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Curriculum for doctoral studies in Microdata Analysis

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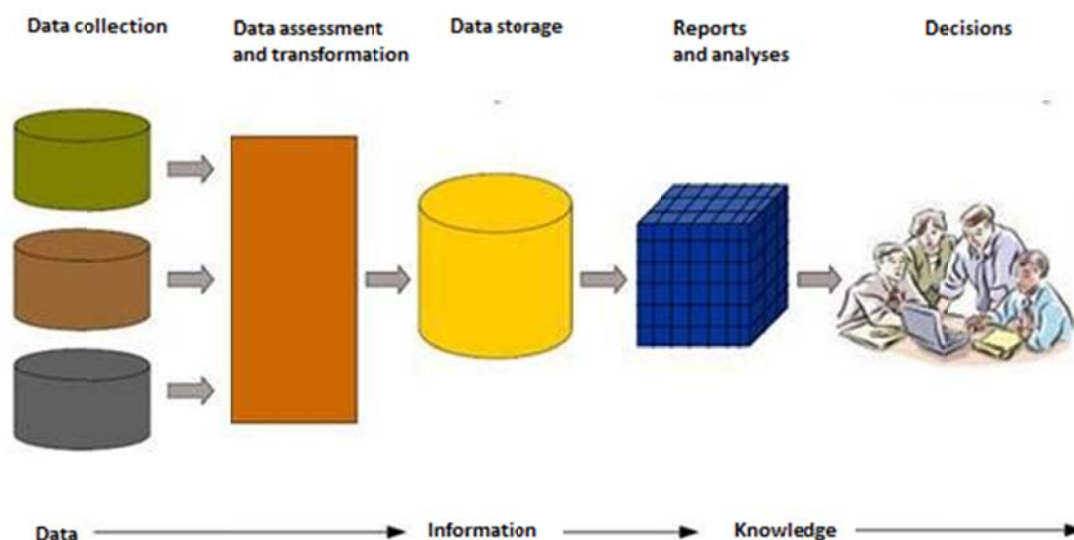
1. Description of subject

The subject Microdata Analysis concerns complex processes in industry and the built environment.

Microdata Analysis is a multidisciplinary field of knowledge dealing with the collection, modeling, compilation and interpretation of large data sets, together with underlying algorithms, methods and techniques. Microdata Analysis includes several interrelated areas such as artificial intelligence, decision support systems, management of limited resources, data modeling, design of experiments, focus groups, geographic information systems, visualization, measurement techniques, optimization, forecasting, simulation and statistical inference.

2. Goals for doctoral studies

The complex processes in industry and the built environment which are studied through microdata analysis can be schematically illustrated by a figure, see below. The first part is the collection of data, and requires knowledge and skills in various measurement techniques, as well as design of experiments. The second and third parts are data capture, processing and storage, requiring skills in advanced database techniques such as multi-dimensional database searching and understanding of the importance of metadata. The fourth part is the analysis commonly in the form of mathematical modeling of data and requires skills in statistical modeling, forecasting, simulation techniques, visualization and data mining. The fifth part is decision making and action and requires an understanding of techniques such as benchmarking and counterfactual analysis, and also concerns economic decision making and the dissemination of information within organizations.



Doctoral study in Microdata Analysis is aimed at those students who wish to acquire general skills in all the parts of the process and in addition, deep skill in any single part.

2.1 General learning outcomes

The aims of education in agreement with the Degree Ordinance, Annex 2, Higher Education Ordinance (1993:100) are as follows:

Degree of Licentiate

Knowledge and understanding

For a Degree of Licentiate the third-cycle student shall

- demonstrate knowledge and understanding in the field of research including current specialist knowledge in a limited area of this field as well as specialised knowledge of research methodology in general and the methods of the specific field of research in particular.

Competence and skills

For a Degree of Licentiate the third-cycle student shall:

- demonstrate the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively, and to plan and use appropriate methods to undertake a limited piece of research and other qualified tasks within predetermined time frames in order to contribute to the formation of knowledge as well as to evaluate this work
- demonstrate the ability in both national and international contexts to present and discuss research and research findings in speech and writing and in dialogue with the academic community and society in general, and
- demonstrate the skills required to participate autonomously in research and development work and to work autonomously in some other qualified capacity.

