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Thesis for the Degree of Master of Science in Engineering
Robotics 30.0 credits

THESIS TITLE

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Abstract

This section will simply be that: a summary of the whole report. An appropriate length is about 200 - 250 words. A good rule of thumb is to keep the abstract as short as possible, it should be compact but still clear, informative and arouse interest. Give the main facts and summarise everything that is essential in the report. The following should be included:

– *Presentation/introduction of the field of work*

– *outline of the task including purpose and questions*

– *Motivation why the area and the task are important and interesting*

– *General description of how you have approached the task, what you have done*

– *Summary of results and conclusions and the contribution of your work*

No details should be included in the summary, nor a description of how the report is structured. The summary should be read independently of the rest of the report, and by a fairly wide range of readers. It should provide a good basis for a reader to judge whether they are interested in reading the whole report. The executive summary is the part of a report that is read the most and by the most people. It is therefore particularly important to write a good executive summary. You need to have a firm grasp of the content of the report when writing the executive summary, and once the full report is complete, you should review and, if necessary, revise the executive summary to make it consistent with the report.

Contents

List of Figures

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List of Abbreviation

SVM . . . . Support Vector Machine

ML . . . . Machine Learning

1   Introduction

The current sectioning is an example to illustrate the use of the Latex template to write the thesis report. The text for the sections and subsections should be adapted to reflect the content of each section best. For example, the "problem formulation" does not need to be a subsection of the introduction. It can be a complete the section on its own (if there is enough material).

The introduction can be seen as an expanded version of the abstract. The authors can have roughly the same structure but one or two paragraphs for each point in the summary. The following should be included:

– Presentation of the field and topic of the work. This should come early and should capture interest. It can include a brief background and possibly important definitions of terms

– You can briefly describe the intended audience for the report. Whom have you written for?

– Brief overview of previous work and its limitations

– Presentation of the assignment including purpose and research questions

– Description of your approach to the task, methodology and why it is appropriate

– Motivation: why the task is interesting, what the relevant questions are, why your approach is good and why the results are essential.

– description of the main results and their limitations and what is new in your work

– overview of the report

You can discuss the significance of the conclusions, but the introduction should only briefly summarise the results. No specialized terminology or mathematics should be included here.

The introduction can be written as a funnel: area - sub-area - task - any sub-task - purpose. You then lead the reader towards a progressively more detailed and specific understanding of the task and purpose. By the end of the introduction, you and the reader should have a base of shared understanding. The reader should understand the task, the scope of the work, the methodology and its main contribution, i.e. what is new in your work.

The other sections of the report may also need a short introduction at the beginning so that the reader understands the purpose of each section and its place in the report.

1.1   Problem Formulation

In this section, you formulate and specify the three essential things: purpose, question and motivation. First, you should present the task at a high level and in detail and discuss why it is essential. Next, explain the assumptions and limitations. You can then formulate the aim and question from the description of the task. Keep in mind that once the purpose is met, the question should be able to be answered. It is also essential that the purpose and motivation are linked. Once the purpose and question are clear, you can start developing the objectives which must be achieved to reach the purpose. Each objective should be small, achievable and possible to evaluate.

Tips! Write down your research question on paper and put it next to the screen. This will help you remember the research question when working on the report. This is how to use the references [1, 2] or Turing [5] and this is how to use the acronym Support Vector Machine (SVM) or Machine Learning (ML).

2   Background

In this section, you provide the knowledge the reader needs to understand your work and your contribution. Present fundamental knowledge needed to understand the field and the task. For example, you can explain relevant theories and concepts you use or introduce mathematical notation. Write the background so that someone familiar with the area can skip it.

3   Previous work/literature review (Related Work)

The purpose of this section is to place your work in context and compare it with previous published work and results in the field. This section should be thorough. You describe here existing knowledge and how this is extended by your work. It should include analyses of previous work, describing, for example, how different methods differ. You should point out the main similarities and differences in terms of task, approach/methodology and results. It is important that you discuss in a neutral way the advantages and disadvantages of your own work compared to that of others.

