Please note:

The legally binding version of these regulations can only be found in our Official Notices.

A neural machine translation service was used for the translation of these regulations. We do not guarantee the quality and accuracy of the translation.

Doctoral degree regulations of the Department of Computer and Data Science of the Graduate School for Applied Research in North Rhine-Westphalia

from 14.07.2023

Based on § 67b (3) and § 67 (3) of the Higher Education Act of the State of North Rhine-Westphalia (Hochschulgesetz – HG) of September 16, 2014, as amended by the Act Amending the Higher Education Act of July 12, 2019 (GV. NRW. p. 377) and the Framework Doctoral degree regulations of the Graduate School for Applied Research in North Rhine-Westphalia of January 31, 2023 (RPO), as amended, the Department Council of the Department of Computer and Data Science has issued the following doctoral degree regulations:

Contents

§ 1 Scope of application

(1) These doctoral degree regulations apply to all doctoral procedures carried out in the Department of Computer and Data Science of the Graduate School for Applied Research in North Rhine-Westphalia.[1] Insofar as no provisions have been made in these doctoral degree regulations, the corresponding rules of the framework doctoral degree regulations of the Graduate School for Applied Research in North Rhine-Westphalia apply.

(2) In the case of interdepartmental doctoral topics, a department is determined by the supervisors at the suggestion of the doctoral candidate and the procedure is carried out via its doctoral degree regulations. The supervisors, reviewers and members of the examination committee are appointed in such a way that the departments involved are represented accordingly.

§ 2 Conferral of doctoral degrees

(1) After passing the doctoral examination, the department awards the academic degree in the doctoral program AI and Data Science

- Doktor der Ingenieurwissenschaften (Doktor-Ingenieur – Dr.-Ing.),
- Doktorin der Ingenieurwissenschaften (Doktor-Ingenieurin – Dr.-Ing.) or
- Doktor*in der Ingenieurwissenschaften (Doktor-Ingenieur*in – Dr.-Ing.)

or the academic degree

- Doktor der Naturwissenschaften (Doctor rerum naturalium – Dr. rer. nat.),
- Doktorin der Naturwissenschaften (Doctor rerum naturalium – Dr. rer. nat.) or
- Doktor*in der Naturwissenschaften s (Doctor rerum naturalium – Dr. rer. nat.)

and in the doctoral program Applied Computer Science and Business Informatics the academic degree

- Doktor der Ingenieurwissenschaften (Doktor-Ingenieur – Dr.-Ing.),
- oktorin der Ingenieurwissenschaften (Doktor-Ingenieurin – Dr.-Ing.) or
- Doktor*in der Ingenieurwissenschaften (Doktor-Ingenieur*in – Dr.-Ing.),

or the academic degree

- Doktor der Naturwissenschaften (Doctor rerum naturalium – Dr. rer. nat.),
- Doktorin der Naturwissenschaften (Doctor rerum naturalium – Dr. rer. nat.) or
- Doktor*in der Naturwissenschaften (Doctor rerum naturalium – Dr. rer. nat.)

or the academic degree

- Doktor der Wirtschaftswissenschaften (Doctor rerum politicarum – Dr. rer. pol.),
- Doktorin der Wirtschaftswissenschaften (Doctor rerum politicarum – Dr. rer. pol.) or

[1] The provisions in these regulations do not apply to cooperative doctoral procedures in which the procedure is conducted exclusively via the right to award doctorates of the university or other universities entitled to award doctorates.

- Doktor*in der Wirtschaftswissenschaften (Doctor rerum politicarum – Dr. rer. pol.).

(2) The academic degree

- Doktor der Ingenieurwissenschaften (Doktor-Ingenieur – Dr.-Ing.),
- Doktorin der Ingenieurwissenschaften (Doktor-Ingenieurin – Dr.-Ing.) or
- Doktor*in der Ingenieurwissenschaften (Doktor-Ingenieur*in – Dr.-Ing.)

is awarded if the dissertation is predominantly of an engineering nature. The academic degree

- Doktor der Naturwissenschaften (Doctor rerum naturalium – Dr. rer. nat.),
- Doktorin der Naturwissenschaften (Doctor rerum naturalium – Dr. rer. nat.) or
- Doktor*in der Naturwissenschaften (Doctor rerum naturalium – Dr. rer. nat.)

is awarded if the dissertation is predominantly of a scientific nature. The academic degree

- Doktor der Wirtschaftswissenschaften (Doctor rerum politicarum – Dr. rer. pol.),
- Doktorin der Wirtschaftswissenschaften (Doctor rerum politicarum – Dr. rer. pol.) or
- Doktor*in der Wirtschaftswissenschaften (Doctor rerum politicarum – Dr. rer. pol.)

is awarded if the dissertation is predominantly of a business informatics nature. The decision is made by the responsible doctoral examining committee.

§ 3 Purpose and form of the doctorate

(1) The doctorate serves as proof of the ability to carry out in-depth academic work in one of the department's specialist areas. The doctorate is based on independent academic work (dissertation) and an oral examination (disputation).

(2) The doctorates take place within the framework of the doctoral programs mentioned in § 2 (1). Within the framework of both doctoral programs, the requirements specified in the compulsory and compulsory elective areas must be fulfilled. These are part of the requirements for admission to the doctoral procedure.

(3) The doctorates can also be carried out across departments. The fulfillment of the requirements of the doctoral programs remains unaffected. In justified exceptional cases, it is possible to deviate from the requirements of the compulsory elective area. This must be specified in the supervision agreement and must be approved by the doctoral examining committee.

(4) The duration of a doctorate should not exceed five years. In justified cases, the doctoral examining committee may extend the deadline by one year in each case upon application, which must be submitted sufficiently in advance of the deadline; the application must be accompanied by a justification and a statement from the supervisory team. Acceptance as a doctoral candidate expires at the end of the maximum permissible period of twelve years, unless the doctoral procedure has already been initiated. The personal circumstances of doctoral candidates can be taken into account; periods of protection and leaves of absence in accordance with § 20 are not counted towards the duration of the doctorate.

§ 4 Doctoral examining committee

(1) The composition, responsibilities and working methods of the doctoral examining committee are regulated in § 4 of the RPO.

(2) The doctoral examining committee is responsible for both doctoral programs in the department.

(3) To ensure a quorum, two deputies are appointed for the elected professorial members.

(4) The majority of the professorial members must belong to the department.

(5) Secret ballots and the transfer of voting rights are not permitted for decisions relating to examination law and, in particular, for decisions on the withdrawal of doctoral degrees.

(6) Certain tasks and decisions, particularly of an administrative nature, may be delegated to the chairperson. The delegation of these tasks and decisions is determined by the doctoral examining committee and can be changed when it is newly composed.

