COURSE DESCRIPTION CARD - SYLLABUS

Course name
Advanced data compression

Course

Field of study
Electronics and Telecommunciations
Area of study (specialization)

Level of study
Second-cycle studies
Form of study
full-time

Year/Semester
II/IV
Profile of study
general academic
Course offered in
English
Requirements
elective

Number of hours

Lecture
30
Laboratory classes
0
Other (e.g. online)

Tutorials
0
Projects/seminars
15/0

Number of credit points

4

Lecturers

Responsible for the course/lecturer:
dr inż. Damian Karwowski

damian.karwowski@put.poznan.pl

Responsible for the course/lecturer:

Prerequisites

1. Student has a systematic knowledge of mathematical analysis, algebra and theory of probability.

2. Has a systematic knowledge, together with necessary mathematical background, of 1D signal theory; this knowledge allows him/her to understand the representation of signals and signal analysis in time domain and in frequency domain.

3. Demonstrates the ability to solve problems related to signal analysis in time domain and in frequency.

4. Student knows the principles of construction of computer programs ; has knowledge from the area of computing science; knows the syntax of a selected high level programming language (e.g., C, C++, C#, MatLab), is able to write software for basic computational algorithms, using popular programming languages (e.g. Matlab, C).

Course objective

Familiarize students with advanced compression techniques for general data (e.g, text), audio data, image and video data, and hyperspectral data. There are presented methods of effective representation of text data using Burrows-Wheeler transform, and also methods using sophisticated algorithms of data statistics modeling. There are presented contemporary tools of audio compression. Additionally, the goal is to familiarize students with advanced techniques of video compression, the idea of distributed video coding, methods of context-adaptive entropy coding, and compression techniques of hyperspectral data.

Course-related learning outcomes

Knowledge

1. The student has skills associated with the state of the art compression techniques of text data, audio data, image and video data, and hyperspectral data.

2. The student has knowledge in terms of idea of the known data compression algorithms, and is able to use the known methods for efficient representation and transmission of data in a telecommunication channel.

3. The student knows advantages and disadvantages of the known compression techniques, and understand well the benefits from using the methods for efficient representation of data.

Skills

1. The student is able to give the mathematical description of the known algorithms of data compression and to propose appropriate method in order to efficiently represent data of a given type.

2. The student is able to perform compression of a given type data in order to represent them in an efficient way, and is able to do the analysis of compression performance of the method.

3. On the basis of the known methods, the student is able to design the own compression method dedicated to a defined application.

Social competences

1. The student understands the need for continuous training in order to improve skills.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

1. Lecture

Written and / or oral exam. The exam consists of a few to over a dozen questions (depending on the assumed nature of the questions) and concerns the content presented during the lectures. The exact nature of the exam questions will be presented to students during one of the last lectures. Pass threshold: 50% of points.

2. Projects

Presentation of the results of projects made by students. Assessment of the results obtained, the complexity of the project and the presentation of the project itself.

Programme content

1. Lecture

Advanced techniques of general data compression (methods that use the Burrow-Wheeler transform and advanced data statistics modeling techniques).

Advanced compression of audio data (selected contemporary methods).

Advanced image and video data compression (e.g., hybrid coding schemes, sub-band coding).

Distributed video coding.

Advanced context-based adaptive entropy coding techniques (review of the selected contemporary methods).

Advanced compression of hyperspectral data.

2. Projects

Projects are strictly related to the topics of advanced data compression and include the following topics:.

Advanced techniques of general data compression (measuring the compression performance of the selected methods).

Analysis of compression performance of the selected coding tools used in audio compression.

Analysis of the selected methods of image and video compression.

Compression performance of the selected contemporary entropy coding techniques.

Compression of hyperspectral data.

Under the project it is allowed to put the task of developing of the own data compressor and decompressor.

Teaching methods

1. Lecture

Classes with clear elements of traditional lecture and problem lecture (discussion with students of a specific problem), depending on the content of the presented material. Presentation of the theory and methods with examples of their use. Selected contents of the lecture are presented on a multimedia projector or board. The discussion of the issues is accompanied by information on their practical application.

2. Projects

Solving problems given by the teacher. Interpretation of the received solutions and formulation of conclusions. Discussion of the practical application of the methods/algorithms being the subject of projects. Practice in presenting the project results.

Bibliography

Basic

1. G. Salomon, G. Motta, Handbook of data compression, Springer-Verlag, 2010.

2. J. W. Woods, Multidimensional Signal, Image, and Video Processing and Coding, Elsevier, 2012.

3. G. Motta, F. Rizzo, J. A. Storer (editors), Hyperspectral Data Compression, Springer, 2010.

Additional

1. P. L. Dragotti, M. Gastpar, Distributed Source Coding, Elsevier, 2009.

2. Technical documentation of working groups MPEG, VCEG and other related.

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,0
Classes requiring direct contact with the teacher	58	2,0
Student's own work (literature studies, preparation for exam, project preparation) [1]	42	2,0

[1] delete or add other activities as appropriate