

Andreas Holzinger
VO 706.996 W DiplomandInnen Seminar
VO 706.997 W DissertantInnen Seminar



Welcome to the Holzinger Group HCI-KDD Part 3: Formalia for PhD Students Requirements and Strategies



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Web: <http://hci-kdd.org/scientific-working-for-students>



- The “best” is the enemy of the “good” – whenever you try to be “perfect” – there is the danger that you finalize nothing*) ...”

*) zero, nada, null

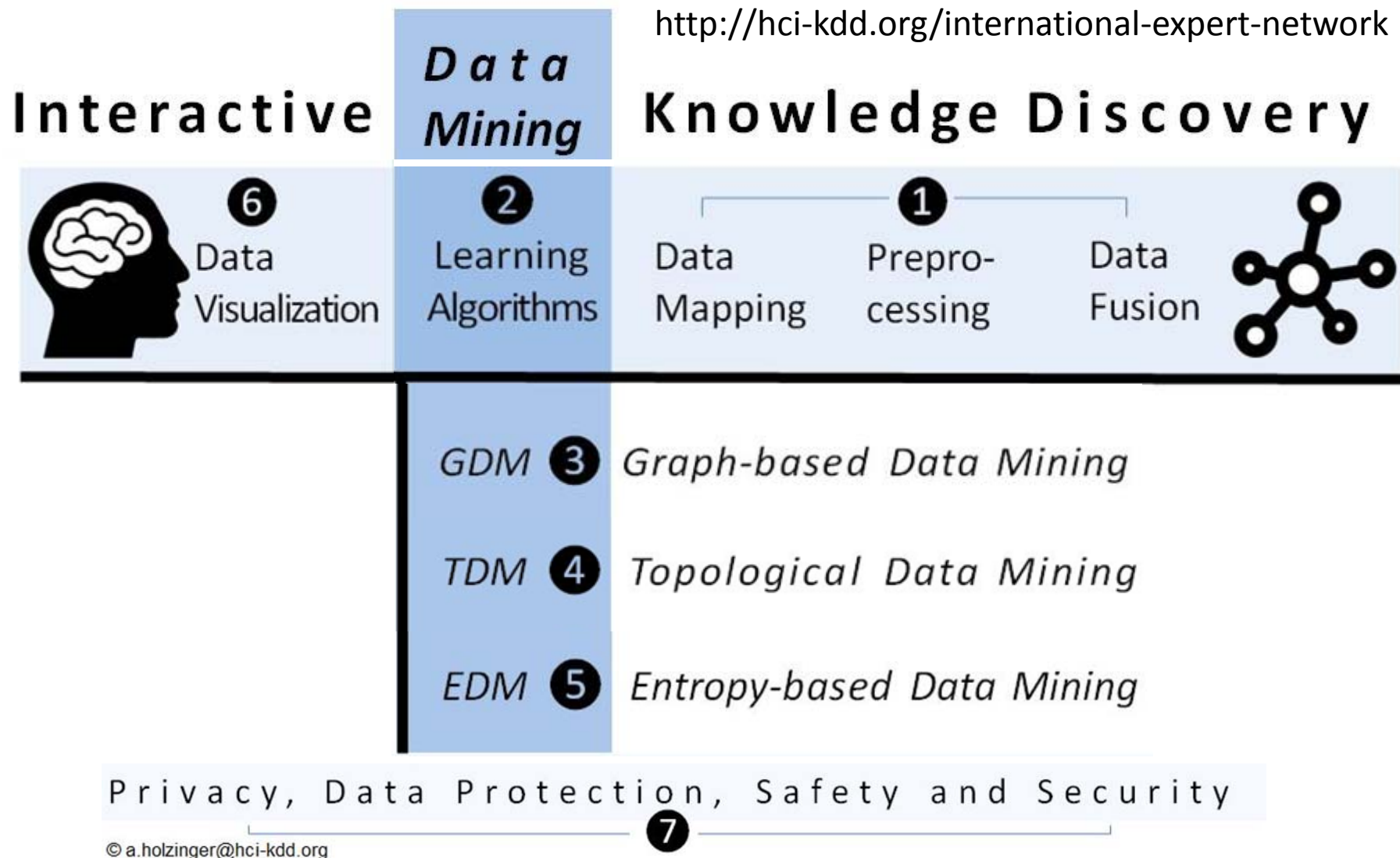


François-Marie Arouet (1694 – 1778)
known as “Voltaire”



**Science is to test crazy ideas –
Engineering is put these ideas
into Business!**

- At the end of this seminar you should
- ... be familiar with the formal requirements
- ... be aware of the requirements for a PhD
- ... know the HCI-KDD approach
- ... have an overview on our research topics
- ... understand what research is
- ... getting started with your work
- ... understand how to write a paper



Holzinger, A. 2014. Trends in Interactive Knowledge Discovery for Personalized Medicine: **Cognitive Science meets Machine Learning**. IEEE Intelligent Informatics Bulletin, 15, (1), 6-14.