§ 5 Admission requirements

(1) According to HG § 67 (4), access to the doctoral procedure is granted to those who hold

a) a degree following a relevant university course of study with a general standard period of study of at least eight semesters, for which a degree other than “Bachelor” is awarded, or
b) a degree after a relevant university degree with a general standard period of study of at least six semesters and subsequent appropriate studies in the doctoral subjects in preparation for the doctorate or
c) a degree from a Master's degree program within the meaning of HG § 61 (2) sentence 2

which was obtained in a natural science, engineering or business informatics subject with basic informatics content and with a final grade of at least 2.3 (good). If the qualified degree according to sentence 1 a) to c) was not obtained in a natural science, engineering or business informatics subject with basic informatics content, the doctoral examining committee may exceptionally admit the applicant to the doctorate, provided that the other admission requirements are met. Admission to the doctoral procedure is granted to those who additionally

d) demonstrate language proficiency in German or English to at least level B2 (according to the Common European Framework of Reference for Languages (CEFR))
e) have not already been accepted as a doctoral candidate or admitted to doctoral studies in the same academic subject at another faculty or university and have not already passed a corresponding doctoral examination in the same academic subject at a university.

(2) If admission to the doctoral procedure is granted in accordance with § 5 (1) b), the doctoral examining committee shall determine the modules and examinations to be completed as part

of the preparatory studies for the doctorate, taking into account the completed course of study and the envisaged dissertation topic. The required scope of work may not exceed the number of ECTS credits required for a consecutive Master's degree. The modules and examinations must be taken from the Master's degree programs of the supporting universities that are relevant to the doctorate. The pre-doctoral studies have been passed if all modules and examinations to be taken have been completed with an average grade of at least “good” or 2.3. The requirements must be fulfilled by the start of the doctoral procedure, unless another deadline is specified.

§ 6 Acceptance as a doctoral candidate

(1) Acceptance as a doctoral candidate by the doctoral examining committee is regulated in § 6 of the RPO.

(2) Acceptance is initially limited to five years and can be extended by one year at a time upon justified request, provided the supervisory team confirms that this is necessary. Acceptance as a doctoral candidate expires at the end of the maximum permissible duration of twelve years of the doctorate, unless the doctoral procedure has already been initiated. Protection periods and leaves of absence in accordance with § 20 are not counted towards the duration of the doctorate.

§ 7 Supervision

(1) Supervision is regulated in § 7 of the RPO.

(2) The supervisors support the doctoral candidate in an appropriate manner in the various work steps and phases. They undertake to provide professional supervision that ensures the continuous and targeted implementation of the doctoral project. Professional and personal circumstances (e.g. employment, family obligations) of the doctoral candidate can be taken into account in justified individual cases.

(3) Decisions in the support team should generally be made by mutual agreement.

(4) Doctoral candidates and supervisors regularly exchange information about the progress of the doctoral project.

(5) For the purpose of constructive and productive collaboration, the conclusion of a supervision agreement is mandatory and this becomes effective upon acceptance as a doctoral candidate. In this agreement, the doctoral candidate agrees a structured work plan and timetable with the supervisors, among other things.

(6) At least once a year, the doctoral candidate and the supervisor (or at least one supervisor) meet for a progress meeting to discuss the progress of the doctoral project, to agree on the next steps and any events to be completed and to update the above-mentioned work plan and timetable.

The doctoral candidate reports in writing once a year on the status of the doctoral project and the results of their research. During the progress report meeting, the supervisors keep minutes in which progress, further planning steps and changes to the work plan and timetable are recorded. The form and type of minutes are to be determined jointly by the participants.

(7) For interdisciplinary doctoral projects, the supervisors are appointed in such a way that the disciplines involved are represented accordingly.

(8) In the case of an interdisciplinary and interdepartmental doctorate that is carried out via these regulations, at least one person in the supervisory team (see § 7 (2), (3) RPO) must come from the Department of Computer and Data Science.

§ 8 Opening of the doctoral procedure

(1) The opening of the doctoral procedure is regulated in § 8 of the RPO.

(2) The evidence required in § 8 (1) No. 7 of the RPO also includes evidence of the services agreed as part of the individual supervision agreements.

§ 9 Reviewer

(1) The appointment and exclusion of reviewers is governed by § 9 of the RPO.

(2) For interdisciplinary doctoral projects, the reviewers should be appointed in such a way that the disciplines involved are represented; however, at least one reviewer must belong to the Department of Computer and Data Science.

§ 10 Examination board

The composition and working methods of the examination board are regulated in § 10 of the RPO.

§ 11 Dissertation

(1) The doctoral candidate must submit an independent scientific thesis in the scientific field of computer science or data science that represents a significant advance in the state of scientific knowledge.

(2) The writing and assessment of the dissertation is governed by § 11 of the RPO.

(3) As a rule, the dissertation must be written in German or English throughout.

(4) In the case of a cumulative doctorate, the dissertation may be published in parts or consist of several published publications or papers accepted for publication (each peer reviewed). Further details are regulated in § 11 (4) of the RPO.

(5) In the case of a cumulative doctorate, the doctoral examining committee, in consultation with the supervisory team, determines as part of the supervision agreement how many publications are to be published in which media, organs or journals as part of the doctoral project, but at least two of at least four peer-reviewed publications must have been published or accepted for publication in internationally recognized publication organs. The doctoral candidate must be listed as the first author of at least one article.

§ 12 Expert opinions

(1) The reviews of the dissertation should also be submitted in electronic form.

(2) The deadline for posting the dissertation and the reviews in the department in accordance with § 11 (9) of the RPO may be shortened to a minimum of ten working days at the request of the doctoral candidate if there are serious reasons for doing so.

(3) In the case of an interdisciplinary, interdepartmental doctoral procedure, the inspection may be extended to other departments of the PK NRW. The decision on this is the responsibility of the relevant doctoral examining committee.

§ 13 Disputation

(1) The conduct and assessment of the disputation is regulated in § 12 of the RPO.

(2) In the case of a public disputation, the academic discussion following the lecture can be divided into a public and a non-public part.

(3) As a rule, the oral examination must be held in the language in which the dissertation is written. The examination committee decides on exceptions.

§ 14 Overall grade of the doctorate

The determination of the overall grade of the doctorate is regulated in § 13 of the RPO.

§ 15 Completion of the doctorate and certificate

The completion of the doctorate is regulated in § 14 of the RPO.

§ 16 Publication of the dissertation

The publication of the dissertation is regulated in § 15 of the RPO.

§ 17 Withdrawal from the defense

Withdrawal from the defense is regulated in § 16 of the RPO.

§ 18 Deception and revocation of the doctorate

The procedure in the event of cheating and withdrawal of the doctorate is regulated in § 17 of the RPO.

§ 19 Inspection

Inspection is regulated in § 18 of the RPO.

§ 20 Appeal against decisions in the doctoral procedure

Appeals against decisions in the doctoral procedure are regulated in § 19 of the RPO.

§ 21 Protection periods

The protection periods are regulated in § 20 of the RPO.

