Universidad Carlos III de Madrid

DENOMINACIÓN ASIGNATURA: Information Theory		
POSTGRADO: MÁSTER UNIVERSITARIO EN Information and Health Engineering Profesor/a: Tobias Koch	ECTS: 6	CUATRIMESTRE: 2

CRONOGRAMA DE LA ASIGNATURA (versión detallada)

SEMANA	SESIÓN	DESCRIPCIÓN DEL CONTENIDO DE LA SESIÓN (En su caso, incluir las recuperaciones, tutorías, entrega de trabajos, etc)	GRUPO (marcar X)		Indicar espacio Necesario distinto aula (aula informática, audiovisual, etc..)	TRABAJO DEL ALUMNO DURANTE LA SEMANA		
			1	2		DESCRIPCIÓN	HORAS PRESENCIALES	HORAS TRABAJO
1	1	Introduction: examples of data compression problems.	X			Reinforcing course material at home.	1.5	
	2	Entropy, relative entropy, and mutual information.	X			Reinforcing course material at home.	1.5	4
2	3	Conditional mutual information, Jensen's inequality.	X			Reinforcing course material at home. Homework Exercise 1 (to be handed in in Session 6).	1.5	4
	4	Properties of relative entropy, entropy, and mutual information. Log-sum inequality and data-processing inequality.	X			Reinforcing course material at home. Homework Exercise 1 (to be handed in in Session 6).	1.5	4

3	5	The method of types and the law of large numbers.	X			Reinforcing course material at home. Homework Exercise 1 (to be handed in in Session 6).	1.5	4
	6	Laboratory class: Discussion of Homework Exercise 1.	X			Reinforcing course material at home.	1.5	4
4	7	Introduction to data compression. Expected length of non-singular source codes.	X			Reinforcing course material at home. Homework Exercise 2 (to be handed in in Session 18).	1.5	4
	8	Kraft's inequality for prefix-free codes.	X			Reinforcing course material at home. Homework Exercise 2 (to be handed in in Session 18).	1.5	4
5	9	Bounds on the expected length of prefix-free codes, mismatch.	X			Reinforcing course material at home. Homework Exercise 2 (to be handed in in Session 18).	1.5	4
	10	McMillan's inequality for uniquely-decodable codes.	X			Reinforcing course material at home.	1.5	4

						Homework Exercise 2 (to be handed in in Session 18).		
6	11	Huffman codes and proof of their optimality.	X			Reinforcing course material at home. Homework Exercise 2 (to be handed in in Session 18).	1.5	4
	12	Non-prefix-free codes.	X			Reinforcing course material at home. Homework Exercise 2 (to be handed in in Session 18).	1.5	4
7	13	Universal compression.	X			Reinforcing course material at home. Homework Exercise 2 (to be handed in in Session 18).	1.5	4
	14	Laboratory class: The Lempel-Ziv algorithm.	X		Computer room	Reinforcing course material at home. Homework Exercise 2 (to be handed in in Session 18).	1.5	4

8	15	Non-prefix-free codes.	X			Reinforcing course material at home. Homework Exercise 2 (to be handed in in Session 18).	1.5	4
	16	Arithmetic coding.	X			Reinforcing course material at home. Homework Exercise 2 (to be handed in in Session 18).	1.5	4
9	17	Introduction to lossy compression. Definition and properties of the rate-distortion function.	X			Reinforcing course material at home. Homework Exercise 3 (to be handed in in Session 22).	1.5	4
	18	Laboratory class: Discussion of Homework Exercise 2.	X			Reinforcing course material at home.	1.5	4
10	19	Calculation of the rate-distortion function for binary sources with Hamming distortion and Gaussian sources with squared-error distortion.	X			Reinforcing course material at home. Homework Exercise 3 (to be handed in in Session 24).	1.5	4
	20	Statement of the rate-distortion theorem for memoryless sources. Proof of the converse.	X			Reinforcing course material at home.	1.5	4

						Homework Exercise 3 (to be handed in in Session 24).		
11	21	Achievability proof of the rate-distortion theorem.	X			Reinforcing course material at home. Homework Exercise 3 (to be handed in in Session 24).	1.5	4
	22	Laboratory class: Simultaneous description of independent Gaussian random variables.	X		Computer room	Reinforcing course material at home. Homework Exercise 3 (to be handed in in Session 24).	1.5	4
12	23	Introduction to vector quantization. Fixed-rate versus variable-rate quantization. Dithered quantization.	X			Reinforcing course material at home. Homework Exercise 3 (to be handed in in Session 24).	1.5	4
	24	Laboratory class: Discussion of Homework Exercise 3.	X			Reinforcing course material at home.	1.5	4
13	25	Scalar and lattice quantization.	X			Reinforcing course material at home. Homework Exercise 4 (to be handed in in	1.5	4

						Session 27).		
	26	Laboratory class: Lloyd's algorithm.	X		Computer room	Reinforcing course material at home. Homework Exercise 4 (to be handed in in Session 27).	1.5	4
14	27	Laboratory class: Discussion of Homework Exercise 4.	X			Preparation for final exam.	1.5	4
	28	Revision of course material.	X			Preparation for final exam.	1.5	4
TOTAL HORAS							42	108