Formalia Doctoral Program

Curriculum for the Doctoral Programme in Technical Sciences

Curriculum 2007 in the version of 2012

Legal validity remains restricted to the German original

The changes to the curriculum for the Doctoral Programme in Technical Sciences were decided by the Curricula Commission for Doctoral Programmes and University Courses on May 14, 2012.

On the basis of the Universities Organisation and Studies Act (UG 2002), Austrian Federal Law Gazette (BGBl.) No. 120/2002 in its valid version, the Senate of Graz University of Technology issues the following curriculum for the Doctoral Programme in Technical Sciences.

§ 1 Objective and Qualification Profile

(1) Beyond pre-professional education, the objective of the Doctoral Programme in Technical Sciences at Graz University of Technology is to develop students' ability to do advanced, independent scientific research in the fields of competence of Graz University of Technology. Graduates are awarded the academic degree of Doktorin/Doktor der technischen Wissenschaften (Doctor of Technical Sciences; Dr. techn.). According to UG 2002, § 54, section 4, this degree is equivalent to the highest academic degree of "Doctor of Philosophy (PhD)".

(2) Qualification profile

A graduate of the Doctoral Programme of Technical Sciences of Graz University of Technology has advanced and perfected the ability to formalise problems in the engineering and natural sciences and to develop research-guided analyses and solutions. The graduate is capable of performing high-level scientific work independently.

The graduate is capable of team work in the field of engineering and scientific research, in both the university and industrial sectors, and can assume coordinating and leading functions.

The graduate has a broad basis and a consolidated field of specialisation and can thus advance and innovatively apply scientific knowledge in various fields of application.¹⁾

§ 2 Admission, Curricular Workload and Period of Study

(1) Applicants are admitted to the programme by the Rector. Further to the general requirements according to § 60 and 63 UG 2002, admission is subject to the following prerequisites pertaining to the part on study regulations of the statutes of Graz University of Technology:

1. a relevant diploma or master's degree of a university in Engineering or the Sciences, or
2. a different degree of a recognised Austrian or foreign school of higher education equivalent to number 1., or
3. a degree of a recognised Austrian or foreign school of higher education, together with supplementary curricular obligations.
4. A Bachelor's degree in a qualifying subject of a university according to § 64, section 4a UG.

For admissions according to point 4, the admission criteria of the Rector's Office Guidelines on "Proof of General Eligibility for Admission to Doctoral Studies on the Basis of a Bachelor's Degree" also apply.

Applicants with degrees missing the equivalence criteria of numbers 1 or 2 may be subject to specific additional classes. Their scope and content are determined by the Vice Rector of Teaching and Studies through the Dean of Studies of the related faculty in consultation with the coordinator of the respective doctoral school (see § 3)²⁾.

(2) Studies of doctoral candidates admitted according to section (1), numbers 1 or 2, are single-stage periods of 3 years (official period of the programme). Studies of doctoral candidates admitted according to section (1), number 3, may be extended by up to two semesters. The period of studies may be shortened if all the criteria specified in the curriculum have been met and all imposed additional obligations have been fulfilled. The shortening of the period of studies requires written approval by the Dean of Studies.

§ 3 Doctoral Schools

(1) Doctoral schools are expert boards responsible for implementing the subject-specific details of the curriculum. Every doctoral school comprehends a broad subject area with its sub-disciplines. Doctoral schools may be set up across faculties or in cooperation with other universities. In this case the teaching responsibilities according to § 6 are to be shared in mutual consultation between the participating faculties or universities.³⁾

(2) In the admission process, every doctoral candidate is assigned to a doctoral school, which he/she has the right to propose. As a rule, the doctoral supervisor should be a member of this doctoral school.⁴⁾

(3) Every institute of Graz University of Technology is assigned to a doctoral school. Every doctoral school comprises the faculty with a *venia docendi* of the assigned institutes, as well as the assigned doctoral candidates. The doctoral schools are set up upon approval by the curricular commission for doctoral and postgraduate programmes and presentation to the Senate by the curricular commission. Every doctoral school nominates a coordinating team and its chairman.

(4) The coordinating team works out the statutes of the doctoral school. The statutes specify the contents of the instructional classes according to § 6. In inter-faculty and inter-university doctoral schools it determines the guidelines of cooperation. The subject-specific educational goals and qualification profiles are also outlined in the statutes. The curricular commission for doctoral and postgraduate programmes approves the statutes and presents them to Senate.⁵⁾



External Member with Venia Docendi

External Member with Venia Docendi

Havemann, Sven, Dipl.-Inform. Dr.-Ing. Priv.-Doz.

