Information theory and coding

lingi2348
2021

UCLouvain

5.00 credits	30.0 h + 15.0 h	Q2

Teacher(s)	Louveaux Jérôme ;Macq Benoît ;Pereira Olivier ;
Language :	English
Place of the course	Louvain-la-Neuve
Main themes	• Information representation: decorrelation coding and entropic coding. • Information security: cryptographic coding. • Information correction: channel coding theory and error-correcting codes.
Learning outcomes	**At the end of this learning unit, the student is able to :** 1 Given the learning outcomes of the "Master in Computer Science and Engineering" program, this course contributes to the development, acquisition and evaluation of the following learning outcomes: • INFO1.1-3 • INFO2.2 • INFO5.2 • INFO6.4 Given the learning outcomes of the "Master [120] in Computer Science" program, this course contributes to the development, acquisition and evaluation of the following learning outcomes: • SINF1.M1 • SINF2.2 • SINF5.2 • SINF6.4 Students completing this course successfully will be able to • explain the notions, methods and results that are used in the analysis and design of information representation, protection and correction systems. • present not only general results that determine the possibilities offered by information theory, but also effective compression, security and correction methods. • provide some design tools for multimedia (image, sound, data) information coding.
Evaluation methods	Written examination covering both theory and exercises. The exam may be divided into a closed-book part and an open-book part.
Teaching methods	The course consists of magistral courses as well as exercice sessions to explore the different aspects of the theory.
Content	• Basic notions in information theory; mutual information and entropy. • Discrete source coding by fixed length-codes and variable-length codes. • Decorrelation coding and coding gain notions. • Basic notions in cryptology; secret-key and public-key cryptographic coding systems. • Discrete memoryless channel; capacity notion; noisy channel coding theorem. • General block coding theory; role of the minimum distance. • Linear codes: generator matrix and parity-check matrix; syndrome decoding. • Study of certain classes of linear block codes: cyclic codes and Reed-Solomon codes. • Introduction to convolution codes.
Inline resources	Moodle https://moodleucl.uclouvain.be/course/view.php?id=5483
Bibliography	• R.G. Gallager, "Information Theory and Reliable Communication" , John Wiley, 1968. • F.J. MacWilliams and N.J.A. Sloane, "The Theory of Error-Correcting Codes" , North-Holland, 1977.
Other infos	Background: • LFSAB1402 : solid basic knowledge in computer science • LFSAB1103 : solid basic knowledge in mathematics

Faculty or entity in charge	INFO

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Data Science Engineering	DATE2M	5		🔍
Master [120] in Electrical Engineering	ELEC2M	5		🔍
Master [120] in Computer Science and Engineering	INFO2M	5		🔍
Master [120] in Data Science: Information Technology	DATI2M	5		🔍
Master [120] in Computer Science	SINF2M	5		🔍
Master [120] in Mathematical Engineering	MAP2M	5		🔍