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Translation of Subject Curriculum (Study Plan) for Third-cycle (PhD) Education

Computerized Image Processing

Swedish title: Datoriserad bildbehandling

TNDBIB00

Swedish curriculum adopted by the Board of the Faculty of Science and Technology (Third-cycle Educational Board) on 2012-03-07, revision on 2018-01-17.
Translations approved 2012-03-07 and 2018-01-17.

The Study Plan for third-cycle studies consists of three parts: a general part, this subject specific study plan, and each doctoral student's individual study plan.

Objective

In relation to the first and second-level education in the subject area, the graduate level education shall give additional insight into the field's most important areas and deep knowledge in at least one subarea. This includes training in research methodology, along with good insight into the issues that exist in the research area and its applications. Through supervision and thesis writing, the doctoral student should become well prepared for critical and independent research or other professional activity where deep subject knowledge and research abilities are required.

The doctoral student shall also be able to present her/his own goals and results orally and in writing to different target groups in English and, in the case of Swedish-speaking doctoral students, in Swedish.

Subject description

Computerized Image Processing concerns development and analysis of methods to create and process digital images and to extract information from these. The goal is that these methods should be useful for one or more of the following purposes:

- To quantitatively and qualitatively describe the content of an image.

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- To segment an image into components so that these can automatically be recognized and visualized.
- To develop methods and systems that can be used to visualize or interactively analyze images.
- To visualize data so that they can be scrutinized and interpreted through our senses.
- To provide information about the environment to autonomous systems.
- To create and test models for how biological vision works.
- To encode images so that they can be stored and transmitted as efficiently as possible.

The development of methods, their scientific evaluation and implementation are key components of this activity.

The research in Computerized Image Processing is carried out at the Centre for Image Analysis and organized as a part of the Division for Visual Information and Interaction within the Department for Information Technology, Uppsala University. The applications are mainly taken from biomedicine, natural sciences, and digital humanities. Information about current research topics can be found at www.cb.uu.se.

Eligibility

Basic Eligibility

The basic eligibility for third-cycle studies is described in the general part of the study plan.

Special Eligibility

Specific eligibility for third-level education in Computerized Image Processing encompasses passed examination in courses relevant for Computerized Image Processing corresponding to at least 90 higher education credits. Out of these at least 30 credits must be from courses on an advanced level. A master thesis or similar achievement with relevance for Computerized Image Processing is desirable. Persons who have acquired corresponding knowledge outside Sweden are also qualified.

Admission

Applicants for third-cycle studies in Computerized Image Processing must submit an application to the Head of the Department of the Department of Information Technology. Admission to doctoral studies

takes place normally several times per year.

Upon admission to postgraduate education, the Swedish title of the degree is to be specified in the application. According to decision (TEKNAT 2012/215), postgraduate education in Computerized Image Processing shall lead to a *teknologie doktorsexamen*. The English rendering will be a licentiate/doctorate degree of philosophy.

At the time of admission, the department must provide a financial assistance plan demonstrating sufficient support to cover the maintenance of the applicant as well as her/his research.

Program structure

At the time of admission, each doctoral student and her/his supervisor shall draw up an individual study plan after consultation with the professor in charge of third-cycle studies. The plan is to be approved by the Head of the Department (by delegation of the Faculty Board) at the time of admission.

The individual study plan shall be annually reviewed by the doctoral student and her/his supervisor jointly, and supplemented with a summary of the achieved results and the plans for the coming year. Significant changes as well as any disagreement on the individual study plan shall be reported to the Head of the Department or, if deemed necessary, to the Third-cycle Educational Board.

Courses

Courses in third-level education are intended to provide wider insight into the subject as a complement to the specialist competence acquired in the research work. The courses are divided into base courses, that may be common to all third-level students in Computerized Image Processing, and complementary courses adapted to the planned content of the thesis as well as knowledge broadening courses. The complementary courses are meant to deepen the knowledge within the area of the thesis subject. The broadening courses are intended to give the student the possibility to acquire knowledge from other scientific areas that are of a special relevance to the thesis subject and its applications.

Examples of base courses are:

- Research methods in Computerized Image Processing 1 SEP
- Analysis of multidimensional and multi-spectral images and video sequences

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- Digital imaging systems
- Multidimensional signal processing
- Pattern recognition and decision theory
- Discreet geometry in two and more dimensions
- Mathematical morphology
- Machine learning/Neural networks

In addition to these courses, courses offered in adjacent third-level programs, or on advanced level in relevant topics, may, after permission from the main supervisor, be included in the individual study plan. This will primarily be courses in mathematics, numerical analysis, mathematical statistics, signal processing, computer science and computer engineering.

Examples of such courses are:

- Optimization
- Computer graphics
- Regression analysis
- Multivariate analysis
- Differential geometry
- Topology
- Graph theory
- Algorithm analysis
- Signal processing

It is also desirable to include some course in a subject relevant for the application area of the student's research project, for instance in bioscience or medicine. Courses from a lower-level program may not exceed 15 higher education credits. Courses that have been used for admission to the program may not be part of the individual study plan.

Requirements for doctoral degree

The requirements for the doctoral degree consist of passed examinations in the courses included in the approved individual study plan of each doctoral student, as well as a passed public defense of the degree project. The studies awarded a doctoral degree comprise 240 higher education credits (four years of full-time studies), of which the doctoral thesis comprises a minimum of 120 higher education credits and the course part a minimum of 90 higher education credits.

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Requirements for licentiate degree

A doctoral student who has acquired at least 120 higher education credits (two years of full-time studies) is eligible for a licentiate degree. The requirements consist of passing the examinations included in the program stage and receiving a passing grade on an academic paper of at least 60 higher education credits. The part of the course amounts to a minimum of 45 higher education credits.

Other

Research in Computerized Image Processing is conducted in the context of national and international cooperation and requires an extensive global information flow. It is necessary that the graduate student can understand and write texts related to Computerized Image Processing in English. The dispersing of knowledge outside of the academic world is important. Students in third-level programs should therefor take part in activities aiming at distributing knowledge to different parts of society.