Holzinger, Andreas, Mag.phil. Mag.rer.nat. Dr.phil. Univ.-Doz. Ing.

Leberl, Franz, Em.Univ.-Prof. Dipl.-Ing. Dr.techn.

Maurer, Hermann, Em.Univ.-Prof. Dr.phil.

Strohmaier, Markus, Dipl.-Ing. Dr.techn. Priv.-Doz.

§ 4 Rights and Duties of Doctoral Supervisors and PhD Students

(1) In the admissions process, the doctoral candidate proposes a supervisor. Upon acceptance of a doctoral candidate, an educational agreement is concluded and signed by the doctoral candidate, the supervisor, and the Dean of Studies.

(2) The supervisor confirms with personal signature that, according to the supervisor's expertise in the subject, the PhD project may be accomplished within the envisaged timeframe. The doctoral candidate agrees with personal signature to observe the guidelines of Graz University of Technology ensuring good scientific practice.

(3) One task of the supervisor is to guide the PhD student towards independent scientific work. This includes encouraging activities of independent scientific publication.

(4) The PhD student and the supervisor discuss the progress of the PhD project at regular intervals. Either party can ask for meetings in person.

The PhD student provides the supervisor with yearly progress reports about the PhD project. The supervisor comments in a written form.

The report and comments are made available to all members of the doctoral school with a *venia docendi*.⁶⁾

(5) Failure to submit a PhD thesis within 5 years after admission to the doctoral programme requires justification in the respective report and a comment from the supervisor according to section (4).⁷⁾

(6) In serious cases, the supervisor is entitled to apply to the Dean of Studies to resign as the supervisor. Together with a justification, the request is made public within the doctoral school.

(7) In case of irreconcilable differences on the PhD project between the PhD student and the supervisor, both parties are entitled to appeal to the Dean of Studies as the arbitration authority.

§ 5 PhD Thesis

(1) In the course of the doctoral studies, a PhD thesis is to be written, which proves the doctoral candidate's ability to master new scientific problems independently.

In the admission process, the doctoral candidate, in consultation with the supervisor, proposes a working title for the PhD thesis and the respective doctoral school. A short description of the PhD project is made available to the members of the doctoral school with a *venia docendi*.⁸⁾

(2) The PhD thesis is assessed according to § 28, sections 5 through 7, of the part on study regulations of the statutes of Graz University of Technology. As a rule, the supervisor is the first referee of the PhD thesis. In consultation with the Dean of Studies, additional referees are pre-selected by the coordinating team of the doctoral school. The supervisor and the doctoral candidate have the right to propose names of referees. At least one referee should be from outside Graz University of Technology. Referees must not all be employed at the same institute. The members of the doctoral school with a *venia docendi* according to § 3 section (3) are informed about the pre-selection of referees by the coordinating team and have the right to comment.⁹⁾

(3) The referees should be pre-selected 2 months before submission of the PhD thesis at the latest. From that time on, all the referees are to be provided with a preliminary version of the PhD thesis. Upon submission of the PhD thesis, the Dean of Studies initiates the final assessment by the selected referees. As a part of the assessment, the PhD thesis is to be marked according to the applicable rating system.¹⁰⁾

(4) Upon submission of the PhD thesis, the required number of copies as specified by Graz University of Technology is to be made available. The graphics design and binding should follow the guidelines of Graz University of Technology.

(5) The PhD thesis must present the new scientific knowledge from the work accomplished and a comparison with the current state of scientific research. The work carried out must be documented consistently and the results presented in a comprehensible form. The structure of the PhD thesis should follow the standards of the subject. For group work, the individual contributions of each student are to be clearly identified, according to § 28, section 1 of the part on study regulations of the statutes of Graz University of Technology. Every contributing doctoral candidate must submit an independent PhD thesis. It is recommended that the PhD thesis be written in the usual language of the subject.¹¹⁾

(6) Publication of finished parts of the PhD thesis in international scientific media, even before assessment, is recommended. If evidence of such publications cannot be provided at the time of appointment of the referees, at least three referee reports are required. At least one report must come from outside Graz University of Technology. A final comprehensive PhD thesis is, however, indispensable. This thesis may consist of a summary of publications of the candidate ("Mantel" PhD thesis) and must include a list of publications of the doctoral candidate.¹²⁾

7) As a rule, the PhD thesis (as a whole) must be made publicly available after the defence. In exceptional, justified cases the doctoral candidate can apply to the Dean of Studies for restriction of access to the thesis. The period of restriction is temporally limited. The doctoral school is to be informed about the restriction.¹³⁾

§ 6 Instructional Classes

(1) The extent of the instructional classes is 14 semester course hours, broken down as specified in the following sections (2) through (4). In justified cases, the statutes of a doctoral school may require more classes.¹⁴⁾

(2) Subject-specific basic courses (6 - 8 semester course hours, selection from a catalogue of compulsory courses)

Every doctoral school specifies courses at a high level. They widen the PhD student's knowledge in the own field and the specific topic of the PhD thesis and lead to the current state of research in additional fields.