§ 22 Compensation for disadvantages

Compensation for disadvantages is regulated in § 21 of the RPO.

§ 23 Retention of examination documents

The storage of examination documents is regulated in § 22 of the RPO.

§ 24 Doctorate in joint supervision with universities entitled to award doctorates and joint awarding of degrees

Doctorates in joint supervision with universities entitled to award doctorates and joint awarding of degrees are regulated in § 23 of the RPO.

§ 25 Cooperative doctorates with universities not authorized to award doctorates

Cooperative doctorates with universities that are not authorized to award doctorates are regulated in § 24 of the RPO.

§ 26 Entry into force

Issued on the basis of the resolution of the Department Council of 14.07.2023. The regulations come into force on the day after their announcement in the Official Notices of the Graduate School for Applied Research in NRW.

Sankt Augustin, 14.07.2023

The Chairman of the Department Council

signed *Herpers*

(Prof. Dr. Rainer Herpers)

Attachments

1) Doctoral program AI and Data Science

2) Doctoral Program Applied Computer Science and Business Informatics

Annex 1: Doctoral program AI and Data Science of the Department of Computer and Data Science

The doctoral program AI and Data Science deals with scientific and technical approaches to generating knowledge from data, especially when traditional methods from applied computer science reach their limits or have to be automated.

The focus here is on data collection and processing, modelling and simulation, analysis and optimization as well as method evaluation and archiving of large, inhomogeneous data sets. Innovative technologies are applied in interdisciplinary approaches in order to create high-quality and efficient solutions at the interface between computer science, natural sciences, engineering, humanities and social sciences as well as industry. This requires methods from the fields of *artificial intelligence* and *data science.*

The program is aimed at doctoral candidates from computer science and related disciplines, in particular information science, mathematics, physics, mechanical engineering, industrial engineering, statistics, automation and electrical engineering as well as geosciences and life sciences. Comprehensive basic mathematical knowledge and sound knowledge in special areas of computer science, statistics and the respective application domains are therefore important prerequisites. Due to the interdisciplinary and international approach (English is the lingua franca), the program is very well suited for foreign doctoral candidates.

The compatibility of family and academic work is particularly supported. Special support measures are agreed as required (see also the guidelines of the PK NRW on the compatibility of family and academic work).

1 Aim of the program

The aim of the *AI and Data Science* doctoral programme is to provide Doctoral candidates with an overarching view of the methodological foundations of the disciplines of data science, artificial intelligence and machine learning that goes beyond specializations in the individual disciplines (computer science, information science, mathematics, physics, mechanical engineering, industrial engineering, statistics, automation and electrical engineering, geosciences and life sciences) and to make them usable for science and practice. The professional exchange is institutionalized beyond national and international, interdisciplinary application projects, so that a common scientific basis, terminology and methodology is ensured, taking into account ethical aspects in the various application disciplines.

The doctoral program aims to develop the following fundamental skills in Doctoral candidates[1]:

- Learning to research: The individual researcher profile should be formed on the basis of the respective competencies and specialist knowledge from studies or professional

[1] For the competencies listed below, see Ulrike Senger: Kompetenzentwicklung Promovierender – Impulse für universitäres Forschen, Führen und Lehren Lernen, *journal hochschuldidaktik* 1–2, 2015.

activity. In terms of content, the specific research question and the research methods to be used must be worked out. The student's own scientific contributions are critically reflected upon and embedded in the scientific landscape.

- Learning to lead: The doctoral project as a whole must be seen as a project that must be planned and implemented efficiently within the envisaged time frame, but in which risks must also be explicitly taken into account. In addition, Doctoral candidates are often involved in the management of projects with external researchers and clients, including the management of (student and academic) staff and in cooperation with the administration, which also develops leadership skills.
- Learning to teach: Teaching courses can also be part of a doctoral candidate's duties. Taking individual circumstances into account, Doctoral candidates can also deepen their knowledge transfer in the field of university teaching. This "hinge function of doctoral candidates between students and professors"[2] is a desired competence.

The doctoral program provides specialist supervision for dissertations in these areas. Specialist qualification opportunities are offered (in particular in the colloquium of the doctoral program or the research focus, to which external experts are also invited). The doctoral program offers a structural framework to support university graduates in their academic development process.

The *AI and Data Science* doctoral program deals with research into questions from the fields of data science, AI and ML. Doctoral candidates are taught the necessary skills to make an independent scientific contribution to the further development of these research areas.

In contrast to previous approaches in computer science, AI and data science place data at the center of all questions. The focus is on the needs-based, cross-disciplinary generation of knowledge in order to be able to work and make decisions based on data. This requires skills that in the past were often only available across the subjects of computer science, statistics and mathematics. These include knowledge of data structures and algorithmic processes as well as the assessment of problems from different scientific perspectives.

These technical, primarily mathematical-statistical data skills only form the starting point for a central competence that is acquired during the doctorate: How is data knowledge used to solve current challenges?

The required skills are thus derived both from the requirements of basic research and from the applications of business and society. Special skills are required for data and applications from mechanical engineering and automation technology (sensor data), industrial engineering and the life sciences, among others. The large, inhomogeneous amounts of data generated in these areas require novel methods that are not covered by classical computer science, mathematics and statistics alone. For this reason, Doctoral candidates work together with scientists from the disciplines of computer science, information science, mathematics, physics, mechanical engineering, industrial engineering, statistics, automation and electrical engineering and the geosciences as well as the life sciences. As part of their doctoral studies,

[2] Ulrike Senger: Ulrike Senger: Kompetenzentwicklung Promovierender – Impulse für universitäres Forschen, Führen und Lehren Lernen, *journal hochschuldidaktik* 1–2, 2015, p. 15.

doctoral candidates acquire the skills needed to make an independent contribution to working on the following issues, for example:

- What role do data quality and data security play for AI and ML algorithms? How are algorithmic methods developed for handling and analyzing large data sets and data streams (big data)? How are errors and gaps in the data handled algorithmically?
- What formal, abstract processes and methods exist in AI for data analysis? How are these theoretically founded? How are new ML and DL algorithms developed to uncover hidden structures and correlations in the data?
- How can high-dimensional data be visualized in a meaningful way so that it can be used in practice? How can data be synthesized? How are algorithms used for process simulation and optimization?
- What is the context of the data? Where is it collected and how, and where are the results of the data analysis used? What is the socio-political relevance of the data, algorithms and analyses? How is the bias in the data and algorithms handled or avoided?

The specialist supervision of Doctoral candidates is provided by the teams of experts designated in this FSP, which can also be put together individually on an interdisciplinary basis, i.e. from other departments of the PK NRW.

2 Doctoral degrees

In the doctoral program *AI and Data Science,* the doctoral degrees Dr. Ing. and Dr. rer. nat. are awarded. The thematic focus of the dissertation is decisive in determining which of the two doctoral degrees can be awarded. For dissertations with a primarily engineering character, the department awards the degree Dr.-Ing.; for dissertations with a primarily scientific character, the department awards the degree Dr. rer. nat.

