

## Rules & Regulations BSc thesis project in Artificial Intelligence

The BSc thesis project is a prominent part of the final phase of the Bachelor programme Artificial Intelligence (AI). By performing a proper research project and writing the accompanying BSc thesis, students show that they meet the requirements to become a BSc in AI. The thesis project should comprise scientific research on a topic that is relevant for the field of AI. Examples of finished BSc theses are available at the Secretariat AI and the Blackboard site “Opleiding KI”. As will be explained in this document, it is highly recommended to start with the preparations for a thesis project well in advance of the (planned) start of the actual research. As of 2012-2013, a new procedure is in place. Students have to apply for a research topic and corresponding supervisor via the course website bki300 on Blackboard. The course website is always available to students via self-enrollment. Read more about the procedure for applying for BSc thesis supervision on the information pages concerning “BSc/MSc theses” (available via the Blackboard site “Opleiding KI”).

Note that scientific integrity is considered of utmost importance by Radboud University. To ensure scientific integrity, this document specifies a number of rules of conduct to which students and supervisors must adhere.

**Goals** The goals of performing the BSc thesis are:

- To teach the student how to position the research in a scientific theoretical framework, to formulate one or more research questions, to pursue the corresponding research project, and to report on these issues in a scientific manner.
- To shape the scientific attitude of the student by encouraging a high level of independence during the work, embedding the research questions within the international literature, and discussing the outcomes of the research project within the framework of established AI research areas.
- To teach the student how to function in an organization. In general, students have to acquire their thesis project themselves. They have to learn how to arrange regular meetings with their supervisors, show incentive during the project, write their thesis and present their project results.
- By performing a good thesis project and writing a high quality scientific report, the student demonstrates the skills and expertise that are required to become a BSc in AI, allowing the student to enroll in the MSc programme in AI.

**Credits** of the BSc thesis project amount to **12 EC**.

### Requirements for commencing a BSc thesis project

Before officially starting a BSc thesis project, the student:

- Has to be formally registered in the BSc study programme AI at the Radboud University.
- Must have obtained at least 135 EC of the BSc programme AI, including all mandatory exam parts that are required to successfully pursue the thesis project, as according to the supervisors. In cases where students have obtained less than 135 EC, the student needs to get approval from the Board of Examiners AI (BoE) before initiating the thesis project.
- Must have (i) visited the BAKO; (ii) applied for a first-choice supervisor; (iii) get admitted by a supervisor. After admittance, the supervisor is responsible for further supervision and guidance, possibly in close cooperation with a second supervisor.
- Has to have completed a project proposal in cooperation with the supervisor(s). The proposal has to be signed by the supervisors and handed in at the Secretariat AI within two weeks of starting the thesis project.

Note that the search for a suitable topic and supervisor is not part of the actual BSc thesis project. The student is free to start this search before all conditions listed above are satisfied.

### Content of the thesis

### Research topic

The research topic is initially determined by the student. He/she may hear from interesting research during a particular lecture, by visiting the regular BaMa internship markets, reading about open topics on the list of available research projects on Blackboard, visit the personal research interests from staff members, or by talking to potential supervisors. The final research topic is determined in close cooperation between the student and the supervisors. The research topics must be relevant for the field of AI (broadly defined). Research topics would in general be related to ongoing research conducted by supervisors from the staff of the AI or other departments, unless supervisors and student decide otherwise. One or more of the following research topics characterizes an AI BSc thesis project:

- Building computational models and efficient, effective and flexible computer simulations for complex task execution and/or problem solving;
- Research on robotics, human-robot interaction, human-computer interaction, or brain-computer interfaces;
- Developing or exploring theories on human and/or artificial cognitive functioning by means of cognitive modeling and computer simulations, i.e., through:
  - empirical research on human cognitive functioning, pursuing results relevant for AI
  - or empirical research on artificial cognitive functioning, pursuing results relevant for AI or Cognitive Neuroscience;
- Studying theoretical (e.g., philosophical or complexity) aspects of computational models relevant for AI or Cognitive Neuroscience.

