

# Writing a bachelor or master thesis with Thomas Bolander

Thomas Bolander

November 2, 2024

## Contents

<b>1</b>	<b>Before deciding to write a thesis with me</b>	<b>1</b>
1.1	Types of projects I supervise . . . . .	1
1.2	Choosing a topic and project . . . . .	2
1.3	What to provide when contacting me to be a supervisor . . . . .	2
1.4	Supervision meetings . . . . .	3
1.5	Group projects . . . . .	3
<b>2</b>	<b>Writing the thesis itself</b>	<b>4</b>
2.1	Length . . . . .	4
2.2	Writing strategy . . . . .	4
2.3	Intended audience . . . . .	4
2.4	Formalities, intuition and examples . . . . .	4
2.5	Defend your claims! . . . . .	5
2.6	Feedback on thesis drafts . . . . .	5
<b>3</b>	<b>Defence</b>	<b>6</b>
3.1	Formalities . . . . .	6
3.2	Presentation . . . . .	6
3.3	Examination . . . . .	6

## 1 Before deciding to write a thesis with me

### 1.1 Types of projects I supervise

For any supervisor you might choose to work with, it makes sense to take a short while to check out the research of this person, to see if you seem to be aligned in terms of interests and style of research. A list of my papers can be found on my web page, <http://www2.compute.dtu.dk/~tobo/>. My web page also has a list of previous bachelor, master and PhD projects, but it is not always up to date. Probably the ideal way to get an idea about what kind of projects I supervise, and what I expect from my students, is to look through some of

my recently supervised projects. Go to DTU Findit, <http://findit.dtu.dk>, choose “Thesis” under Type, write “supervisor:Bolander” in the search field and sort by most recent.

I do both theoretical and practical projects, but I’m definitely leaning towards the theoretical side. It means that most of my papers develop new theory, usually involving mathematical definitions, theorems and proofs. I don’t mind supervising projects that have a more practical focus and implement existing theories or algorithms, but my theoretical incline means that I find mathematical precision very important. If you prefer something less formal and mathematical, you might want to consider whether I’m the right supervisor, as there might be a mismatch between your interests and my expectations.

The closer a project is to my own research, the more time I can dedicate to it, since then it might not only count as fulfilling my duties as a supervisor, but can also contribute to fulfilling my duties as a researcher. Projects that can potentially lead to publications are particularly attractive in this respect, though it’s naturally quite rare that a bachelor or master thesis leads to results that are publishable in respectable venues (but it happens). If you might potentially consider to eventually do a PhD, you should definitely try to do a project that has some research flavour and can in the best case lead to a publication (either within the project period itself or afterwards). If I’m a co-author, I’ll be happy to assist.

## 1.2 Choosing a topic and project

You don’t need to have a specific idea for a topic or project when you contact me, but it is of course fine if you have. However, as I get many requests to be a supervisor, I will generally turn down supervision of projects that are not relying on my specific expertises. For instance, a project that *only* involves deep learning and no symbolic AI and no robotics could be better supervised by someone else who is specifically an expert on deep learning. If you’re uncertain about my specific research expertise, have a look at my papers as also suggested above. As I’m very interested in neuro-symbolic AI, I can of course supervise projects that *also* involve deep learning (say), but it just makes more sense for me when it’s deep learning combined with symbolic techniques.

It’s also completely fine for you to approach me without any specific topic or project in mind, and then I can try to suggest some potential projects based on my current research.

## 1.3 What to provide when contacting me to be a supervisor

You should include your grade sheets, so that I can see which courses you took and where your strengths and weaknesses might be. Due to my theoretical inclination and my expectation of receiving student theses with high theoretical and mathematical precision, I would normally expect high grades in the theoretically oriented courses. There can of course always be exceptions for various

reasons, but it is important that the project you end up doing is well aligned with your expertises and strengths—no matter whether I or someone else end up supervising it.

There is no strict rule that you need to have taken any of my courses to be supervised by me, but it's obviously an advantage if you have done courses related to my research and expertise, so areas such as logic, symbolic AI, search, automated planning, social aspects of AI, cognitive robotics. For a master thesis with me, it will most often be ideal if you have completed both 02285 and 02287, as they together cover a significant part of the background of my own research.

## 1.4 Supervision meetings

I rarely have weekly meetings with students. I tend to be busy and supervise many students, and if I had weekly meetings with everybody, I would have very little time left for research. Meetings with me are usually on demand. This means that when you have something interesting to show me or you get stuck and need help to progress further, you can write me by email and set up a meeting.

I generally expect significant independence from my students. I'm of course fully aware that more independence can be expected from a PhD student than a master student, and more from a master student than a bachelor student, but I still see all types of projects as a chance of learning to work more independently and get some experience with independent research. The best projects are usually the ones where the students take ownership and try to work on their own ideas and find their own way. It might still be a project where I have come up with the overall idea, for instance based on my current research, but it's best if you can take the project in your own direction and make it your own.

Sometimes it can be a bit hard to ensure progress in a project when not having regular meetings with a supervisor. If you feel that might potentially be true for you, I propose that you every Friday send me an email with a short status report on what you have done during the week and what you plan to do next week. This is actually more a tool for you to ensure progress than it is for me to keep track of you, but in my experience it can still work quite well (I've done this myself as a student and assistant professor).

## 1.5 Group projects

I generally encourage students to work in groups of 2 or even 3 whenever possible. This will give you more resources to do an interesting project, and you will have the advantage of being able to support each other, since you probably don't have exactly the same strengths and weaknesses, and hence don't get stuck on exactly the same things. However, I'm also OK with supervising single students, as long as you're aware of the expected independence (see above).

