Teaching Guide				
Identifying Data				2023/24
Subject (*)	Intelligent Systems		Code	614G01020
Study programme	Grao en Enxeñaría Informática			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	2nd four-month period	Second	Obligatory	6
Language	SpanishEnglish			
Teaching method	Face-to-face			
Prerequisites				
Department	Ciencias da Computación e Tecnoloxías da InformaciónComputación			
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General description	The first objective of the course is to provide students with basic knowledge in the field of symbolic artificial intelligence systems: search, resolution, representation and reasoning. The second objective of the course is to provide students with basic knowledge in the field of subsymbolic artificial intelligence systems. The knowledge acquired will allow them to consider these systems as alternative computational tools that can be applied in solving different types of problems.			

Study programme competences	
Code	Study programme competences
A21	Coñecemento e aplicación dos principios fundamentais e técnicas básicas dos sistemas intelixentes e a súa aplicación práctica.
B1	Capacidade de resolución de problemas
B3	Capacidade de análise e síntese
B5	Habilidades de xestión da información
B9	Capacidade para xerar novas ideas (creatividade)
C6	Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.
C8	Valorar a importancia que ten a investigación, a innovación e o desenvolvemento tecnolóxico no avance socioeconómico e cultural da sociedade.

Learning outcomes	
Learning outcomes	Study programme competences

Conocimiento y aplicación de los principios fundamentales y técnicas básicas de los sistemas inteligentes y su aplicación práctica.	A21	B1 B3 B5 B9	C6 C8

Contents	
Topic	**Sub-topic**
1. Introduction	1.1. An historical perspective 1.2. Preliminary aspects 1.3. General considerations
2. Problem-Solving	2.1. Introduction to solving problems in AI 2.2. The state space concept. Searching 2.3. General characteristics of searching processes 2.4. Uninformed search strategies 2.5. Informed search strategies. Heuristic functions 2.6. Local search
3. Structured Knowledge Representation	3.1. Introduction 3.2. Declarative methods 3.3. Procedural methods 3.4. Examples and a practical case
4. Production Systems	4.1 Architecture: Knowledge base, active memory, inference engine 4.2. Dynamics of rule production systems 4.3. Basic cycle of a production system
5. A Brief Introduction to Reasoning in AI	5.1. Introduction 5.2. Categorical model 5.3. Bayesian reasoning fundamentals
6. Connectionist Systems: Origin and Context; Biological Fundamentals	6.1 Historical Evolution and Precursors. 6.2 Birth of Connectionist Systems. 6.3. Biological Basis of the Adaptive Systems 6.4. Adquisition and organization of the knowledge in Adaptive Systems.
7. Architecture, Feeding and Learning in Connectionist Systems	7.1 Processing element in Connectionist Systems. 7.2 Comparison between the biological element and the formal one. 7.3 Feeding and architecture of the Connectionist Systems. 7.4 Learning in Connectionist Systems.
8. Feed-Forward Connectionist Systems	8.1. Adaline 8.2. Perceptron 8.3. Aplications
9. Other Models of Connectionist Systems	9.1 Self-organizing networks 9.2. Other self-organizing models: Growing neural networks 9.3. Hopfield network.
10. New approaches in Sub-Symbolic Artificial Inteligence	10.1 Evolutionary Computation. 10.2 Artificial Life. 10.3 NBIC Technologies.

Planning				
Methodologies / tests	**Competencies**	**Ordinary class hours**	**Student?s personal work hours**	**Total hours**
Laboratory practice	A21 B1 B5	20	0	20

Supervised projects	B3 B9	10	20	30
Guest lecture / keynote speech	C6 C8	30	60	90
Personalized attention		10	0	10
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	**Description**
Laboratory practice	- Using Symbolic Artificial Intelligence techniques to solve problems. - Using Subsymbolic Artificial Intelligence techniques to solve problems.
Supervised projects	- Study of the different models of symbolic intelligent systems and identification of the concepts involved in these models in practical application examples. - Search, analysis of real problems that show the application of Sub-symbolic Intelligence Artificial Systems.
Guest lecture / keynote speech	Imparting of the contents of the different topics of the subject, encouraging the participation of students in the understanding of practical examples.

Personalized attention	
Methodologies	**Description**
Laboratory practice Supervised projects	Personalized attention to practices in the classroom and for TGR will be developed.

