SYLLABUS

Image Processing with Space Applications 7.5 credits R7011R

Bildbehandling med rymdtillämpningar

Course syllabus admitted: Autumn 2024 Sp 1 - Present

DECISION DATE
2024-02-15

Luleå University of Technology 971 87 Luleå, Sweden
Phone: +46 (0)920 49 10 00 • Corporate Identity: 202100-2841

LULEÅ TEKNISKA UNIVERSITET

Image Processing with Space Applications 7.5 credits R7011R

Bildbehandling med rymdtillämpningar

Second cycle, R7011R

Education level	Grade scale	Subject	Subject group (SCB)
Second cycle	G U 3 4 5	Rymd- och atmosfärsvetenskap	Space Technology

Main field of study

Space Technology

Entry requirements

120 hp in completed courses in physics and/or technologhy, and Linear algebra(M0048M Linear Algebra and Calculus), Fourier transforms (M0018M Linear Analysis), programming (D0009E Introduction to Programming), basic optics (F0005T Physics 2).

Knowledge in English equivalent to English 6.

Selection

The selection is based on 30-285 credits

Course Aim

After completing the course participants should be able to :

1. with broad expertise in the field of space engineering, be able to describe the impact on the post-processing methods from the image formation system in space applications such as northern light measurements, astronomy and earth observations. This is shown through ability to suggest concepts for image correction enhancement methods for given space applications.

2. apply knowledge in mathematics and science for qualitative and quantitative analysis of common digital image processing methods, and to describe images, systems and operations in different domains. This is shown by comparison of results of applying different methods: calculation of error residuals, SNR, visual artefacts, and for linear systems calculations and mathematical descriptions of images and operations in both spatial and frequency domain.

3. model and simulate system effects using software such as MATLAB, and implement and analyze image correction methods. This is shown through laboratory work where the student chose, implements, and applies different methods for different types of system degradations.

Contents

The course will cover:

Examples on image formation systems in space (for example aurora research, earth observation from space, astronomy) .

Radiometric and geometric correction

Image processing: Contrast enhancement, filtering, color composites, principal components

Image restoration, de-convolution

Digital classification

Image compression

Image processing in spatial and frequency domain

Realization

Each course occasion´s language and form is stated and appear on the course page on Luleå University of Technology's website.

The course is a combination of lectures, assignments and individual exercises. All students must hand in reports on the assignments. The individual exercises and assignments will give an opportunity for the student to test methods taught during lectures, to analyse and compare the methods and to make the student familiar with the software tools (MATLAB). Apart from scheduled teaching the students are expected to study scientific papers and parts of the course literature individually and solve exercises belonging to course sections.

Examination

If there is a decision on special educational support, in accordance with the Guideline Student's rights and obligations at Luleå University of Technology, an adapted or alternative form of examination can be provided.

The course is assessed through an individual written exam and written assignments.

Intended learning outcome 1-2 is assessed through the written exam and the assignments. Intended learning outcome 3 is assessed through assignments. Some assignments render bonus marks on the written exam that follows directly after the course has been given and the following two re-exams. All exams included in the module need to be completed for a course grade.

Supplementation is permitted within 3 weeks after the examination by written home assignment. Completion is possible if all parts and assignments have been submitted and approved and the supplement only concerns a partial question on the written exam.

Unauthorized aids during exams and assessments

If a student, by using unauthorized aids, tries to mislead during an exam or when a study performance is to be assessed, disciplinary measures may be taken. The term “unauthorized aids” refers to aids that the teacher has not previously specified as permissible aids and that may assist in solving the examination task. This means that all aids not specified as permissible are prohibited. The Swedish version has interpretative precedence in the event of a conflict.

Remarks

Second cycle course

Course offered by

Department of Computer Science, Electrical and Space Engineering

Modules

Code	Description	Grade scale	Cr	Status	From period	Title
0004	Written exam	G U 3 4 5	4.5	Mandatory	A21	
0005	Assignment report	G U 3 4 5	3	Mandatory	A24	

Last revised

by Robert Brännström 2024-02-15

Syllabus established

by Dept of Space Science 2007-02-28