3 Structure/content of the program

The doctoral program is designed for a period of three years and includes qualification courses as well as achievements from a compulsory area, a compulsory elective area and an elective area, which are determined in agreement with the supervisory team as part of the supervision agreement (see table in the appendix). While all courses and achievements listed in the compulsory area must be completed, the achievements specified in the compulsory and elective areas should be completed in an appropriately differentiated selection. Further details are regulated by the supervision agreement.

Attendance at courses offered by other departments or doctoral programs of the PK NRW is possible if there is evidence of a professional fit and after approval by the supervisory team and the doctoral examining committee. It is also possible to receive recognition for work already completed.

The courses are offered in German or English. The years listed in the compulsory sector of the doctoral program are recommendations; the courses can be attended differently and can be offered and completed as online courses or block courses.

In the first year, the focus is on narrowing down the dissertation topic (literature research, data collection) as well as methodological principles (research methods) and scientific ethics. Initial results should be presented at workshops and conferences towards the end of the year. Publications in specialist journals should follow. The dissertation will be written primarily in the last year of the doctoral project.

3.1 Dissertation

The dissertation can be written as a closed scientific work (monograph) or submitted as a cumulative dissertation of already published or reviewed publications in which the doctoral candidate is substantially involved.

For ***cumulative*** doctoral procedures, at least four publications should be submitted, two of which must have already successfully undergone a peer review process or at least two of which must have been published or accepted for publication in a peer-reviewed, internationally recognized publication organ. Further details are regulated by the RPO and APO in § 11. As part of a publication-based doctorate (cumulative doctorate), the publications should be prepared as a complete work (cumulative dissertation) before the doctoral procedure is opened, which places the published work in a common context and jointly evaluates and discusses it (see also RPO § 11).

3.2 Supervision

A time and work plan is drawn up for the duration of the doctorate, setting out interim goals and milestones. The time and work plan is an annex to a supervision agreement, which is concluded with each doctoral candidate. At least once a semester, a discussion takes place between the doctoral candidate and the supervisory team to check whether the agreed schedule has been realized or is feasible and to adjust it by mutual agreement if necessary. In addition, the next steps are documented and discussed.

The specialist advice and support are designed to promote and support early academic independence. In addition, the doctoral candidate is supported in starting their further career. Individually tailored offers are coordinated with the doctoral candidates and supervisors. The interdisciplinarity known in the field of AI and data science is to be taken into account and further professional qualification is to be motivated.

The obligation to provide supervision until completion of the doctorate is independent of the duration of funding for the doctorate. Further details are regulated by the RPO.

3.3 Mandatory area

For all doctoral procedures, at least three publications must be submitted, two of which must have already undergone a peer review process or the peer review process must have been

completed. The doctoral candidate should have presented an active contribution at least once at a peer-reviewed conference to a specialist audience assigned to the doctoral topic.

For a schematic overview of the compulsory coursework to be completed or courses to be attended, see the tabular overview of courses in the appendix.

3.3.1 Event on good scientific practice

In this course, doctoral candidates are taught the guidelines for good scientific practice on the basis of the DFG[3] or the WR; this is regularly offered centrally by the PK NRW or the sponsoring universities of the PK NRW. Attendance in the first year is recommended.

3.3.2 Event on ethics and responsibility in society

This compulsory course is offered centrally by the PK NRW or by the supporting universities of the PK NRW. Attendance in the first year is recommended.

3.3.3 Doctoral seminar of the Dept. of IuDS (all FSPs are integrated; possibly across departments)

A core element of the doctoral program is the doctoral seminar. In this seminar, all Doctoral candidates in the department meet across the boundaries of the FSPs (research focuses) represented and present, discuss and reflect on their work together with their professorial supervisors the procedures, interim results and/or new developments of the doctoral projects in the addressed FSP as well as interdisciplinary approaches, if applicable with other departments and doctoral programs of the PK NRW or external research institutions.

The department's doctoral seminar takes place several times a semester and serves to promote professional and interdisciplinary exchange as well as in-depth study. This regular series of events is organized as an interdisciplinary seminar involving multiple fields of computer science and also includes work from other departments conducting research in the field of digitalization and computer science. As an alternative to a regular event, the doctoral seminar can also be organized as a block event and include guest lectures by internal and external researchers.

Active participation in the doctoral seminar is compulsory for all Doctoral candidates of the IuDS department. Participation in doctoral seminars at other departments or comparable events at other external research institutions can be arranged as required as part of the supervision agreement.

[3] See https://wissenschaftliche-integritaet.de/ueber-den-kodex/. Last accessed on 27.03.2023.

3.3.4 In-depth specialist events/colloquium of the doctoral program or the research focus AI & Data Science (subject-specific within the FSP AI & Data Science)

Another core element of the doctoral program is the colloquium of the doctoral program/FSP as an in-depth specialist event within the FSP. It takes place regularly (several times during the lecture period, if necessary also outside the lecture period) and serves as a discussion platform, for professional exchange within the FSP and for the presentation of partial results from the doctorate. Each doctoral candidate presents at least once a year in the colloquium of the doctoral program/FSP.

In contrast to the topics dealt with in the doctoral seminar, which can be described as generally understandable in the field of computer science, special, in-depth results from the FSP are discussed in the colloquium of the doctoral program/FSP. These are often oriented towards the doctoral projects currently being worked on and form a specialist context for the preparation of presentations at specialist conferences and other scientific events. Additional specialist keynote speeches (e.g. keynotes) by internal and external academics can supplement the content of the doctoral program/FSP colloquium.

As part of the FSP of this doctoral programme, further specialized event formats are also offered at the individual sponsoring universities, in which research-specific aspects are discussed and deepened. At the local working group level, this communication is supplemented by individual event formats.

Active participation in the colloquium of the doctoral program/FSP is mandatory for all doctoral candidates of this doctoral program of the IuDS department. Participation in colloquia at other departments or comparable events at other external research institutions can be arranged as required within the framework of the supervision agreement.

3.3.5 Written progress report and discussion

Doctoral candidates prepare a written report on the progress of their doctoral project once a year and discuss it with their supervisory team. The time and work plan set out in the supervision agreement is reviewed and modified or updated if necessary. Further details are set out in the supervision agreement.

3.4 Compulsory elective area

As part of the individual supervision agreements, information on the selection from the compulsory elective area must be documented; in particular, attendance and participation in scientific conferences and overall publication activities within the framework of the supervision agreement should be specified here.

For a schematic overview of the courses that can be specified in the compulsory elective area, see the course overview in the appendix.