1. A catalogue of courses is to be established by each doctoral school. The Dean of Studies, in consultation with the coordinating team of the doctoral school, assigns the courses.
2. The basic topics of these courses should be fixed in advance to a large extent, and they should be offered at least every two years. The institutes of the doctoral school should be involved in setting up and updating these courses on a regular basis.
3. A preview of the courses for the doctoral programme is to be made public in due time for two years in advance.
4. The doctoral candidate selects the subject-specific basic courses primarily from the catalogue of the candidate's doctoral school according to § 3, section (1). Courses from other subject areas or other universities may be chosen upon application to the Dean of Studies and consultation of the candidate's supervisor. The doctoral school shall make the choices public.¹⁵⁾

(3) Scientific Methods and Communication (4 - 6 semester course hours are mandatory)

1. Each doctoral school offers, on a yearly basis, "Methods of Scientific Work" (2 semester course hours) as a semester or full-year course or seminar, compulsory from the first year of studies. The course reviews, teaches and discusses fundamental methods and conventions of research in the respective subject area. It is recommended to include qualified lectures on the history and theory of science of the respective subject area.
2. The "Doctoral Seminar" (2 x 1 semester course hours) is offered as a full-year course in every doctoral school, compulsory from the second year of studies. Professors of the doctoral school take turns in directing this seminar. All the PhD students participate and give presentations. All members of the doctoral school are expected to attend the seminar. The purpose of the seminar is to help the PhD students to improve on their speaking to a public, communication skills, and presentation of their field of work. Attendance is mandatory.
3. Up to 2 semester course hours of so-called "soft-skill" courses (presentation skills, rhetorics, etc.) may be selected from the catalogues of different fields of study, provided that they were not already a part of a previous degree.¹⁶⁾

(4) The Exclusive Seminar ("Privatissimum"; 2 semester course hours), compulsory in the course of the doctoral programme, is usually offered by the supervisor of the PhD student.

(5) The courses listed in sections (2) to (4) are marked individually; passed exam results are either "very good" (1), "good" (2), "satisfactory" (3), or "sufficient" (4). Negative results are marked as "unsatisfactory" (5). An exception is the doctoral seminar, for which proof of successful participation is sufficient.

(6) The instructional classes are subsumed into a single examination subject. An examination subject is successfully completed if all of its courses were completed successfully. The mark of the examination subject is determined as the average of the individual examination marks weighted by the number of semester course hours of the courses. Values with decimals greater than 5 should be rounded up to the next whole number; smaller numbers are rounded off.¹⁷⁾

§ 7 Thesis defence

(1) The defence of the PhD thesis is the final examination in the doctoral studies. The date of the thesis defence may be set upon proof of successful completion of the courses according to § 6, submission of the annual reports according to § 4, section (4), and positive assessment of the thesis according to § 5, sections (3) and (4), in compliance with the guidelines in § 21 and 22 of the part on study regulations of the statutes of Graz University of Technology. The defence is public in front of a board of at least three examiners.

(2) The board of examiners is convened by the Dean of Studies in compliance with the guidelines of § 23 of the part on study regulations of the statutes of Graz University of Technology. The board consists of a chairperson and at least two examiners. The examiners do not have to be the referees, and they must not be employed at the same institute. They are proposed by the coordinators of the doctoral school, taking into consideration the doctoral candidate's right to propose examiners. The proposed board is to be made public within the doctoral school.

(3) The thesis defence is an examination in two parts, consisting of

1. a presentation by the doctoral candidate of appropriate length on the scientific work conducted, and
2. an oral examination on the subject area of the PhD thesis by the board of examiners.¹⁸⁾

(4) The thesis defence is assessed (marked) according to § 24, sections 5 and 6 of the part on study regulations of the statutes of Graz University of Technology.

- $180 + 120 = 300$ ECTS min. for **PhD admission**
- Duration: **36 months** regular (max. 48 months)
- Classes over the 36 months: **14 course hours***
e.g. this course LV 706.997 has one hour, LV 706.315 has two hours, 706.046 has three hours
- **PhD-Plan** for the 36 months with deliverables
- Deliverables in form of **papers** to international peer-reviewed conferences/journals
- **Recommended output:** 2 papers per year (e.g. one conference and one journal)
- **Minimum: 1 paper per year**
- Yearly **progress report** (1 page)

*) in German: Semesterwochenstunden (semester course hours), no ECTS necessary!