Judgement and approach

For a Degree of Licentiate the third-cycle student shall

- demonstrate the ability to make assessments of ethical aspects of his or her own research
- demonstrate insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used, and
- demonstrate the ability to identify the personal need for further knowledge and take responsibility for his or her ongoing learning.

Degree of Doctor

Knowledge and understanding

For the Degree of Doctor the third-cycle student shall

- demonstrate broad knowledge and systematic understanding of the research field as well as advanced and up-to-date specialised knowledge in a limited area of this field, and
- demonstrate familiarity with research methodology in general and the methods of the specific field of research in particular.

Competence and skills

For the Degree of Doctor the third-cycle student shall

- demonstrate the capacity for scholarly analysis and synthesis as well to review and assess new and complex phenomena, issues and situations autonomously and critically
- demonstrate the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively, and to plan and use appropriate methods to undertake research and other qualified tasks within predetermined time frames and to review and evaluate such work
- demonstrate through a dissertation the ability to make a significant contribution to the formation of knowledge through his or her own research

- demonstrate the ability in both national and international contexts to present and discuss research and research findings authoritatively in speech and writing and in dialogue with the academic community and society in general
- demonstrate the ability to identify the need for further knowledge and
- demonstrate the capacity to contribute to social development and support the learning of others both through research and education and in some other qualified professional capacity.

Judgement and approach

For the Degree of Doctor the third-cycle student shall

- demonstrate intellectual autonomy and disciplinary rectitude as well as the ability to make assessments of research ethics, and
- demonstrate specialised insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used.

2.2 Local learning outcomes

For the degree of licentiate, the doctoral student shall:

- demonstrate a theoretical understanding of the five parts of the microdata analysis process, and in-depth knowledge in any of these parts,
- be able to manage and evaluate the handling of sensitive and confidential data such as information about customers in a bank, credit card information, patient information in hospitals concerning technical, social and ethical aspects,
- apply the acquired knowledge to select and adapt methods and techniques in order to manage complex, large and varying amounts of data,
- model the data and perform data analysis in which methods and models from different paradigms are valued, selected, adapted and applied,
- develop hybrid approaches that combine quantitative and qualitative methods and techniques to solve various problems,
- integrate and incorporate microdata analysis methods and techniques to analyze practical problems in research or decision-making,
- Evaluate the strengths and limitations of methods and techniques in microdata analysis when used in research or as a support for decision making.

For a degree of doctor, the doctoral student shall in addition:

- demonstrate an ability to contribute to the development of the research field by being able to present and discuss research findings in an international context, in dialogue with researchers with different disciplinary backgrounds,
- be able to provide constructive feedback on others' scientific works in Microdata Analysis,
- demonstrate teaching ability to communicate research results and microdata analysis methods and techniques for different audiences.

3. Admission to the program

3.1 General

Admission to doctoral study is for full-time study for four years and leads to a doctoral degree. Admission may also be made for two years of study which leads to a licentiate degree.

The Head of Research is responsible for advertising doctoral student positions nationally and internationally at fixed times during the year. Recruitment follows the same form as the University's other announcements of employment.

The Head of Research is responsible for evaluation of applications and ranking of applicants on the basis of the selection criteria set out in the general curriculum. The Doctoral Programmes Board decides on the admission or rejection based on the assessment of the applications and what has emerged through interviews of the candidates and by consultation with references.

The following criteria should be assessed in the context of potential admission to doctoral studies:

1. Quality and feasibility of the study plan.
2. That issues of research ethics have been considered.
3. Financial plan.
4. That the overall supervision skills available are sufficient to provide good and professional supervision within the proposed field.

3.2 Qualifications

To be admitted to the programme of doctoral study in Microdata Analysis, the applicant must meet both the general and specific entry requirements and thus have the capacity to benefit from the doctoral study.

General admission

General entry requirements for admission to doctoral studies are;

1. A degree at advanced level.
2. Has completed courses totalling at least 240 credits, including at minimum of 60 at advanced level, or
3. Can demonstrate acquisition of equivalent skills in another way, either in or out of the country.