3.4.1 Conferences/meetings

Participation in symposia and conferences is supported as part of the doctorate. The aim is always to present their own academic contribution (poster/lecture/workshop). The Doctoral candidates acquire special mediation skills here (as well as in workshops). National or international conferences are attended in order to engage in academic discourse in the relevant specialist community, to establish and maintain international contacts and to initiate international research cooperations. Where possible, the department and/or the home university will support the financing of conference participation.

3.4.2 Workshops/Events

This includes participation in interdisciplinary qualification workshops (one or more days), university didactic workshops, other advanced training courses (one or more days), a summer/winter school or a language course. Doctoral candidates also acquire various interdisciplinary skills.

3.4.3 Publications

As part of the doctoral project, contributions on the dissertation topic should be published in relevant, peer-reviewed journals or conference proceedings. The concretization of the publications is coordinated with the supervisors and recorded in the supervision agreement. The preparation of the publications is supported by the supervisors both professionally and organizationally. Financial support for these activities must be clarified as part of the supervision activities. Publication activities promote networking and establishment within the specialist community.

3.5 Elective area

If required, further qualification events from the elective area are determined and documented accordingly in the supervision agreement. Attendance or attendance of further qualification events is strongly recommended.

3.5.1 Methods workshop

The specific content of the methods workshop is primarily determined in consultation with the doctoral candidates and supervisors in the FSP and is based on their needs and the specific application contexts of the doctoral projects.

3.5.2 Lecture series

The lecture series consists of several individual events that take place at the various PK NRW partner universities involved in the doctoral program. On the one hand, Doctoral candidates learn about the research spectrum of AI and data science as well as current research projects of the doctoral program or other doctoral programs, on the other hand, attending the lecture

series enables them to classify their own research results within the research areas of the PK NRW.

3.5.3 Transfer services

This includes the organization and implementation of information events or workshops (e.g. for the interested public). Skills are acquired for the transfer of research results into different areas of society.

3.5.4 Teaching

Integration into teaching at the home university is supported and can be recognized, taking local conditions into account. Appropriate regulations must be made in the supervision agreement and in the job description of the home university. Doctoral candidates acquire central teaching skills in the areas of university didactics and adult education. In the case of participation in teaching, it is recommended to attend an accompanying didactic course.

3.5.5 Miscellaneous

This includes, for example, a research stay of at least two weeks with a connection to a research institution or university, an internship of at least two weeks in an area relevant to the career path, the organization of a scientific conference/event, activities in academic self-administration and committee work, the organization of an exhibition as well as stays abroad to acquire further knowledge on the doctoral topic, to expand foreign language skills, to learn special or new methods and to maintain contact with cooperation partners. A prerequisite for recognition is that subject-specific and professionally relevant skills are acquired.

During the doctoral phase, the development of extracurricular qualifications is also promoted. These include networking activities, interdisciplinary workshops, workshops for personal and professional development (also outside academia). Further details can be found in the supervision agreement.

Event overview

Courses/services in the compulsory area

Year	Event/Performance	Remark
1	Event on *good scientific practice*	• Central event of the PK NRW/at the supporting universities of the PK NRW.
	Event on *ethics and responsibility in society*	• Central event of the PK NRW/at the supporting universities of the PK NRW.
	Doctoral seminar of the IuDS department	• Disciplinary and interdisciplinary references of the research topics worked on are critically reflected on by the doctoral candidates and discussed within the

Year	Event/Performance	Remark
	Presentation of own research in the context of the doctoral seminar of the IuDS department (at least twice during the doctoral phase)	department or the doctoral program (if necessary with the involvement of colleagues from other departments and doctoral programs) with the supervisors as well as with researchers from the department and other departments.
	Colloquium of the doctoral program or the research focus(es) Presentation of your own research at the colloquium of the doctoral program or the research focus(es) (usually once a year)	• Specialized event formats within the FSP, in which research-specific aspects are discussed and deepened • at working group level at the individual supporting universities • possibly with external/internal input (keynote/guest lecture)
	Progress report	• Written report on the progress of the doctoral project • Discussion with the support team • Review and, if necessary, update the time and work plan
2	Doctoral seminar of the IuDS department Presentation of own research in the context of the doctoral seminar of the IuDS department (at least twice during the doctoral phase)	• see above.
	Colloquium of the doctoral program or research focus(s) Presentation of own research in the context of the colloquium of the doctoral program or research focus(s) (usually once a year)	• see above.
	Publication/article in a recognized journal or conference proceedings (peer-reviewed, impact	• For all doctoral procedures, at least three publications must be submitted, two of which must have already undergone a peer review process or whose review should have been completed. Details

Year	Event/Performance	Remark
	factor, relevance for the subject)	are determined together with the supervisory team in the supervision agreement.
	Progress report	• see above.
3	Doctoral seminar of the IuDS department Presentation of own research in the context of the doctoral seminar of the IuDS department (at least twice during the doctoral phase)	• see above.
	Colloquium of the doctoral program or research focus(s) Presentation of own research in the context of the colloquium of the doctoral program or research focus(s) (usually once a year)	• see above.
	Publication/article in a recognized journal or conference proceedings (peer-reviewed, impact factor, relevance for the subject)	• For all doctoral procedures, at least three publications must be submitted, two of which must have already undergone a peer review process or whose review should have been completed. Details are determined together with the supervisory team in the supervision agreement.
	Conference participation	• Active contribution at a peer-reviewed conference
	Progress report	• see above.

Courses/services in the compulsory elective area

Performance according to the framework doctoral program	Note/Comments
Conferences	
Participation in national or international conference (without own contribution)	Should be specified in the supervision agreement.
Participation in national or international conference with own contribution (poster, lecture or competitive demonstration)	To be specified in the supervision agreement.

Performance according to the framework doctoral program	Note/Comments
Workshops/Events	
Interdisciplinary qualification workshop (one or more days)	This is determined in consultation with the supervisory team as part of the supervision agreement.
University didactic workshop	
Further training (one or more days)	
Summer/Winter School	The thematic fit must be agreed with the supervisory team.
Language course	Can be specified as part of the supervision agreement if there is a doctoral-related necessity.
Additional publications, if applicable Details are defined together with the supervision team in the supervision agreement.	
Article in a recognized journal (peer-reviewed, impact factor, relevance for the subject)	
Article in a less recognized journal (not peer-reviewed, low impact factor)	
Publication in other organs (e.g. conference proceedings)	
Publication of a review	
Editorship of a conference volume or similar.	
<u>Elective area</u>	
Transfer services	
Information event or workshop for companies, the public sector or organizations	This is determined in consultation with the supervisory team as part of the supervision agreement.
Application for a patent	
Founding a start-up	
Miscellaneous	
Implementation of a course	This is determined in consultation with the supervisory team as part of the supervision agreement.
Research stay with a connection to a research institution or university (at least two weeks) and submission of a report on the results	

Performance according to the framework doctoral program	Note/Comments
Internship in an area relevant to your future career (at least two weeks)	
Organization of conferences/events	
Activities in academic self-administration and committee work (e.g. spokesperson of Doctoral candidates, membership of an advisory committee)	Activities in academic self-administration and committee work are supported on request and in consultation with the supervisory team.
Organization of an exhibition	This is determined in consultation with the supervisory team as part of the supervision agreement.

