis has to contain the following items:

- title page
- abstract and 5 keywords

- table of contents
- list of abbreviations and symbols
- introduction/objectives
- methods
- results (for hardware / software /experimental work) or summary (for literature reviews)
- discussion
- literature
- appendix (if required)

Deviations from this structure may become necessary in rare instances and must then be discussed with the supervisor.

For the title page there exist templates on the web page(s).

2.1 ABSTRACT

The abstract is a summary, which is also divided into objective, methods, results and conclusion. The most important statements from the corresponding chapters are to be summarized in two to three sentences.

2.2 INTRODUCTION/OBJECTIVES

This section serves as an explanatory introduction to the tasks of the thesis. The background and the significance of the work should be pointed out and the problem (objectives, specifications, etc.) clearly stated. In this context, important publications representing the state of the art are to be discussed.

2.3 METHODS

This chapter contains a complete description of the equipment, materials, methods and procedures used. The description should be detailed enough to allow reproducibility by other investigators. However, methods and procedures that can be assumed to be generally known need not be explained in detail. If certain methods are published elsewhere, a reference must be given. Manufacturers of devices, drugs, software, components, etc. are listed in parentheses after the type designation or brand name, e.g. Accutrend (Boehringer Mannheim, Germany) or Matlab (Mathworks Inc., Natick, USA).

For literature reviews, the methods of searching as well as the databases used should be indicated. Furthermore, it should be stated which keywords or combinations of keywords were searched for. For papers with a didactic focus, it should also be stated how the content was prepared or which tools were used. Naturally, the method section is usually shorter for literature reviews than for hardware and software works.

2.4 RESULTS

For hardware, software and experimental work, this chapter presents only the results obtained. Therefore, this chapter can be short under certain circumstances. It is wrong to describe in this chapter how the results have been obtained (□ chapter methods) or how the results are to be interpreted (□ chapter discussion). Since individual results frequently do not contribute to a deeper understanding of the treated problem, results should be generalized whenever possible using appropriate statistical methods (e.g., mean, standard deviation). The same data should usually not be presented in both table and figures, but rather the most appropriate type of presentation for understanding the information to be conveyed ("message") should be chosen in each case. Extensive (e.g. tabular) results should be presented in the appendix, if necessary.

In the case of literature work, statistics of the sources found or information about the availability of the literature should be provided first. The main part is then the condensed summary of the critically selected and evaluated information from the source texts.

2.5 DISCUSSION

This chapter serves the critical interpretation of your results, both from the point of view of the method used (e.g. error estimation) and in comparison to other published results. Above all, this critical interpretation should enable you to assess and evaluate the significance of the work you have done. The most common mistake in this chapter is that the results are repeated and not discussed. Refer in an appropriate form to those results that seem particularly noteworthy to you, but in the style of a factual presentation.

The discussion chapter is concluded by a conclusion (Was the objective achieved or the task solved? What further considerations can be deduced from it ?)

In the case of literature work, the interpretation of one's own results is missing, of course, and is replaced by a critical discussion of the literature worked on.

2.6 LITERATURE

References to literature are made in the text with a number in square brackets. The literature should be arranged in the order in which it first appears in the paper and formatted according to [the IEEE TBME](#) style of citation. Respective guidelines can be found on the web.

2.7 APPENDIX

The appendix contains everything that is not directly necessary for the understanding of the interpretations and conclusions given in the thesis (e.g. long formula proofs, derivations, program listings, operating instructions, data tables with individual results).

3 STANDARDS

Information on how to prepare equations, legends, tables and figures as well as on the use of abbreviations, units and symbols should also be taken from [the IEEE TBME guidelines for authors](#).

4 GENERAL HINTS

- Keep the written version reasonably short. In many cases, 60 - 80 pages of text (without appendix, DIN A4 with 2.5 cm margins, font size 12 pt, line spacing 1.5 lines) are sufficient. The evaluation of your performance depends less on the extent of the written presentation than on other criteria (e.g. independent fulfillment of the task, engineering expression, good structuring).

- Do not write in the "I" or "we" form. Use factual, technical language.

- Do not excessively repeat passages from standard textbooks. When presenting basic principles, limit yourself to contexts that

- are not part of the general knowledge in that subfield,
- are substantially related to your assignment.

Often, even in the area of basic knowledge, reference to the generally available basic literature is more efficient.

- Remember that not all readers of your thesis will be familiar enough with all the details to understand your expositions and conclusions right away.

- Pay attention to the use of tenses (important: making measurements in the past tense, general results and statements in the present tense).

- Start writing in a timely manner. From experience, the final writing speed (including corrections) is one page per day!

- Discuss a draft of your written presentation with your supervisor in good time. (structure, elaboration of certain focal points).

- Proofread (or let proofread) your final thesis thoroughly. The correct use of the English language is important. Please consider that the thesis will be made publicly available.

According to the resolution of the Curricula Commission for Bachelor's, Master's and Diploma Studies of 10.11.2008, the following affidavit of independent performance must be included in all academic theses (diploma theses, bachelor's and master's theses):

AFFIDAVIT

I declare that I have authored this thesis independently, that I have not used other than the declared sources/resources, and that I have explicitly indicated all material which has been quoted either literally or by content from the sources used. The text document uploaded to TUGRAZonline is identical to the present master's thesis.

Date, Signature

5 PRESENTATION / DEFENSE

You will have 20 minutes for the presentation and 10 min for a discussion afterwards. Use this time efficiently and convey your message to the audience. Try to see your work from the position of the audience and work out a concept for it.

From experience, you can show one slide per minute. It is common to show the title of the work and your name on the first slide. The rest of the slides should be structured like the thesis: Background, Objectives, Methods, Results and Discussion.

6 APPENDIX: TYPICAL STEPS FOR A LITERATURE REVIEW

- Formulate the research question (usually at least partially defined by the supervisor). Typical issues are:
 - state of the art of a certain method (technical, diagnostic, therapeutic,...), current knowledge about relevant phenomena, diseases, studies,...
 - open problems worth being solved
 - relevance of the current solutions/knowledge in a certain context

- literature search
 - define the keywords relevant for the posed research question
 - define the search criteria and methods
 - carry out the search in the selected databases and information channels

- critical analysis of the sources found
 - sort by relevance; typically go top down from books/meta-studies/review papers towards individual research papers/studies
 - check for quality of the data / methodological approach
 - check for inconsistencies and uncertainties

- presentation of the information found in a compact way and using an inherently consistent nomenclature and notation.

- Interpret the found information in the context of the posed research question

- Draw clear conclusions in the context of the research question.