The Doctoral Programmes Board may, for an individual application, permit individual exemption from the general entry requirements, if there are special reasons.

Transitional arrangements: A candidate who fulfilled the requirements for basic eligibility for admission to doctoral studies before 1 July 2007, will also be considered eligible for admission to doctoral studies, but only until the end of June 2015.

Specific eligibility

Specific requirements for admission require a candidate to have passed at least five of the following courses (or equivalent):

- Entry course in database systems for Master in Business Intelligence, 7.5 credits, Ground level 1
- Data Analysis and Statistics, 7.5 credits, First Cycle Level 1
- Introduction to artificial neural networks, 7.5 credits, Second Cycle Level 1
- Introduction to object oriented programming, 7.5 credits, First Cycle Level 1
- Mathematics for Microdata Analysis, 7.5 credits, First Cycle Level 2
- Microeconomics, 7.5 credits, First Cycle Level 1
- Optimization Techniques and probability theory, 7.5 credits, Second Cycle Level 1

3.3 Selection

Selection among applicants meeting the eligibility requirements should be made according to their ability to succeed in doctoral studies and is based on the following criteria in order of priority:

1. Personal suitability
2. Previous study with special emphasis on the quality of degree at advanced level

3. Level of oral and written communication in English
4. Other qualifications

3.4 Supervision

For each student, at least two supervisors will be appointed. At least one of the supervisors must have undergone supervision training or have equivalent experience and qualifications. One of the supervisors is appointed as a principal supervisor and shall be qualified as an associate professor or professor. Secondary supervisors should have a PhD. The Head of Research is responsible for suggesting supervisors and The Doctoral Programmes Board approves the choice of supervisors at admission. Decisions on the assigned supervisor can be changed on request from the student or tutor, or for other reasons. A change of supervisor is decided by the Doctoral Programmes Board. Doctoral students are entitled to supervision of 128 hours per year in accordance with the prescribed training of 120 credits and 240 credits.

4. Programme structure

4.1 General

Training for the doctoral degree (licentiate) consists of four (two) years of full-time study, a total of 240 (120) credits. The training consists of compulsory courses totalling at least 30 credits and a further 15 (licentiate degree) and 30 (PhD) credits from elective courses. In addition, a thesis of 75 (licentiate) and 180 (PhD) credits is required.

A licentiate thesis normally consists of two scientific papers and a doctoral thesis of four scientific papers. These papers will be presented in a research seminar after which they are completed. Before the student's doctoral studies concludes with a public defense, all the scientific papers in the thesis should have been presented in a seminar. The Head of Research suggest an appropriate time for the defense.

Training time may be extended if there are special circumstances as indicated in The Higher Education Ordinance. Special reasons may be sick leave, military service, work for trade unions and parental leave. The doctoral student should perform departmental work at typically 20 per cent of work time and compensated by a corresponding extension of the study duration.

4.2 Individual study and financial plan

An individual study plan will be drawn up in connection with admission to show how education should be performed. The individual plan is designed jointly by the research student and his/her supervisor and should clarify all parties' commitments, including both specific goals for the student and the supervision arrangements. The individual plan should:

1. name the primary supervisor and secondary supervisor(s)
2. name the examiner who may not be identical with the primary supervisor and secondary supervisor(s)
3. include a timetable for the doctoral student's research training, a tentative title of the thesis and a description of the scientific work
4. specify the supervision arrangements
5. contain a schedule of the proposed third-cycle courses to be incorporated
6. provide a description of other scholarly activity such as attendance at seminars, conferences and research visits to other institutions
7. include the financing plan,

8. include agreements with the doctoral student's employer for doctoral students based in industry.

The individual study plan is approved by the Doctoral Programmes Board after processing of the Head of Research. A financial plan that clarifies the financial responsibility for the student's entire graduate training should be included as an appendix.

In cases where the funding will be made within the framework of a job with another employer, the director of operations in which the student is employed must approve the entire study plan, in order to certify that training can take place as described.

The individual study plan is reviewed once per school year unless otherwise stated by the Doctoral Programmes Board. In conjunction with the annual review the individual study plan is revised if necessary by the doctoral student and supervisors in collaboration. The main supervisor should assess during the annual review whether the research student is following the study plan and give explanation to possible deviations.