Annex 2: Doctoral program Applied Computer Science and Business Informatics of the Department of Computer and Data Science

The *Applied Computer Science and Business Informatics* doctoral program supplements and supports the individual research work carried out by Doctoral candidates. It teaches additional skills and supplementary specialist knowledge that enable an efficient approach to research work at doctoral level and provides support in the preparation and presentation of the research results achieved to the various target groups. The doctoral programme is also concerned with imparting skills for an overarching view of the methodological foundations and technical and social contexts, which also go beyond the included specializations of the research focus areas (FSP) *Cyber Security*, *Visual Computing* and *Business Informatics.*

The program is aimed at doctoral candidates interested in applied computer science and related disciplines, especially those who want to deepen their scientific knowledge in the research areas of *cyber security*, *visual computing* or *business informatics.* Comprehensive basic computer science knowledge combined with sound knowledge in the above-mentioned special research areas of applied computer science and the respective application domains are important prerequisites. Due to the often interdisciplinary and international approach, this doctoral program is also well suited for foreign doctoral candidates.

The compatibility of family and academic work is particularly supported. Special support measures are agreed as required (see also guidelines of the PK NRW on the compatibility of family and academic work).

1 Aim of the program

The aim of the *Applied Computer Science and Business Informatics* doctoral programme is to provide Doctoral candidates with an overarching view of the methodological foundations of computer science that goes beyond the specializations in the individual FSPs *Cyber Security*, *Visual Computing* and *Business Informatics* and to make it usable for science and practice. The professional exchange is institutionalized beyond national and international, interdisciplinary application projects, so that a common scientific basis, terminology and methodology are ensured, taking into account ethical aspects in the various application disciplines.

The doctoral program provides suitable qualification events and supporting measures for early career researchers. Further competencies, in particular subject-specific competencies, are defined in the respective FSPs represented in the doctoral program or result from the individual research questions of the doctoral candidates.

Specifically, the doctoral program aims to provide Doctoral candidates with the following skills in particular.[1]

[1] For the competencies listed below, see Ulrike Senger: Kompetenzentwicklung Promovierender – Impulse für universitäres Forschen, Führen und Lehren Lernen, *journal hochschuldidaktik* 1–2, 2015.

- Learning to research: The individual researcher profile should be formed on the basis of the respective competencies and specialist knowledge from studies or professional activity. In terms of content, the specific research question and the research methods to be used must be worked out. The student's own scientific contributions are critically reflected upon and embedded in the scientific landscape.
- Learning to lead: Overall, the doctoral project must be seen as a project that must be planned and implemented efficiently within the envisaged time frame, but in which risks must also be explicitly taken into account. In addition, Doctoral candidates are often involved in the management of projects with external clients, including the management of (student and academic) staff and in cooperation with the administration, which also develops leadership skills.
- Learning to teach: Teaching courses and working with students can also be part of a doctoral candidate's duties. Taking individual circumstances into account, doctoral candidates can also deepen their knowledge transfer in the field of university teaching. This "hinge function of doctoral candidates between students and professors"[2] is also a desired competence of doctoral candidates at the participating supporting universities, which is supported by this program.

The doctoral program is highly interdisciplinary and brings together different research disciplines and areas of application. The following research focuses are represented:

- *Cyber security*: This research focus examines innovative approaches to attack prevention, attack detection, attack containment and tracing attacks on the internet as well as the development and analysis of advanced and future-proof methods for privacy protection. To this end, the security of basic procedures, protocols, technologies and implementations is evaluated, vulnerabilities are identified and countermeasures are developed to reduce the risks of advancing digitalization.
- *Visual Computing*: *Visual Computing* is a research focus that combines the information technology disciplines of computer graphics, image processing, human-computer interaction and computer vision and is generally concerned with the analysis or generation of (interactive) images. The methods used are applied in basic research and used to develop new applications for industry and other end users. *Visual computing* is a cross-sectional technology and is used in areas such as the automotive industry, the media, medicine and the games industry. Due to its interdisciplinary character, a background not only in computer science is relevant, but also in other application areas such as (industrial) design or human factors, perception and psychology.
- *Information Systems*: Societies, organizations and individuals are facing the challenge of digital transformation. The research focus on business *informatics* addresses these current challenges from various perspectives and answers questions relating to the design, analysis and use of systems for data and information processing in a social context (socio-technical systems) on the basis of various qualitative and quantitative

[2] Ulrike Senger: Ulrike Senger: Kompetenzentwicklung Promovierender – Impulse für universitäres Forschen, Führen und Lehren Lernen, *journal hochschuldidaktik* 1–2, 2015, p. 15.

methods. The focus is on the interplay between people, tasks and technologies with different areas of investigation.

The doctoral program thus deals with a variety of interdisciplinary research questions in applied computer science and business informatics and places them in a scientifically motivated application context.

The specialist supervision of Doctoral candidates is provided by the teams of experts designated in these FSPs, which can also be put together individually on an interdisciplinary basis, i.e. from other departments of the PK NRW.

2 Doctoral degrees

In the doctoral program *Applied Computer Science and Business Informatics,* the doctoral degrees Dr. Ing., Dr. rer. nat. and Dr. rer. pol. are awarded. The thematic focus of the dissertation is decisive in determining which of the three doctoral degrees can be awarded. For dissertations with a primarily engineering character, the department awards the degree of Dr.-Ing.; for dissertations with a primarily scientific character, the department awards the degree of Dr. rer. nat. and for dissertations with a primarily business informatics character, the department awards the degree of Dr. rer. pol.

3 Structure/content of the program

The doctoral program is designed for a period of three years and includes qualification courses as well as achievements from a compulsory area, a compulsory elective area and an elective area, which are determined in agreement with the supervisory team as part of the supervision agreement (see table in the appendix). While all courses and achievements listed in the compulsory area must be completed, the achievements specified in the compulsory and elective areas should be completed in an appropriately differentiated selection. Further details are regulated by the supervision agreement.

It is possible to attend courses offered by other departments or doctoral programs of the PK NRW if there is evidence of a professional fit and with the approval of the supervisory team and the doctoral examining committee. It is also possible to receive recognition for work already completed.

The courses are offered in German or English. The years listed in the compulsory section of the doctoral program are recommendations; the courses can be attended differently and can be offered and completed as online courses or block courses.

In the first year, the focus is on narrowing down the dissertation topic (literature research, data collection) as well as methodological principles (research methods) and scientific ethics. Initial results will be presented and discussed at workshops and conferences towards the end of the year. Subsequently, publications will be made in specialist journals or at relevant conferences. The dissertation will be written primarily in the final year of the doctoral project.