Other topics may be appropriate, provided that the research is approved by the supervisors. In cases of doubt or disagreement between student and supervisors about the research topic, the BoE AI can be asked for advice.

### Literature study

The supervisor(s) and the student select a collection of initial literature. Based on this foundation, the student should perform a thorough literature study on the state-of-the-art and research questions of the proposed research. In general, the amount of literature will expand during the course of the project.

### Research questions

During the literature study the student and supervisors will formulate one or more concrete research questions. The supervisors should verify that answering these questions is feasible within the framework of the proposed research plan. Literature study and research questions should be mentioned in the thesis project proposal as well as in the first chapter(s) of the thesis.

### Structure and organization of the thesis

The BSc thesis AI should preferably be written in English. The structure and organization of the thesis should follow the guidelines described in [Appendix 4](#).

## Internal, affiliated and external research projects

The student should find an appropriate thesis topic and corresponding supervisor(s). Research projects are distinguished in three categories, depending on where the research takes place:

- *Internal research project*: The project is carried out at the Department of AI under daily supervision of an AI staff member (the *internal supervisor*).
- *Affiliated research project*: The project is carried out under the daily supervision of an *affiliated supervisor*, typically working at an affiliated institute like ICIS/Computing Science, The Max-Planck Institute for Psycholinguistics, the Centre for Language Studies, or one of the centres of the Donders Institute. In general (but not mandatory), the research takes place at the affiliated institute, so outside the Department of AI. An *internal supervisor* is required to take a formal role in affiliated research projects, to monitor the project and ensure a proper progress and quality of the result.

- *External research project:* The project is carried out outside the Department of AI under the daily supervision of an *external supervisor*. These projects are rare for BSc thesis projects. Only in some occasions, external research projects have been carried out in companies or at other universities. An *internal supervisor* is required to take an active and formal role in external research projects, to: help in the design of the project proposal; approve the project proposal; participate in regular progress meetings; and control the process of assessing the results.

The institute at which the thesis project is carried out as well as the supervisors involved should be mentioned in the project proposal.

### **Internal, affiliated and external supervision**

For each project holds that at least one internal supervisor must be involved in the process of supervision and assessment. Supervision aims to guide the student and to provide control and feedback on the progress and quality of the work. To ensure that supervision can take place in an appropriate manner, the student should maintain regular contacts with the daily supervisor. As mentioned above, daily supervision may be performed by an internal, affiliated or external supervisor. Students are entitled to 6 contact hours in total for supervision. Note that daily supervision does not necessarily involve daily contacts. Preferably at least once per two weeks progress meetings should be maintained.

#### *Internal supervision*

The daily supervision of an internal research project is performed by an internal supervisor. The internal supervisor is responsible for (i) guidance in writing the project proposal, (ii) supervision in the daily work on the thesis research, (iii) guidance in writing the thesis, (iv) guidance in the preparation of the presentation. Furthermore, the internal supervisor has the role of examiner in which she/he is responsible for the determination of the final grade for the thesis project. The student and internal supervisor jointly select one or more co-assessors. The co-assessor can be a lecturer or PhD student who is involved in the AI Department or associated institutes.

#### *Affiliated supervision*

The daily supervision of an affiliated research project is performed by an affiliated supervisor. The affiliated supervisor is responsible for (i) guidance in writing the project proposal, (ii) supervision in the daily work on the thesis research, (iii) guidance in writing the thesis, and (iv) guidance in the preparation of the presentation. The internal supervisor monitors the whole process, and may be more or less involved in daily supervision as well. The internal supervisor is responsible for (at least): approval of the project proposal; participate in regular (but not necessary daily) progress meetings; and control the process of assessing the results. The internal and affiliated supervisors jointly assess the work.