Established and revised individual study plans and completed credits must be documented and archived by the Study Director for doctoral programmes who also reports status to the Doctoral Programmes Board. The report will include how supervision and the collaboration between the doctoral student and the supervisors works.

Significant deviations from an individual study plan may mean that the doctoral student is denied access to the university's resources, in accordance with the Higher Education Ordinance.

If the deviation is significant, it should be reported to supervision committee in the form of a written statement (including copies of the individual study plan). The Study Director should give the student the opportunity to provide a written comment on the supervisor's report, after which the Head of Research determines whether a request for withdrawal of resources will be submitted for comments of Doctoral Programmes Board and decision by the Vice-Chancellor. The request must include a judgment of how the university has fulfilled its obligations to the doctoral student. The request must be accompanied by the supervisor's letter and the student's written opinion on the matter, the opinion of the Doctoral Programmes Board, along with the individual study plan.

4.3 Thesis

As part of their doctoral studies, doctoral students write a thesis. The dissertation must demonstrate the student's ability to perform research a satisfactory scientific level and independently solve the required research task. The scientific work which forms the thesis must be of quality suitable to be accepted for publication in recognized refereed scientific journals.

Licentiate thesis

The thesis consists of 75 credits. The licentiate thesis must be designed as a pair of scientific papers with a brief summary that serves as an introduction to the thesis topic.

Doctoral dissertation

The thesis consists of 180 credits. The doctoral dissertation will be designed as a number of scientific articles with a summary (i.e. a compilation dissertation). The doctoral dissertation normally consists of four scientific papers that have been discussed at research seminars. However, it should be noted that it is the scientific quality and the student's independent contributions to the development of knowledge that are considered, not the number of articles in the thesis.

4.4 Courses

Taught third-cycle courses are given by the Schools of Technology and Society at Dalarna University, or at other schools or universities. Each course should have a written curriculum with course objectives, content and number of credits indicated. The supervisor determines the number of credits which the student can incorporate into their research degree. The courses are divided into mandatory and optional courses.

Degree of Licentiate

The licentiate degree incorporates course work of 45 credits, of which 31.5 are mandatory. The following mandatory courses in microdata analysis must be included:

Data collection and data quality, 5 credits
 Complexity and approximations, 9 credits
 Statistical modeling and controversy in statistical inference, 10 hp
 Advanced Microeconomics, Graduate level, 7.5 credits

Courses to be included in the training of a doctoral student registered for a licentiate degree shall be specified in the individual study plan.

Degree of Doctor

The PhD incorporates coursework of 60 credits, of which 30 are mandatory. The following mandatory courses in microdata analysis must be included:

Data collection and data quality, 5 credits
 Complexity and approximations, 9 credits
 Statistical modeling and controversy in statistical inference, 10 hp
 Advanced Microeconomics, Graduate level, 7.5 credits

Doctoral students who teach and do not have equivalent pedagogical skills/qualifications should take a basic pedagogical course of up to 7.5 credits.

Courses to be included in the training of a doctoral student registered for a PhD degree shall be specified in the individual study plan.

5. Degree Requirements

To be awarded the degree it is required that the student receive a pass on both the courses included in the training and on their PhD/licentiate thesis. The Study Director of the doctoral study program in microdata analysis, in conjunction with the principal supervisor of the student, verifies that all formal requirements for the PhD/licentiate degree have been met.

Degree of Licentiate

In order to obtain a licentiate degree requires 120 credits, of which 45 credits are obtained from course work and the remaining 75 credits is a licentiate thesis. All mandatory courses totalling 32.5 credits must be completed before the licentiate degree can be awarded. The licentiate thesis must be presented orally in English or Swedish at an open seminar led by the examiner of the thesis. The thesis is graded pass or fail.

Degree of Doctor

To obtain a doctoral degree requires an additional 120 credits (total 240 credits), including 15 credits (total 60 credits) obtained in the taught course component and the remaining 105 credits (total 180 credits) consists of a doctoral dissertation. The dissertation must be defended orally in English or Swedish at a public defense. The thesis is graded pass or fail.

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