3.1 Dissertation

The dissertation can be written as a closed scientific work (monograph) or submitted as a cumulative dissertation of already published or reviewed publications in which the doctoral candidate is substantially involved.

For ***cumulative*** doctoral procedures, at least four publications should be submitted, two of which must have already successfully undergone a peer review process or at least two of which must have been published or accepted for publication in a peer-reviewed, internationally recognized publication organ. Further details are regulated by the RPO and APO in § 11. As part of a publication-based doctorate (cumulative doctorate), the publications should be prepared as a complete work (cumulative dissertation) before the doctoral procedure is opened, which places the published work in a common context and jointly evaluates and discusses it (see also RPO § 11).

3.2 Cumulative doctoral thesis in the field of business informatics

The following additional requirements apply to cumulative doctoral procedures in the field of business informatics: The cumulative doctoral thesis contains an exposé of the doctoral topic as Part A. This exposé motivates the topic and organizes the following individual contributions into an overarching framework. The synopsis typically comprises 30 to 60 pages. In the following Part B, the doctoral thesis contains at least four peer-reviewed scientific contributions to journals and/or conferences. This must include at least one publication in a B-ranked (or higher) journal. The ranking is taken from VHB-JOURQUAL. If no ranking is available there, the quality of a journal is assessed by the reviewers of the doctoral procedure or the doctoral examining committee. At least one of the scientific contributions should have been written by the first author. Three contributions must have been published or accepted for publication (possibly with conditions). In addition, the doctoral thesis in Part B can also be supplemented by further non-reviewed articles or articles that are still in the first phase of the review process. Further details are determined by the doctoral examining committee and regulated in the supervision agreement.

3.3 Supervision

A time and work plan is drawn up for the duration of the doctorate, which sets interim goals and milestones. The time and work plan is part of a supervision agreement that is concluded with each doctoral candidate. At least once a semester, a meeting is held between the doctoral candidate and the supervision team to check whether the agreed timetable has been realized or is still feasible and to adjust it by mutual agreement if necessary. The next steps are also documented and discussed.

The specialist advice and support are designed to promote and support early academic independence. In addition, the doctoral candidate is supported in starting their further professional career. Individually tailored offers are coordinated with the doctoral candidates and supervisors. In doing so, the interdisciplinarity known in applied computer science is to be taken into account and further professional qualification motivated.

The obligation to provide supervision until completion of the doctorate is independent of the duration of funding for the doctorate. Further details are regulated by the RPO.

3.4 Mandatory area

For all doctoral procedures, at least three publications must be submitted, two of which must have already undergone a peer review process or the peer review process must have been completed. The doctoral candidate should have presented an active contribution at least once at a peer-reviewed conference to a specialist audience assigned to the doctoral topic.

For a schematic overview of the compulsory coursework to be completed or courses to be attended, see the tabular overview of courses in the appendix.

3.4.1 Event on good scientific practice

In this course, doctoral candidates are taught the guidelines for good scientific practice on the basis of the DFG[3] or the WR; this is regularly offered centrally by the PK NRW or the supporting universities of the PK NRW. Attendance in the first year is recommended.

3.4.2 Event on ethics and responsibility in society

This compulsory course is offered centrally by the PK NRW or by the sponsoring universities of the PK NRW. Attendance in the first year is recommended.

3.4.3 Doctoral seminar of the IuDS department (all FSPs are integrated, if necessary across departments)

A core element of the doctoral program is the doctoral seminar. All Doctoral candidates in the department meet here across the boundaries of the FSPs represented and, together with the professorial supervisors, present, discuss and reflect on procedures, interim results and/or new developments of the doctoral projects in the FSPs addressed as well as interdisciplinary approaches, if necessary with other departments and doctoral programs of the PK NRW or external research institutions.

The department's doctoral seminar takes place several times a semester and serves to promote professional and interdisciplinary exchange as well as in-depth study. This regular series of events is organized as an interdisciplinary seminar involving multiple fields of computer science and also includes work from other departments conducting research in the field of digitalization and computer science. As an alternative to a regular event, the doctoral seminar can also be organized as a block event and include guest lectures by internal and external researchers.

Active participation in the doctoral seminar is compulsory for all Doctoral candidates of the IuDS department. Participation in doctoral seminars at other departments or comparable

[3] [3] See https://wissenschaftliche-integritaet.de/ueber-den-kodex/. Last accessed on 27.03.2023.

events at other external research institutions can be arranged as required as part of the supervision agreement.

3.4.4 In-depth subject-specific events/colloquium of the doctoral program or the research focus(s) (subject-specific within the FSP)

Another core element of the doctoral program is the colloquium of the doctoral program/FSP as an in-depth specialist event within the FSP. It takes place regularly (several times during the lecture period, if necessary also outside the lecture period) and serves as a discussion platform, for professional exchange within the respective FSP and for the presentation of partial results from the doctorate. Each doctoral candidate presents at least once a year in the colloquium of the doctoral program/FSP.

In contrast to the topics dealt with in the doctoral seminar, which can be described as generally understood in the field of computer science, special, in-depth results from the FSPs are discussed in the colloquium of the doctoral program/FSP. These are often oriented towards the doctoral projects currently being worked on and form a specialist context for the preparation of presentations at specialist conferences and other scientific events. Additional specialist keynote speeches (e.g. keynotes) by internal and external scientists can supplement the content of the colloquium of the doctoral program/FSP.

As part of the FSP of this doctoral programme, further specialized event formats are also offered at the individual supporting universities, in which research-specific aspects are discussed and deepened. At the local working group level, this communication is supplemented by individual event formats.

Active participation in the colloquium of the doctoral program/FSP is mandatory for all doctoral candidates of this doctoral program of the IuDS department. Participation in colloquia at other departments or comparable events at other external research institutions can be arranged as required within the framework of the supervision agreement.

3.4.5 Written progress report and discussion

Doctoral candidates prepare a written report on the progress of their doctoral project once a year and discuss it with their supervisory team. The time and work plan set out in the supervision agreement is reviewed and modified or updated if necessary. Further details are set out in the supervision agreement.

3.5 Compulsory elective area

As part of the individual supervision agreements, information on the selection from the compulsory elective area must be documented; in particular, attendance and participation in scientific conferences and overall publication activities within the framework of the supervision agreement should be specified here.

For a schematic overview of the courses that can be specified in the compulsory elective area, see the course overview in the appendix.

3.5.1 Conferences/meetings

Participation in symposia and conferences is supported as part of the doctorate. The aim is always to present their own academic contribution (poster/lecture/workshop). The Doctoral candidates acquire special mediation skills here (as well as in workshops). National or international conferences are attended in order to engage in academic discourse in the relevant specialist community, to establish and maintain international contacts and to initiate international research cooperations. Where possible, the department and/or the home university will support the financing of conference participation.