#### *External supervision*

For an external thesis project, the internal supervisor is responsible for (i) guidance in writing the thesis project proposal, (ii) regular control on the progress and quality of the work, (iii) guidance in writing the thesis, and (iv) the preparation of the presentation. Daily supervision is in the control of the external supervisor(s): one or more associates of the institute at which the thesis research takes place. Furthermore, at least one external supervisor should be involved in formulating the thesis project proposal and in guidance of writing the thesis. The internal and external supervisors jointly assess the work.

## Preparation of the thesis project

### *Finding a thesis project and supervisors*

The student should start searching for a thesis research topic well in advance (recommended: between two to four months before starting the project). Proper ways to do this are via the BA/MA thesis information sessions, the “BSc/MSc Thesis” Blackboard community, information from lecturers, websites from relevant research institutes, and announcements of possible projects, etcetera. In first instance, the student will make the initial contact with potential research institutes and supervisors. When opting for an *internal* project (by definition managed by an internal supervisor), a second supervisor can but need not be selected (though a second assessor is required). For *external* thesis projects, an appropriate internal supervisor is chosen, who should make one or more visits to the external research institute. The latter is to ensure that the project fulfills the requirements for a BSc thesis project in AI. For *affiliated* research projects, the student must make first explorations with an affiliated supervisor and formalize an initial project proposal. The student must also apply for an internal supervisor and ask him/her for advice in further drafting the proposal and for formally approving the proposal.

Note that the process of finding a suitable research topic and corresponding supervisor is very important: You will have to feel a “click” with the topic and supervisor. Note that this also holds for the other way around. It is recommended that both student and supervisor determine whether or not there is a sufficient mutual “click” to successfully collaborate on the respective project.

### *Spring period or Fall period*

The research is performed in the period February-July (“Spring”) or September-January (“Fall”). The student has to formally apply for supervision before the corresponding deadlines, respectively November 15 (for Spring period) and June 15 (for Fall period).

### *Formally applying for research supervision*

The procedure for obtaining a supervisor contains the following steps:

1. Enroll for the course bki300 and read the final instructions on the bki300 course website.
2. Follow the BAKO (either in May or in October).
3. Visit the BaMa internship market and/or pursue other ways to find a suitable research topic.
4. Write a brief abstract of your proposed research, choose a first-choice supervisor and submit your application before the deadline

Just after the deadline, all submissions will be discussed by a team of AI-staff members. In the vast majority of cases, your first-choice supervisor will be appointed to you. In some occasions, the supervisor will be too busy (he/she already has many other students to supervise and other supervisors are relatively less occupied). If that is the case another supervisor will be appointed to you. In very rare occasions it may occur that you and your supervisor cannot find the right “click”. In these cases, it is preferred that another supervisor who is better suited is assigned to you.

### *Writing the thesis project proposal*

Before commencing the project, the student writes a project proposal, to be approved by the supervisor(s) and a second assessor. The proposal should follow the guidelines listed in [Appendix 1](#). The project proposal serves to judge the suitability of the research environment, the availability of sufficient research facilities, the relevance of the chosen research topics, and to ensure the scientific level of the proposed research. Furthermore, the proposal should record expectations with respect to content and planning of the research, from the standpoint of both the student and supervisors.

### *Submitting the project proposal*

The project proposal should be submitted to the supervisors before the thesis research starts. The supervisors judge the proposal on feasibility, scientific level, and relevance for Artificial Intelligence. Two judgements are possible:

- The proposal is rejected by one or more supervisors. In this case, the student cannot start the project and she/he should submit a revised proposal, after which the review is repeated.
- The proposal is approved and the student can commence the thesis project. It is possible that some minor points for improvement are made by the supervisors, which should be incorporated in the final proposal within two weeks of starting the thesis project. The final proposal must be signed by the supervisors and handed in at the Secretariat AI.

Approved proposals are regularly checked afterwards by the BoE on the requirements listed above (in particular scientific level, scale, feasibility and relevance for AI).