## 2 Writing the thesis itself

### 2.1 Length

A bachelor or master thesis should rarely be more than 50 pages long. If it's joint work between several students, it can be a bit longer, but usually not more than 60 pages, and definitely never more than 70. Quality is rarely about length. A concise, precise and well-structured report is usually way better than a long and verbose one. You can consider research papers for inspiration. These are usually relatively short, since journals and in particular conferences have quite strict page limits. A 6 page paper in a top AI journal could still easily be the result of a full year of research, so it's a lot of ideas compressed into very little space. Bachelor and master theses are not supposed to be *that* compressed, they are supposed to be accessible to a wider audience, but still, conciseness is a huge value in research. Try to be as mathematically precise as possible, that also often means using less space.

### 2.2 Writing strategy

It's usually a bad idea to start writing the thesis at the very end. Try to get into the habit of at least writing fairly detailed notes throughout the project period that can then later be turned into parts of the thesis. You can for instance start up a latex document already initially that will eventually become your thesis, but where you in the beginning only try to write structured notes about your ideas and thoughts and findings. If you for instance start out with a literature study, you would here put down notes about each paper in something that can later become a background chapter of the thesis.

### 2.3 Intended audience

It's very important to reflect on your intended audience. The reader is normally expected to be one at a similar level as yourself when you started working on the thesis. But in some cases, the expected level of the reader could be higher, e.g. if the thesis is supposed to become a research paper, then it might be directed towards the experts in the field. In any case, make sure to clarify in the thesis who the expected reader is, and try to always be aware of this expected reader when you write it.

### 2.4 Formalities, intuition and examples

It's important that all your concepts and ideas are clearly and precisely formulated, but also that you provide the underlying intuition behind each introduced concept. This usually means that you should (mathematically) define each introduced concept, and that you should also exemplify it. If you're e.g. using graphs, you should first define them (in a definition environment in latex), and then later you can exemplify the concept by saying "Consider for instance the

graph  $G = (V, E)$  given by...” (in an example environment unless the example is very short). Figures are also usually important to support intuition. If you struggle with defining a concept in a sufficiently mathematically precise way, examples can also help to show what the intention is, even if the definition has some weaknesses or flaws.

Always make sure to define concepts before using them. So never start talking about graphs before having defined them—unless you assume the notion of a graph to be already known by the intended reader, but then you should still either remind the reader what it is or cite a source that defines it (e.g. a suitable textbook).

It is often nice to work with a running example. You might start out with a simple version of it, and then build on top of it as you introduce more and more concepts allowing you to analyse the example more deeply. You should normally come up with your own example(s) rather than copying from the existing literature. This is in particular important for theses that don't include any original research, as it's then important that you show that you can present your own version of the existing research and still contribute creatively to it.

## 2.5 Defend your claims!

All claims made in the thesis have to be supported/defended. If you e.g. say “in recent years, AI has come to focus more on  $X$ ”, then you need to either explain your evidence for this claim or cite a source stating it (an existing publication).

## 2.6 Feedback on thesis drafts

Unless otherwise agreed, you should send me a draft version of the thesis exactly halfway through the project period (so start out computing the exact date). I will then give you feedback on this in terms of style and content. You will obviously not have a full thesis at this point, maybe you will mainly have the background stuff, and not so much of the (potentially) novel stuff of the thesis. However, it can still be very helpful in terms of aligning expectations between you and me. I can for instance let you know if I feel that your writing is not sufficiently mathematically precise, if you don't have enough examples or figures, if there's not enough intuition, or whatever it might be. But of course you should still from the outside try your best to follow all the advice given in this document.

I normally only offer to read one draft of the thesis, and never a final one. It makes sense to not give feedback on a final or near-final draft, as there needs to be chapters where I can tell the external examiner that it's exclusively your own work. However, I can of course still give feedback on specific parts you might be in doubt about, e.g. specific paragraphs, definitions or examples.

## **3 Defence**

### **3.1 Formalities**

A bachelor or master thesis defence starts with a presentation by you, with slides. This can be at most 30 minutes long, possibly including a demo (if you implemented something that would be relevant to demonstrate). Sometimes bachelor presentations are a bit shorter, 20 minutes. Sometimes bachelor presentations are a bit shorter, 20 minutes. The following examination will then be 15-30 minutes long, followed by up to 15 minutes for grading.

### **3.2 Presentation**

The most natural place to start is to say something general about the project, its purpose and scope. Then afterwards you can dig into some of the more technical stuff, but you probably can't cover everything, so pick the stuff that you think is most novel, original and/or are most proud of. And if you had some thoughts or progress after handing in, you can also include those. It's also often relevant to shortly describe the process of the project: where you started, what happened underway, any possible change of direction during the project. If you've found errors in the report, mention these in the presentation rather than waiting for us to ask questions about them in the examination.

It's advisable to practice the presentation before the defence. You can either record it and see it yourself afterwards to learn from it, or you can try to see if some of your fellow students would be willing to attend you rehearsal and give feedback.

### **3.3 Examination**

Make sure you can defend anything written in your reports and can clarify all the theory you build on. You should reread your thesis as part of the preparation for the defence. When you do so, try to put yourself in the shoes of an examiner. Are all your statements clear and precise? If not, how would you make them clearer? Can you explain every formula and concept introduced in the thesis and can you defend any claim you made?