- **First step: 8 weeks in advance to the exam date**
- ☐ Let your courses check for eligibility (Dekanat für Informatik und Biomedizinische Technik),
- ☐ Check if **all** courses are visible in the TUGOnline with the correct Studienkennzahl ! (If necessary you need Anrechnung/Anerkennung (=approval) for the PhD study from the dean!)
- ☐ announce your committee, usually consisting of three people:
 - 1) PhD-advisor = first reviewer/examiner
 - 2) an external international reviewer/examiner (if this person will not be able to come to the exam, an internal replacement should be prepared in advance)
 - 3) a third internal examiner (who should be not from the same Institute as the PhD-advisor)
- ☐ **Check carefully the exam date with everybody involved**
- ☐ Deliver to all examiners copies of your Mantel-Thesis

- **Second step: 4 weeks in advance to the exam date**
- ☐ Register/upload **final version** of your thesis to TUGonline
- ☐ The PhD-advisor must sign the plagiarism form
- ☐ The Thesis must be confirmed and released in the TUGonline (orange-button → green-button)
- ☐ the link to the thesis abstract must be send via e-Mail to the Dekanat (this must be done with your student account!) – before you do that, please:
- ☐ **Double-check and confirm your exam date with everybody involved and do not forget to reserve a room!**
- ☐ if the exam date is fixed (people, room) then you have to send the date, time, location along with the link of the thesis abstract via e-mail to the Dekanat
- ☐ Statistikblatt USt2 must also be send via e-mail to the Dekanat
- ☐ If you want to attend the formal promotion act in the Aula, you have to send payment, curriculum and abstract to the Dekanat – you can take part in any promotion within one year after the Rigorosum

- **Third step: 2 weeks in advance to the exam date**
- ☐ Two hard copies of your Mantel-Thesis must be delivered to the Dekanat (physically – not via e-Mail ;-)
– inclusive signed plagiarism form.
- ☐ Double-check people, time, location
- ☐ Do not forget to invite your family, friends, ...
and your fan-club
- ☐ Do also not forget to provide copies of your work to
selected people with a personal dedication (family,
friends, professors you liked ;-)

- **Fourth step: 0 weeks in advance to the exam date**
- ☐ Be at the location well in advance
- ☐ Prepare your equipment, test your presentation and then ... relax
- ☐ Ask the chair to provide you with timing hints so that you do not exceed your speaking time
- ☐ After your presentation, be attentive and carefully answer all questions thoroughly
- ☐ Congratulations!!!



**Sample Title: Awesome Machine Learning
Experiments
PhD-Proposal 2017–2019**

Your Name¹, Supervisor: Andreas Holzinger¹²

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Medical University Graz, Auenbruggerplatz 2/V, A-8036 Graz, Austria
your.email@your.server.org

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Abstract. My work in this 6-semester PhD-project will contribute to the goal of discovering knowledge from high-dimensional complex data sets by using interactive machine learning ... within six work packages I will work towards ... (please describe your overall goal and briefly what you want to do - one sentence for each of the 6 work packages) ...

Keywords: Machine learning, knowledge discovery, health informatics ...

1 Motivation for my Research

Please provide at first a short and concise summary WHY you think your research is necessary, interesting, and relevant - for the targeted international scientific community

SAMPLE - please replace according your research interests:

The starting point for my work is from already performed research within my master's thesis [1], [2]. Hot and promising topics for future research in knowledge discovery and data mining from natural image data is in the application and combination of sophisticated graph analysis, topological and machine learning approaches, where natural images are seen as topographical landscapes, or map structures, similar to a terrain network [3]. In addition to this, a graph could also represent a temporal sequence of data snapshots, whose amenability to meaningful analysis depends on the development of novel graph structures which consider properties in both spatial and temporal dimensions ... PhD-Students can found more ideas in [4].

Topic XXX is one of the most important research areas in the field of YYY and gained much popularity within the scientific community through the widespread use of ZZZ.

2 Your Name, Supervisor: Andreas Holzinger

2 Scientific Questions, Hypotheses and Goals of my Research

NOTE: Without bla-bla, straight to the end, state your main question, break it down in manageable sub-questions, define your central research hypothesis, maybe break it down into sub-hypotheses and formulate your goals.

SAMPLE - please replace according your research plans:

According to previous research by [5] some open questions are:

- Are we able to find graph measures which enable or benefit multi-touch interaction?
- What kinds of structural properties do graphs in relation to multi-touch interaction have?
- Which known graph classes are appropriate to model multi-touch interaction graphs properly?