### **Grades for the thesis project and presentation**

The thesis project is examined by the internal supervisor(s). For affiliated and external thesis projects, the judgment of the affiliated/external supervisor(s) is of significant importance. As soon as the supervisors judge the work as sufficiently well matured, the student is allowed to prepare the presentation, which is scheduled in the regular BA/MA thesis project presentation sessions. The presentation may be held before finalization of the thesis and is judged by the supervisors (who should be present during the presentation) and the present AI staff members. Note that the grade for the presentation must be sufficient (grade 6 or higher) before the grade for the thesis project can be obtained. The grade for the presentation may serve for rounding purposes of the grade for the thesis.

Note that each thesis is checked for plagiarism using *Ephorus* by default. After the thesis has been approved, the student must defend the thesis before at least two assessors (see section on supervision). Each assessor independently completes a standardized assessment form with separate evaluations for the relevant aspects of the thesis (clearly motivated research question, adequate methods, language use, etc.) and a proposed overall grade. These evaluations are based on (1) the thesis text, (2) the defence and (3) process information as provided by the daily supervisor. The assessment of process information is regularly monitored by the internal supervisor and is discussed at the regular progress meetings. The actual final grade is established through deliberation between the assessors, who compare the separate thesis assessments forms and decide on a mutually accepted grade. When the assessors cannot agree on a grade, the Board of Examiners is asked to rule. The overall grade for the thesis contains rating elements for the progress and quality of the research. Theses that have been assessed are handed in to the secretary of the degree programme, together with the assessment forms, for digital storage. Appendix 6 contains a list of recent BSc and MSc theses.

After completing the thesis and successfully presenting the thesis research a defense of the thesis is planned. A typical structure of the defense consists of a brief (2 to 5 minutes) oral summary of the work and the major conclusions. This is followed by about 10-20 minutes during which the student should answer questions from the supervisor(s) (and assessor). After the defense, the grade for the thesis is determined and communicated to the student. The internal supervisor fills in a feedback form with points of feedback for the different dimensions on which the thesis project is assessed (see Appendix 4).

### **A summary of steps in reviewing and grading the thesis project, presentation, and thesis**

- Your application for a supervisor is judged by the AI-staff members
- The project proposal is judged by the supervisor(s) (and a second assessor), where the internal supervisor is responsible for the final result;
- The project is examined by the supervisor(s) (and a second assessor), with again the internal supervisor having the main responsibility;
- The presentation is examined by the supervisor(s) and AI staff present during the presentation;
- The thesis is examined by the supervisor(s) (and a second assessor) under the responsibility of the internal supervisor. The grade for the thesis is based on the thesis, the presentation, the defense, and the work done during the research project (see Appendix 4).

### **Rules of conduct, scientific integrity and archiving your results**

Scientific integrity has been an ongoing topic of attention in the world of research. In 2012, a severe breach of scientific integrity has shocked the national and international research communities. As a result, in 2012 and early 2013, several reports have been published on this topic (e.g., by the College van Bestuur, the KNAW (commission Schuyt) and the FSW). The commission Schuyt has identified three categories where the breaching of scientific integrity is evident:

- *Fabrication*: fraud with research data; to make up, fabulate, or fabricate research data.
- *Falsification*: to manipulate or falsely present research data and findings, e.g. by leaving out outcomes that negatively influence the research outcomes.
- *Plagiarism*: the practice of taking someone else's work or ideas and passing them off as one's own, without appropriately referring to the source of the work or ideas.

During the BSc thesis project, the student and supervisors must obey internationally recognized principles of scientific integrity. Pending detailed instructions from the CvB and FSW, the following rules of conduct should be obeyed. These hold for both the student performing the research and the supervisor(s) guiding the student:

- Avoid the three categories of breaching scientific integrity listed above;
- Show the expected level of independence. When using work from others, make the use clear by proper reference. Never claim credit for work from others (software/ideas/text), neither implicitly (not mentioning the original author) nor explicitly (student claims authorship).
- Respect each other and your peers;
- In case of questionable practices, or cases where it is unknown which procedure to follow, consult the BoE;
- Each thesis must contain a detailed justification of methods and data used in the research;
- After performing the research, the supervisor must take care of proper archiving the data, software and results, following the standards and guidelines of the Bachelor programme in AI.