3.5.2 Workshops/Events

This includes participation in interdisciplinary qualification workshops (one or more days), university didactic workshops, other advanced training courses (one or more days), a summer/winter school or a language course. Doctoral candidates also acquire various interdisciplinary skills.

3.5.3 Publications

As part of the doctoral project, contributions on the dissertation topic should be published in relevant, peer-reviewed journals or conference proceedings. The concretization of the publications is coordinated with the supervisors and recorded in the supervision agreement. The supervisors will provide technical and organizational support for the preparation of the publications. Financial support for these activities must be clarified as part of the supervision activities. Publication activities promote networking and establishment within the specialist community.

3.6 Elective area

If required, further qualification events from the elective area are determined and documented accordingly in the supervision agreement. Attendance or attendance of further qualification events is strongly recommended.

3.6.1 Methods workshop

The specific content of the methods workshop is primarily determined in consultation with the doctoral candidates and supervisors in the FSP and is based on their needs and the specific application contexts of the doctoral projects.

3.6.2 Lecture series

The lecture series consists of several individual events that take place at the various PK NRW partner universities involved in the doctoral program. On the one hand, Doctoral candidates learn about the research spectrum of applied computer science as well as current research projects of the doctoral program or other doctoral programs; on the other hand, attending

the lecture series enables them to classify their own research results within the research areas of the PK NRW.

3.6.3 Transfer services

This includes the organization and implementation of information events or workshops (e.g. for the interested public). Skills are acquired for the transfer of research results into different areas of society.

3.6.4 Teaching

Integration into teaching at the home university is supported and can be recognized, taking local conditions into account. Appropriate regulations must be made in the supervision agreement and in the job description of the home university. Doctoral candidates acquire central teaching skills in the areas of university didactics and adult education. In the case of participation in teaching, it is recommended to attend an accompanying didactic course.

3.6.5 Miscellaneous

This includes, for example, a research stay of at least two weeks with a connection to a research institution or university, an internship of at least two weeks in an area relevant to the career path, the organization of a scientific conference/event, activities in academic self-administration and committee work, the organization of an exhibition as well as stays abroad to acquire further knowledge on the doctoral topic, to expand foreign language skills, to learn special or new methods and to maintain contact with cooperation partners. A prerequisite for recognition is that subject-specific and professionally relevant skills are acquired.

During the doctoral phase, the development of extracurricular qualifications is also promoted. This includes networking activities, interdisciplinary workshops, workshops on personal and professional development (also outside academia). Further details can be found in the supervision agreement.

Event overview

Courses/services in the compulsory area

Year	Event/Performance	Remark
1	Event on *good scientific practice*	• Central event of the PK NRW/at the supporting universities of the PK NRW.
	Event on *ethics and responsibility in society*	• Central event of the PK NRW/at the supporting universities of the PK NRW.
	Doctoral seminar of the IuDS department	• Disciplinary and interdisciplinary references of the research topics worked on are critically reflected on by the doctoral candidates and discussed within the

Year	Event/Performance	Remark
	Presentation of own research in the context of the doctoral seminar of the IuDS department (at least twice during the doctoral phase)	department or the doctoral program (if necessary with the involvement of colleagues from other departments and doctoral programs) with the supervisors as well as with researchers from the department and other departments.
	Colloquium of the doctoral program or the research focus(es) Presentation of your own research at the colloquium of the doctoral program or the research focus(es) (usually once a year)	• Specialized event formats within the FSP, in which research-specific aspects are discussed and deepened • at working group level at the individual supporting universities • possibly with external/internal input (keynote/guest lecture)
	Progress report	• Written report on the progress of the doctoral project • Discussion with the support team • Review and, if necessary, update the time and work plan
2	Doctoral seminar of the IuDS department Presentation of own research in the context of the doctoral seminar of the IuDS department (at least twice during the doctoral phase)	• see above.
	Colloquium of the doctoral program or research focus(s) Presentation of own research in the context of the colloquium of the doctoral program or research focus(s) (usually once a year)	• see above.
	Publication/article in a recognized journal or conference proceedings (peer-reviewed, impact	• For all doctoral procedures, at least three publications must be submitted, two of which must have already undergone a peer review process or whose review should have been completed. Details

Year	Event/Performance	Remark
	factor, relevance for the subject)	are determined together with the supervisory team in the supervision agreement.
	Progress report	• see above.
3	Doctoral seminar of the IuDS department Presentation of own research in the context of the doctoral seminar of the IuDS department (at least twice during the doctoral phase)	• see above.
	Colloquium of the doctoral program or research focus(s) Presentation of own research in the context of the colloquium of the doctoral program or research focus(s) (usually once a year)	• see above.
	Publication/article in a recognized journal or conference proceedings (peer-reviewed, impact factor, relevance for the subject)	• For all doctoral procedures, at least three publications must be submitted, two of which must have already undergone a peer review process or whose review should have been completed. Details are determined together with the supervisory team in the supervision agreement.
	Conference participation	• Active contribution at a peer-reviewed conference
	Progress report	• see above.

Courses/services in the compulsory elective area

Performance according to the framework doctoral program	Note/Comments
Conferences	
Participation in national or international conference (without own contribution)	Should be specified in the supervision agreement.
Participation in national or international conference with own contribution (poster, lecture or competitive demonstration)	To be specified in the supervision agreement.

Performance according to the framework doctoral program	Note/Comments
Workshops/Events	
Interdisciplinary qualification workshop (one or more days)	This is determined in consultation with the supervisory team as part of the supervision agreement.
University didactic workshop	
Further training (one or more days)	
Summer/Winter School	The thematic fit must be agreed with the supervisory team.
Language course	Can be specified as part of the supervision agreement if there is a doctoral-related necessity.
Additional publications, if applicable Details are defined together with the supervision team in the supervision agreement.	
Article in a recognized journal (peer-reviewed, impact factor, relevance for the subject)	
Article in a less recognized journal (not peer-reviewed, low impact factor)	
Publication in other organs (e.g. conference proceedings)	
Publication of a review	
Editorship of a conference volume or similar.	
<u>Elective area</u>	
Transfer services	
Information event or workshop for companies, the public sector or organizations	This is determined in consultation with the supervisory team as part of the supervision agreement.
Application for a patent	
Founding a start-up	
Miscellaneous	
Implementation of a course	This is determined in consultation with the supervisory team as part of the supervision agreement.
Research stay with a connection to a research institution or university (at least two weeks) and submission of a report on the results	

Performance according to the framework doctoral program	Note/Comments
Internship in an area relevant to your future career (at least two weeks)	
Organization of conferences/events	
Activities in academic self-administration and committee work (e.g. spokesperson of Doctoral candidates, membership of an advisory committee)	Activities in academic self-administration and committee work are supported on request and in consultation with the supervisory team.
Organization of an exhibition	This is determined in consultation with the supervisory team as part of the supervision agreement.