This calls for investigating graph classes beyond small world and random networks, which seem to be an obvious choice due to their structural properties. The expected results shall help us to reveal appropriate known graph classes to model comprehensive multi-touch interaction properly.

Before I may answer such question, I need to review and evaluate existing definitions of primitives and eventually develop a more in-depth language to describe gestures and multi-touch interactions.

My central hypothesis is that we can meaningfully define a Multi-touch Interaction Graph MTIG = (V, E, MTI), which consists of three sets: a set of vertices V, a set of edges E and a set of multi-touch interactions gestures MTI.

My goal based on my questions and my leading hypothesis is ...

3 PhD Workplan

The following 6 Milestones (M) shall be achieved during the 36 months of my PhD project. The milestones will be documented by publications at conferences, journals and outputs along the lines of algorithms and tools.

M01: Deep Understanding of the related work ... M02: XXX M03: XXX M04: XXX M05: XXX M06: XXX

4 WP 1 M01–M06

Start: M01 **Duration:** 6 months **Motivation:** short sentence why this WP is necessary ...

Selected Related Work:

There are currently XXX The state of the art is described by XXX Most relevant for this project are recent advances in the development of XXX A lot of research

PhD Proposal - Machine Learning 3

has been done on XXX YYY suggested to carry out research on ... However, no work has been done in YYY

Objective: define the main objective of this WP

Alternative/Additional research routes: In case it turns out that your route turns out to be too ambitious: what would be *alternative* research routes. In case your research turns out to be too easy for you and you have time left what would be *additional* research routes.

Tasks: describe with a few words the necessary tasks to reach your objectives

Deliverables: describe your main deliverables of this WP, e.g. possible conferences look at: <http://hci-kdd.org/machine-learning-conferences/> Conference paper at the XXX 2017 conference (deadline: XXX 2016), or journal paper e.g. in Springer Knowledge and Information Systems (KAIS).

5 WP 2 M07–M12

Start: M07 **Duration:** 6 months **Motivation:** short sentence why this WP is necessary ..

Selected Related Work:

There are currently XXX The state of the art is described by XXX Most relevant for this project are recent advances in the development of XXX A lot of research has been done on XXX YYY suggested to carry out research on ... However, no work has been done in YYY

Objective: define the main objective of this WP

Alternative/Additional research routes: In case it turns out that your route turns out to be too ambitious, what would be alternative research routes. In case your research turns out to be too easy for you and you have time left what would be additional research routes.

Tasks: describe with a few words the necessary tasks to reach your objectives

Deliverables: describe your main deliverables of this WP, e.g. Conference paper at the XXX conference (deadline: XXX), or expand the paper from the previous conference into a good journal paper e.g. XXX. check <http://hci-kdd.org/machine-learning-related-journals/>

4 Your Name, Supervisor: Andreas Holzinger

6 WP 3 M13–M18

Start: M13 **Duration:** 6 months **Motivation:** short sentence why this WP is necessary ..

Selected Related Work:

There are currently XXX The state of the art is described by XXX Most relevant for this project are recent advances in the development of XXX A lot of research has been done on XXX YYY suggested to carry out research on ... However, no work has been done in YYY

Objective: define the main objective of this WP

Alternative/Additional research routes: In case it turns out that your route turns out to be too ambitious, what would be alternative research routes. In case your research turns out to be too easy for you and you have time left what would be additional research routes.

Tasks: describe with a few words the necessary tasks to reach your objectives

Deliverables: describe your main deliverables of this WP, e.g. Conference paper at the XXX conference (deadline: XXX), or journal paper e.g. XXX.

7 WP 4 M19–M24

Start: M19 **Duration:** 6 months **Motivation:** short sentence why this WP is necessary ..

Selected Related Work:

There are currently XXX The state of the art is described by XXX Most relevant for this project are recent advances in the development of XXX A lot of research has been done on XXX YYY suggested to carry out research on ... However, no work has been done in YYY

Objective: define the main objective of this WP

Alternative/Additional research routes: In case it turns out that your route turns out to be too ambitious, what would be alternative research routes. In case your research turns out to be too easy for you and you have time left what would be additional research routes.

Tasks: describe with a few words the necessary tasks to reach your objectives

PhD Proposal - Machine Learning 5

Deliverables: describe your main deliverables of this WP, e.g. Conference paper at the XXX conference (deadline: XXX), or journal paper e.g. XXX.

8 WP 5 M25–M30

Start: M25 **Duration:** 6 months **Motivation:** short sentence why this WP is necessary ..

Selected Related Work:

There are currently XXX The state of the art is described by XXX Most relevant for this project are recent advances in the development of XXX A lot of research has been done on XXX YYY suggested to carry out research on ... However, no work has been done in YYY

Objective: define the main objective of this WP

Alternative/Additonal research routes: In case it turns out that your route turns out to be too ambitious, what would be alternative research routes. In case your research turns out to be too easy for you and you have time left what would be additional research routes.

