Translation of Curriculum Statement for Graduate Level (Third Level) Education

Computerized Image Processing

Swedish title: Datoriserad bildbehandling

TNDBIB00

Swedish Curriculum adopted by the Board of the Faculty of Science and Technology (Board for Third-level Education) on 2012-03-07.

The Curriculum Statement for Third-level Education consists of three parts: a general part, this subject specialized curriculum statement, 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.
- 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 software is an essential component of this activity.

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

Eligibility

Basic Eligibility
The basic eligibility for third level education is described in the general part of the curriculum statement.

Specific 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 also required. Persons who have acquired corresponding knowledge outside Sweden are also qualified.

Admission
Applicants for third-level program in Computerized Image Processing must submit an application to the head of the Department of Information Technology. Admissions to places in third-level programs normally take place a few times per year.

In connection with the admission it must be stated how it is planned to finance both the personal maintenance of the doctoral student, and her/his research.
Program structure
In connection with the admission, each doctoral student and her/his supervisor shall draw up an individual study plan, after consultation with the professor in charge of the third-level program. The head of the department (by delegation of the Faculty Board) is to approve the plan, in connection with the admission.

The individual study plan shall be reviewed jointly by the doctoral student and her/his supervisor, annually, and be extended with a summary of the achieved results and the plans for the coming year. Significant changes and any disagreement on the individual study plan shall be reported to the head of the department or, if deemed necessary, to the Board for Third-level Education.

Courses
Courses in third-level education may be of different types, such as lectures, literature studies, practical exercises, field studies, etc. The courses and literature studies are intended to provide wider insight into the subject as a complement to the specialist competence acquired in the research work. Therefore, the courses should include those which cover image processing methods with sufficient depth and breadth.

The third-level course offerings in Computerized Image Processing are continuously revised. Examples of courses are:
- Images with more than two dimensions (volumes, sequences, multispectral)
- Analysis of colour, multispectral and hyperspectral images
- Multidimensional signal processing
- Pattern recognition and decision theory
- Discrete geometry in two and more dimensions
- Mathematical morphology

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
• Neural networks
• 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.

Requirements for doctoral degree
The requirements for doctoral degree consist of on one hand passed examinations in the courses included in the approved individual study plan of each doctoral student, and on other hand passed public defence of the doctoral thesis. The program leading to the doctoral degree amounts to 240 higher education credits (four years of full-time studies), of which the thesis part amounts to a minimum of 120 higher education credits and the course part to a minimum of 90 higher education credits.

Requirements for licentiate degree
A stage of at least 120 higher education credits (two years of full-time studies) in the third-level program may be completed with a licentiate degree. The requirements for this are that the doctoral student both has passed the examinations included in the program stage, and has got an academic paper amounting to a minimum of 60 higher education credits passed. The course part amounts to a minimum of 45 higher education credits.

Other
Research in Computerized Image Processing is conducted in extensive international cooperation and requires an extensive global information flow. It is necessary that the graduate student can understand and write texts related to image processing in English.