ULBS
Universitatea "Lucian Blaga" din Sibiu

"Lucian Blaga" University of Sibiu
Faculty of Engineering
Department of Computer Science and
Electrical and Electronics Engineering

Valid for academic year: 2019 - 2020

COURSE DESCRIPTION

1. Program details

University	"Lucian Blaga" University of Sibiu
Faculty	Engineering Faculty
Department	Department of Computer Science and Electrical and Electronics Engineering
Main field of study	Computer Science and Information Technology
Level of education	Master
Specialization	Advanced Computing Systems

2. Course details

Course title	**Advanced Compression Methods**			
Course code	Type of course	Year of study	Semester	Number of credits
mACS.204.SO	Compulsory	1	2	7
Evaluation type	Type of course (FD=fundamental discipline.; DD=domain discipline; SD=specialized discipline; CD=complementary discipline)			
Exam	SD			
Course instructor	Assoc. Prof. Eng. Macarie BREAZU, PhD			
Seminar/lab/project instructor	Assoc. Prof. Eng. Macarie BREAZU, PhD			

3. Estimated time

Course duration in the curriculum – number of hours per week				
Lecture	Seminar	Lab	Project	Total
2	0	2	0	**4**
Course duration in the curriculum - Total of hours curriculum				
Lecture	Seminar	Lab	Project	Total ($NOAD_{sem}$)
28	0	28	0	**56**

Distribution of hours for individual study	No. hours
Individual study using course handbooks, bibliography and notes	20
Additional documentation in library and on specialized electronic platforms	15
Preparing seminars / labs, homework, essays and portfolios	16
Tutoring	2
Exam preparation	3
Total hours for individual study ($NOSI_{sem}$)	56
Total hours per semester ($NOAD_{sem} + NOSI_{sem}$)	**112**

4. Prerequisites (if applicable)

curriculum	
competencies	Fundamental data compression methods

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5. Conditions (if applicable)

course materials	video projector, internet access
sem/lab/project materials	Computer network, internet access

6. Specific competences acquired

Professional competence	The development of specific high performance applications. Design and acceleration of complex graphic applications. Implementation of advanced compression methods. Development of methods and techniques for automatic understanding of the visual context.
Transversal competences	

7. Objectives (based on the specific grid for the accumulated competences)

General objective	The students must understand the state of the art compression methods and be able to implement some and use the specific tools available. Also, the students must develop good research skills in this field.
Specific objectives	• knowledge and proper operation of discipline-specific advanced concepts • usage of a variety of strategies, methods, techniques for design, implementation and evaluation • developing of a positive attitude towards (the need for validation of the theoretical aspects by) a practical application

8. Contents

Course		No. hours
Course 1	Data compression. Introduction. Classification. History. Image, audio and video formats.	2
Course 2	Statistical coding. Variable length coding. Arithmetic and Huffman coding.	2
Course 3	Predictive coding. Lossless and near-lossless coding. JPEG-LS.	2
Course 4	Principles of audio-video compression: predictive coding, transform-based coding, motion compensation.	2
Course 5	Vector Quantization. Building dictionaries. Variants.	2
Course 6	Fractal Image Compression. Speeding-up methods.	2
Course 7	Subband coding. Wavelet transform. EZW, SPIHT, EBCOT algorithms.	2
Course 8	Still image compression – JPEG and JPEG2000.	2
Course 9	H.261 – coding for videoconferencing. Macroblocks.	2
Course 10	MPEG-1 – coding for digital storage media. Structure. Coding of I, P and B pictures. Motion compensation.	2
Course 11	MPEG-2 – high quality video coding. Differences to MPEG-1. Scalable and nonscalable modes.	2
Course 12	H.263 – coding for low bit rate communications. Differences to H.261 and MPEG-1. Advanced motion compensation. Treatment of B pictures. Protection against error. H.26L.	2
Course 13	Audio coding. Psychoacoustic models. MPEG layer II, III (MP3) and Dolby AC3 audio coding.	2
Course 14	MPEG-4 – content based video coding. Image segmentation. Shape coding. MPEG-7 and MPEG-21 – Content description, search and delivery	2

	Total course hours:	28
Laboratory		No. hours
Lab 1	Implementation of a library of functions for bit-level file access	2
Lab 2	Implementation of an arithmetic coder	2
Lab 3	Implementation of an arithmetic coder	2
Lab 4	Implementation of an arithmetic coder	2
Lab 5	Implementation of a near-lossless predictive coder	2
Lab 6	Implementation of a near-lossless predictive coder	2
Lab 7	Implementation of a near-lossless predictive coder	2
Lab 8	Implementation of a fractal coder	2
Lab 9	Implementation of a fractal coder	2
Lab 10	Implementation of a fractal coder	2
Lab 11	Implementation of a wavelet-based coder	2
Lab 12	Implementation of a wavelet-based coder	2
Lab 13	Implementation of a wavelet-based coder	2
Lab 14	Evaluation of programs	2
	Total lab hours:	28

Teaching methods

Lectures, explanations, conversations, demonstrations, case studies, exercises, debates	Language of instruction	English

References

Recommended reading	1. Khalid Sayood, "*Introduction to Data Compression*", Fifth Edition, ISBN: 978-0-12-809474-7, Morgan Kaufmann, 2018
	2. David Salomon, "*Data Compression: The Complete Reference*", Fourth Edition, ISBN 978-1846286026, Springer, 2007, ULBS library code: 04/S17
	3. Mohammed Ghanbari, "*Standard Codecs: Image Compression to Advanced Video Coding*", ISBN 0852967101, The Institute of Electrical Engineers, IEE, London, 2003
	4. Jens-Rainer Ohm, "*Multimedia Signal Coding and Transmission*", ISBN: 9783662466902, Springer, 2015, ULBS library code: 04/O-34
	5. http://webspace.ulbsibiu.ro/macarie.breazu/ACM.htm
More references	1. Breazu M., "*Tehnici fractale şi neuronale în compresia de imagini*", Editura Universitatii „Lucian Blaga" din Sibiu, ISBN 973-739-251-5, Sibiu, 2006, ULBS library code: 04/B76

9. Linking course content with expectations of the epistemic community representatives, professional associations and employers' representatives in the field related to the program

10. Evaluation

Type	Evaluation criteria	Evaluation methods	Percentage in final grade	Obs.*
Course	Theoretical aspects assimilation	Written exam	50 %	RFE
Lab	Lab coders implementation	Practical presentation	50 %	REP
Minimum standard of performance				
4.50 grade at each component				

(*) REP – required for exam participation; nREP – not required for exam participation; RFE – required for final evaluation.

Date of completion: ……..

Date of approval in the Department:…….

	Position, title, first name, surname	Signature
Course instructor	Assoc. Prof. Eng. Macarie BREAZU, PhD	
Head of department	Prof. Eng. Daniel VOLOVICI, PhD	