Please note that these rules of conduct are not exhaustive. A careful and professional attitude is expected from the supervisors. Furthermore, it is expected that the student has acquired this attitude already during the Bachelor programme and that s/he will further develop an appropriate level of scientific integrity during the project.

### **Process of the thesis project**

The thesis project comprises the following consecutive steps (time frame is tentative):

- *±3-4 months before start*: The student decides if the requirements can be met by the time of the start of the thesis project, which is either in the Spring or Fall periods.
- *±3-4 months before start*: He/she searches for possible projects, research topics and supervisors.

- *±3-4 months before start:* He/she visits the BAKO and submits the application for supervision
- *±2 months before start:* The student gets a suitable supervisor appointed
- *±1 month before start:* The student writes the project proposal on the basis of the research topic and the available initial literature.
- *±2 weeks before start:* The supervisors judge the project proposal.
- *Start of the thesis project:* After approval of the proposal, the thesis project officially commences and the student finalizes the proposal based on comments provided by the supervisors.
- *Within one week of starting:* The student makes any required changes to the proposal and the proposal is archived (signed by the internal supervisor) at the Secretariat AI.
- *The thesis project:* The student carries out the thesis project according to the research plan from the thesis project proposal. The student and supervisors monitor the time frame of the research plan. If required, the research plan and research goals should be adapted in joint cooperation between student and supervisors.
- *The presentation:*
- *After the thesis project:* The student writes the thesis, guided by the supervisors. Notes and parts of the thesis may be written during the thesis project.
- *After finalizing the thesis satisfactorily to the supervisors:* The student and supervisors determine a date and time for the defense.
- *Two weeks before the defense:* The student delivers two hard copies of the thesis and a digital pdf exemplar to the Secretariat AI. Each supervisor should also get a copy.
- *Two weeks before the defense:* The internal supervisor archives the results and checks the thesis on plagiarism using *Ephorus*.
- *Before the defense:* The student gives a presentation of the work done. The student determines with the supervisors when the work is in a sufficiently mature stage for presentation. The student sends an email request to participate in the next BaMa Presentation Session to the Secretariat AI. The presentation is judged by the supervisors and the AI staff members present at the session. The student receives feedback from the audience. The grade for the presentation must be six or higher.
- *The defense:* The student defends the thesis as best as possible. Immediately following the defense, the supervisors and manuscript committee determine the final grade for the thesis project, which is communicated with arguments to the student.

## Complaints

- a. Both the supervisors and the student can direct complaints to the “opleidingscommissie” AI in case of irregular or unsatisfactory events during the supervision of the thesis project. Furthermore, students and supervisors can direct a written appeal to the BoE AI in the following cases:
  1. If a supervisor fails in providing proper supervision or guidance, the student can request the BoE to appoint another supervisor. The student can indicate a preferred supervisor.
  2. If a student fails in achieving proper progress due to a lack of skills or due to a wrong attitude and motivation, the supervisor can request the BoE to allow for termination of the supervision of the thesis project. The BoE will decide on whether continuation of the thesis project is justifiable, who will take over the supervision, and at which phase of the research the student can continue under supervision of the newly appointed supervisors.
- b. The student can complain about the examination (grades) of the thesis and direct the complaints to the BoE. The BoE will advise the head of the AI Department about a possible new grading. The advice will be given after hearing both the student and supervisors and using the available filed information (e.g., thesis project proposal, thesis, evaluation forms).