This also creates an expectation of the contribution of your work, the reader learns here about the limitations of previous work and why your task is a challenge..

Together, this section along with the background will introduce the state of the art/state of practice and its shortcomings, the importance of the assignment and what your work will be compared to.

4   Method

In this section you should describe the scientific methods you have used and how you have approached the work itself. For each objective above, identify a method for achieving the objective. The choice of method should be justified. For example, you may have made a mathematical model, used simulations, made an implementation that you tested, or done experiments that you may have evaluated using statistical methods. In the first instance, you should describe the scientific methods you used, but it is also useful to describe how you worked on the task. The Methods section also answers why you did a certain way or why you used a certain tool. So you should not only describe the "what" but also the "why". Ask yourself: can the chosen method help me to achieve the set objectives and thus answer the research question?

Choosing the right scientific method(s) is important for you to achieve your goals [4, 3], so this is a point that you should discuss with your supervisor at an early stage. Also, search the literature for good descriptions of methods, and how best to write a Methods section.

5 Ethical and Societal Considerations

In the first instance, "ethics" refers to research ethics issues. Does your choice of research question or method imply any research ethics position? For example, if you are interviewing people for your work, can you guarantee their anonymity, and how will you use the information you get from them? Are there other ethical aspects to consider in your career? Might there be ethical aspects to the outcome of your job? You should indicate if you believe that your work does not contain any research ethics issues.

You should also critically review and analyse your work concerning societal aspects. For example, you could discuss how your work relates to economic, social and environmental sustainability objectives. There may also be legal and political aspects to your work.

6   Description of the work

After the sections above, there is a description of what you have done. It would help if you did not use the heading above but replaced it with appropriate titles, depending on your work. The structure should be made clear by the section headings. Having a clear, logical structure and a narrative flow is essential. You should include the advanced background knowledge necessary to understand how you solved the assignment and define hypotheses and critical concepts. The description of experiments should be such that it is possible to repeat them. If such a description is very long and detailed, you can put it in an appendix. See below.

7 Results

Here you can present, for example, the results of experiments, proofs, analysis of data, etc. Your results must be described clearly enough for a reader to be able to judge them. You should also explain and analyse the results.

8   Discussion

Here you present the interpretation of the results and assess their significance. Discuss possible implications of the results, and offer possible recommendations. You must report on whether you have achieved the objectives you set out, answering your research question and achieving the aim of your work. The section should also include reflections on the job and its limitations. You can also discuss solutions to problems that you have identified and discussed earlier or address other issues that the work did not address, questions that were not answered. Also, link your findings to previous work. This way, the discussion can become a conversation with what you wrote in the last section. Finally, put your work in a broader context, and broaden your perspective. Can your results be generalised? Can what you have done be used in some other context?

9   Conclusions

In this section, you should summarise the report and present the conclusions and final analysis. Give a brief overview of the purpose and the research question. You should then clearly state the main findings, explain their significance and put them into context. All conclusions should be supported by previous sections of the report. However, you should not present new details.

An expert should be able to read this section independently of the rest of the report.

References

[1] M. Berndtsson, J. Hansson, B. Olsson, and B. Lundell. *Thesis projects : A guide for students in computer science and information systems*. Springer, London, 2 edition, 2008.

[2] P. Blomkvist. *Metod för teknologer : examensarbete enligt 4-fasmodellen*. Lund : Studentlitteratur, 2014.

[3] K. Säfsten and M. Gustavsson. *Forskningsmetodik för ingenjörer och andra problemlösare*. Första edition, 2019. ISBN 9789144067421.

[4] K. Säfsten and M. Gustavsson. *Research Methodology*. 2020. ISBN 9789144122304.

[5] A. M. Turing. Computing machinery and intelligence, 1950. URL `http://cogprints.org/499/`. One of the most influential papers in the history of the cognitive sciences: http://cogsci.umn.edu/millennium/final.html.