Assessment			
Methodologies	**Competencies**	**Description**	**Qualification**
Guest lecture / keynote speech	C6 C8	Written exam to assess knowledge of the matter.	60
Laboratory practice	A21 B1 B5	- Only work submitted before deadline of students who have attended the hours assigned to the practices are scored.	30
Supervised projects	B3 B9	- Only work submitted before deadline of students who have attended the hours assigned to the TGR are scored.	10

Assessment comments
In order to pass the subject will be required to pass the exam of theory and also achieve at least 5 points after adding the note of written exam, with the notes of practice and TGR. If a student, due to duly justified reasons, is unable to complete all the continuous assessment tests, they should communicate with their professors to establish dates for defending the practical exercises and assignments. Second call: The grade obtained in the practical exercises throughout the course will be maintained, as well as its weight in the final grade. The exam will be conducted under the same conditions as in the first call, with the same weight in the final evaluation and requirements for calculating the average. Attendance Exemption: In case of attendance exception, students will take the exam under the same conditions as the students in the first examination session. Plagiarism: The fraudulent completion of tests or assessment activities, once proven, will result in an automatic failing grade in the examination in which it was committed: the student will be given a grade of "suspenso" (numeric grade 0) in the corresponding academic year's examination, whether the offense occurs in the first opportunity or the second. To this end, the student's grade will be modified in the first opportunity's record, if necessary. No-Shown: Students who do not participate in the Objective Test will receive a grade of "No-Shown."

Sources of information	
Basic	- Russell & Norvig (2021). Artificial Intelligence: A modern approach. Pearson (4ª ed) - Moret et al. (2005). Fundamentos de inteligencia artificial. Servicio de publicaciones de la UDC (2ª ed, 2ª imp) - José T. Palma, Roque Marín Morales et al. (2008). Inteligencia artificial - Técnicas, métodos y aplicaciones. McGraw Hill (1ª ed.) TEMAS 6 y 7 Cajal, S.: ?Textura del SistemaNervioso del Hombre y los Vertebrados?. Tomo I. Ed. Alianza. 1989.Haykin, S.: ?Neural Networks: A Comprehensive Foundation?. McMillan College Publishing. New York. 1994.Hertz, J., Krogh, A. & Palmer, R.: ?Introduction to the Theory of Neural Computation?. Santa Fe Institute, Addison-Wesley Editores 1991.McCulloch, W. S., and Pitts, W.: ?A Logical Calculus of the Ideas Inmanent in the Neural Nets?. Buletin of Mathematical Biophysics, vol. 5, pp. 115-137. 1943.Minsky,M. & Papert, S.: ?Perceptrons?. Cambridge,MIT Press, 1969.Rosenblueth, A., Wiener, N, and Bigelow, J.: ?Behavior, Purpose and Teleology?. Phylosophy of Science nº10, pp. 18-24. 1943.Wiener, N.: ?Cibernetics or Control and Communications in the Animals and Machines?. Ed. MIT. Press. 1948.TEMAS 8 y 9 Hertz,J., Krogh, A. & Palmer, R.: ?Introduction to the Theory of NeuralComputation?. Santa Fe Institute, Addison-Wesley Editores 1991.Hopfield, J. & Tank, D.: ?Computing with Neural Circuits? A Model?. Science, vol. 233, pp. 625-633. 1986.Kohonen, T.: ?Self organizing maps?. Springer Velag. Berlín. Segunda Edición. 1995.Ríos, J.Pazos, A. y otros: ?Estructura, Dinámica y Aplicaciones a las Redes NeuronasArtificiales?. Ed. Ceura. Madrid.1991.Isasi P, Galván I. Redes de Neuronas Artificiales. Un enfoque práctico. Prentice Hall. 2004TEMA 10Gestal M, Rivero D et al. Introducción a los Algoritmos Genéticos y la Programación Genética. Servicio de Publicacións da UDC. 2010. Yao, X. ?Evolving Artificial Neural Networks?. In:Proc. IEEE, Vol. 87 nº9 1423-1447. 1999.
Complementary	

Recommendations
Subjects that it is recommended to have taken before
Programming I/614G01001 Programming II/614G01006 Algorithms/614G01011 Programming Paradigms/614G01014 Software Design/614G01015
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Knowledge Representation and Automatic Reasoning/614G01036 Intelligent Systems Development/614G01037 Machine Learning/614G01038 Computer Vision/614G01068
Other comments
It is necessary to know the programming language Java in order to carry out the practicum of the first part of the course.Work will be done to identify and modify sexist prejudices and attitudes and influence the environment to modify them and promote values of respect and equality. Inclusive language will be used in the material and in the development of the sessions.