## **Appendices**

1. Template project proposal
2. Guidelines for writing BSc theses in AI
3. Evaluation criteria for presentation
4. Evaluation form for thesis research



**Template Project Proposal for BSc Artificial Intelligence Thesis Research**

**PERSONAL INFORMATION STUDENT**

Student name : \_\_\_\_\_  
Telephone : \_\_\_\_\_  
Studentnumber : \_\_\_\_\_  
E-mail address : \_\_\_\_\_

**PROJECT DESCRIPTION**

**1. TITLE OF RESEARCH PROJECT:**

**2. Supervisors (include affiliation) *date + signature of internal supervisor are required!***

**3. ABSTRACT: (MAX 100 WORDS) *INCLUDE A WORD COUNT***

**4. PROJECT DESCRIPTION: (MAX. 1000 WORDS) *INCLUDE A WORD COUNT***

BACKGROUND OF PROJECT (THEORY, STATE OF THE ART)

AIM OF THE PROJECT (RESEARCH QUESTION, MOTIVATION, IMPACT, IMPORTANCE)

RESEARCH PLAN (APPROACH, METHODS, DESIGN, ANALYSES)

**5. SCHEDULE: (MAX. 1 PAGE)**

SPECIFICALLY STATE THE START AND END DATES AND MILESTONES OF THE VARIOUS PHASES OF THE RESEARCH PROJECT. FURTHERMORE, INDICATE THE PLANNED BSC/MSC PRESENTATION SESSION.

**6. SCIENTIFIC, SOCIETAL AND/OR TECHNOLOGICAL RELEVANCE (ONLY WHEN RELEVANT) (MAX. 250 WORDS) *INCLUDE A WORD COUNT***

**7. REFERENCES: (MAX. 20)**

## **Guidelines for writing BSc theses in AI**

### **Content**

- The thesis should be a scientific manuscript, reporting on scientific results in a way that is customary in scientific journals or books.
- Each thesis must contain a detailed justification of methods and data used in the research.
- In case where the thesis is written in the form of an article, it must be accompanied by appendices describing the methods and data used, results achieved and contributions made during the thesis project which did not get reported explicitly in the article.
- The thesis should have a clear organizational structure. Typically, for empirical and modeling research, this will include a Title, Abstract, Introduction, Methods (or Model), Results (or Simulations), Discussion (plus possibly a Conclusion), References (plus possibly Appendices). For theoretical research other structures may be more suitable.
- The thesis should describe research that is clearly relevant for the field of Artificial Intelligence (broadly defined). If judged necessary by the supervisors, devote a section explaining or highlighting this relevance.

### **Format**

- The thesis can be written as a scientific *article* or as a *book* (with a strong preference for the latter)
- The thesis should be preferably written in English
- The thesis should be preferably written in LaTeX
- The thesis should have a consistent format structure, using headings and subheadings (preferably conforming to APA, IEEE, BNAIC, CogSci or some other consistent AI related publication format).
- The thesis must have a cover page stating the following information: Title of the thesis, Student name and number, "Artificial Intelligence", "Radboud University Nijmegen", Date, Supervisor(s) and corresponding affiliation(s), "Bachelor's Thesis in Artificial Intelligence", Reading Committee. (*see for examples of completed theses the public website [www.ru.nl/ai](http://www.ru.nl/ai)*)

## Evaluation form Presentation

### *Bachelor (BSc) AI Thesis Research*

**Student name:**

**Date:**

**Supervisor(s):**

**Assessor:**

**Recommended Grade:**

#### **Content**

Was the research question clearly introduced and motivated?

Were the methods used clearly explained?

Were the results clearly presented?

Were the conclusions clearly presented? Was the 'take home message' clear?

Was the argumentation sound and clear (conclusions supported by evidence and/or reasoning)?

#### **Organization of the presentation**

Were the slides clear (background, color, font, size, readable figures, not too much text)?

Were supporting illustrations, animations and/or examples used in an effective way?

Was the presentation well structured (introduction, methods, results, conclusion)?

Was the presentation interesting (e.g., stimulate your thinking, new perspective, implications)?

#### **Answer Questions**

Answers to the point or dodgy (content)?

Answers clearly formulated (style)?

**Further remarks** (e.g., Any fun? Any (crazy) new ideas? Was he/she relaxed or nervous? Did he/she have good contact with the audience? Did he/she speak (too) fast/slow or lively/monotonous? Anything remarkable (clothes, attitude, body language, event)? Anything noticeable about the English (accent, pronunciation, errors)? Were the sheets distracting (too many gimmicks)?)