Tasks: describe with a few words the necessary tasks to reach your objectives

Deliverables: describe your main deliverables of this WP, e.g. Conference paper at the XXX conference (deadline: XXX), or journal paper e.g. XXX.

9 WP 6 M31–M36

Start: M31 **Duration:** 6 months **Motivation:** short sentence why this WP is necessary ..

Selected Related Work:

There are currently XXX The state of the art is described by XXX Most relevant for this project are recent advances in the development of XXX A lot of research has been done on XXX YYY suggested to carry out research on ... However, no work has been done in YYY

Objective: define the main objective of this WP

Alternative/Additonal research routes: In case it turns out that your route turns out to be too ambitious, what would be alternative research routes. In case your research turns out to be too easy for you and you have time left what would be additional research routes.

6 Your Name, Supervisor: Andreas Holzinger

Tasks: describe with a few words the necessary tasks to reach your objectives

Deliverables: describe your main deliverables of this WP, e.g. Conference paper at the XXX conference (deadline: XXX), or journal paper e.g. XXX.

10 Risk Management

Describe possible risks involved in your research and how you will cope with the risks to avoid any delays, etc. Describe a Plan B if something turns out to be impossible or untraceable and give a statement on how you deal with unexpected events.

References

1. Holzinger, A., Malle, B., Giuliani, N.: On graph extraction from image data. In Slezak, D., Peters, J.F., Tan, A.H., Schwabe, L., eds.: Brain Informatics and Health, BIH 2014, Lecture Notes in Artificial Intelligence, LNAI 8609. Springer, Heidelberg, Berlin (2014) 552–563
2. Holzinger, A., Malle, B., Bloice, M., Wiltgen, M., Ferri, M., Stanganelli, I., Hofmann-Wellenhof, R.: On the generation of point cloud data sets: Step one in the knowledge discovery process. In Holzinger, A., Jurisica, I., eds.: Interactive Knowledge Discovery and Data Mining in Biomedical Informatics, Lecture Notes in Computer Science, LNCS 8401, Volume 8401. Springer, Berlin Heidelberg (2014) 57–80
3. Preuss, M., Dehmer, M., Pickl, S., Holzinger, A.: On terrain coverage optimization by using a network approach for universal graph-based data mining and knowledge discovery. In Slezak, D., Tan, A.H., Peters, J.F., Schwabe, L., eds.: BIH 2014 Lecture Notes in Artificial Intelligence LNAI 8609. Springer, Heidelberg, Berlin (2014) 564–573
4. Holzinger, A.: Extravaganza tutorial on hot ideas for interactive knowledge discovery and data mining in biomedical informatics. In Slezak, D., Tan, A.H., Peters, J.F., Schwabe, L., eds.: Brain Informatics and Health, BIH 2014, Lecture Notes in Artificial Intelligence, LNAI 8609. Springer, Heidelberg, Berlin (2014) 502–515
5. Holzinger, A., Ofner, B., Dehmer, M.: Multi-touch graph-based interaction for knowledge discovery on mobile devices: State-of-the-art and future challenges. In Holzinger, A., Jurisica, I., eds.: Interactive Knowledge Discovery and Data Mining in Biomedical Informatics, Lecture Notes in Computer Science, LNCS 8401. Springer, Berlin Heidelberg (2014) 241–254

Friday 14 October lecture on variational inference.

Final Project

In the second half of the course, you will complete a project. The ideal outcome of this project would be a paper that could be submitted to a top-tier machine learning conference such as NIPS, ICML, UAI, AISTATS, or KDD. There are different ways to approach this project, which are discussed in a more comprehensive document that is available from the course website under the Files tab. There are four separate components of the project:

**... to contribute to the
international scientific
community
(see next lecture)**

Appendix

1. Scientific Aspects

1.1 Motivation for Research

1.2 Goals, Scientific Questions and Hypotheses

1.3 Scientific Relevance and Innovative Aspects

1.4 Importance of the expected results

2. Work Plan

2.1 WP 1 Task 1, Task 2, Deliverable 1, Deliverable 2

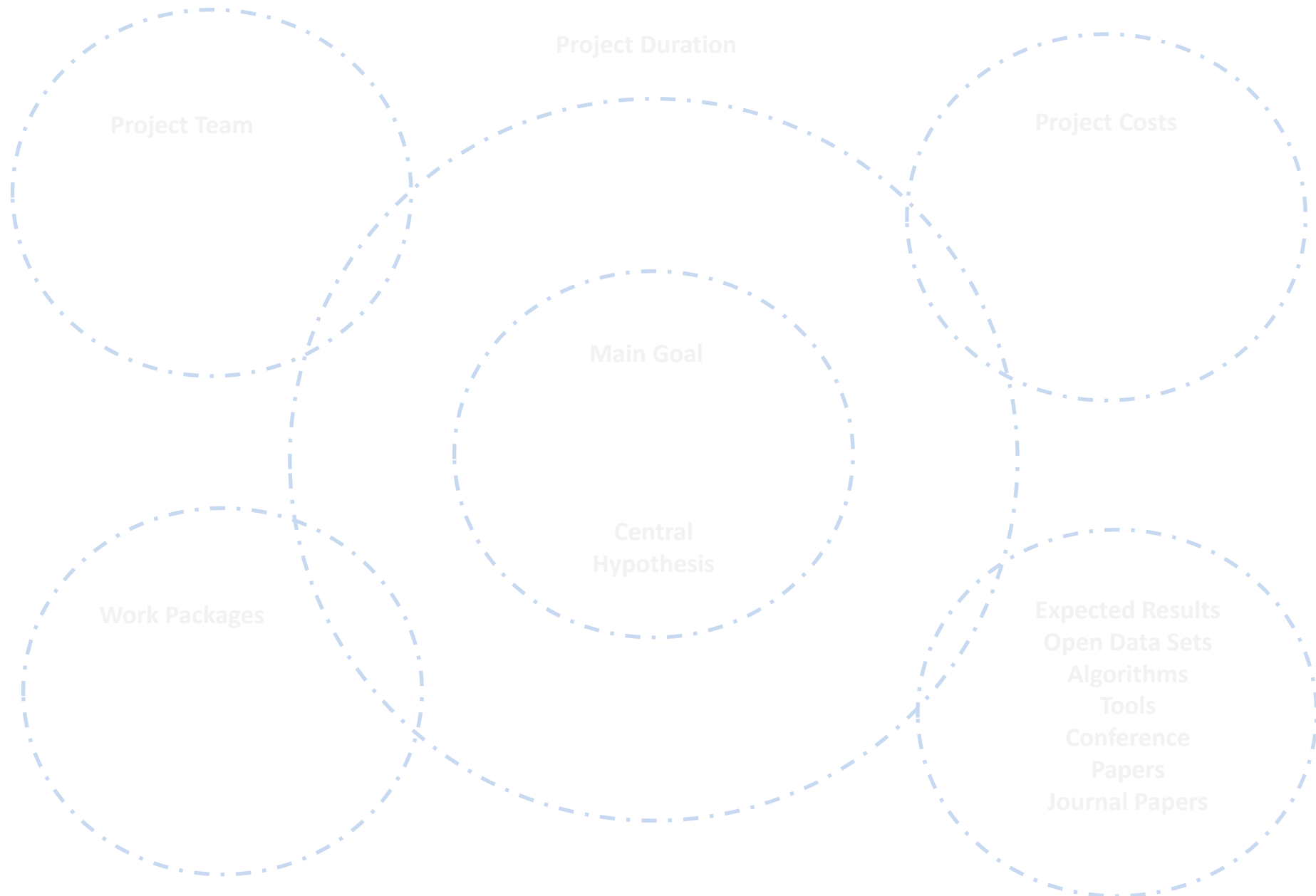
2.2 WP 2 Task 1, Task 2, Deliverable 1, Deliverable 2

2.3 WP 3 Task 1, Task 2, Deliverable 1, Deliverable 2

Task and Gantt Chart

3. Financial Aspects (PhD costs = 36,660 EUR p.a.)

4. Organizational Aspects





- **Duration of study:**
Formal duration: 3 years
Average duration: 4 to 5 years
- **Academic degree:** Doctor of Engineering Sciences (Dr. techn.), equivalent to the Doctor of Philosophy (PhD)
Alternatively, the degree of Doctor of Natural Sciences (Dr. rer. nat.) can be obtained.
- **Language of instruction:** English
- **Admission requirements:** see [requirements for doctoral programmes](#) >
- **Curricula and statutes:**
 - [Curriculum for the Doctoral Programme in Technical Sciences](#) ↓
 - [Curriculum for the Doctoral Programme in Natural Sciences](#) ↓
 - [Statutes of the Doctoral School of Computer Science](#) ↓
- **Catalogues of electives**
 - [Technical Sciences](#) ↗
 - [Natural Sciences](#) ↗

- <https://www.tugraz.at/en/studying-and-teaching/degree-and-certificate-programmes/doctoral-programmes/overview-doctoral-programmes/>
- <https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20002128>
- Deans Office with TO-DO-List:
<https://www.tugraz.at/fakultaeten/infbio/studies/deans-office>