



Subject: Adaptive systems and user modeling (ASUM)  
Code: 32435  
Institution: Escuela Politécnica Superior  
Degree: Master's program in Research and Innovation in Information and Communications Technologies (I<sup>2</sup>-ICT)  
Level: Master  
Type: Elective [Human-centered software development]  
ECTS: 6

## COURSE GUIDE: Adaptive systems and user modeling (ASUM)

**Academic year:** 2015-2016

**Program:** Master's program in Research and Innovation in Information and Communications Technologies (I<sup>2</sup>-ICT)

**Center:** Escuela Politécnica Superior

**University:** Universidad Autónoma de Madrid

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## 1. ASIGNATURA / COURSE (ID)

### Sistemas adaptativos y modelado de usuario Adaptive systems and user modeling (ASUM)

#### 1.1. Programa / program

Máster Universitario en Investigación e Innovación en Tecnologías de la Información y las Comunicaciones (I<sup>2</sup>-TIC)

Master in Research and Innovation in Information and Communications Technologies (I<sup>2</sup>-ICT) [Officially certified]

#### 1.2. Course code

32435

#### 1.3. Course areas

Computer Languages and Systems / Computer Science and Artificial Intelligence

#### 1.4. Tipo de asignatura / Course type

Optativa [itinerario: Software centrado en el usuario]  
Elective [itinerary: Human-centered software development]

#### 1.5. Semester

Second semester

#### 1.6. Credits

6 ECTS

#### 1.7. Language of instruction

The lecture notes are in English. The lectures are mostly in Spanish. Some of the lectures and seminars can be in English.



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## 1.8. Recommendations / Related subjects

Knowledge of Web-based applications at an introductory level is useful to follow the course.

Related subjects are:

- Computación ubicua e inteligencia ambiental [Ubiquitous computing and ambient intelligence]
- Interacción persona- ordenador [Human-computer interaction]
- Minería web [Web mining]
- Recuperación de Información [Information retrieval]
- Redes sociales, colaboración en red [Social networks and collaboration on the Internet]

## 1.9. Lecturers

Add @uam.es to all email addresses below.

**Lectures and labs:**

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## 1.10. Objetivos de la asignatura / Course objectives

En esta asignatura se estudian los métodos y técnicas para diseñar, implementar y evaluar sistemas adaptativos accesibles a través de Internet. En particular, se aborda la generación (semi)automática de entornos en los que los elementos que los componen, así como su organización y presentación, se adaptan a las características, preferencias o necesidades de cada usuario en cada momento determinado. Para poder ofrecer servicios personalizados, es imprescindible contar con modelos de usuario que almacenen la información a utilizar con propósitos adaptativos. En esta asignatura se estudian las técnicas más actuales para la creación y adquisición de modelos de usuario, incluyendo la inferencia automática de información. También se aborda la utilización de herramientas de edición y visualización de entornos adaptativos en los que los usuarios pueden realizar actividades tanto individual como colaborativamente. A lo largo de todo el curso se estudian algunos de los sistemas más conocidos desarrollados en estas áreas, y se propone la creación de sistemas adaptativos por parte de los estudiantes.

This subject introduces methods and techniques for the design, implementation and evaluation of Internet-based adaptive systems. We teach how to (semi)automatically generate adaptive systems in which their components, as well as their organization and presentation, adapt to each user features, preference or needs in each context. In order to be able to offer personalization, it is essential to use information about the users, stored in user models. This course also deals with techniques for user model creation and acquisition, including information automatic inference. We also explore the use of authoring and visualization tools to help non-experts to develop adaptive environments in which the users can tackle individual or collaborative activities. Some of the best-known systems related to these areas are studied during the course. The students are also proposed to design and generate their own adaptive system.

At the end of each unit, the student should be able to:

UNIT BY UNIT SPECIFIC OBJECTIVES	
<b>UNIT 1.- Introduction to adaptive systems</b>	
1.1.	Provide examples of adaptive systems in different areas of applications.
1.2.	Know different methods available to include adaptation in computer-based systems.
1.3.	Know different techniques available to implement adaptation methods.
<b>UNIT 2.- User modeling</b>	
2.1.	Understand the concept of user model and its relevance for adaptive systems.
2.2.	Know and identify different types of user models.
2.3.	Know methods and techniques to build user models.
2.4.	Know the latest trends to acquire user features automatically.
2.5.	Identify and understand the utility and requirements to share user models between different applications.
2.6.	Formulate user models and set their parameters for specific adaptive applications.
<b>UNIT 3.- Authoring and visualization</b>	
3.1.	Understand the difficulty of authoring adaptive systems and environments.
3.2.	Design an adaptive application, specifying its components and adaptation criteria.
3.3.	Use authoring tools to create adaptive applications.
3.4.	Understand the complexity of visualizing adaptive structures, built on the fly



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	according to the user behaviors and needs.
3.5.	Use tools to visualize and edit adaptive structures.
<b>UNIT 4.- Applications</b>	
4.1.	Identify different domains in which adaptation is useful.
4.2.	Understand the possibilities and details of adaptation in e-learning environments: student modeling, course dynamic generation, adaptive collaboration support and adaptive feedback.
4.3.	Understand the usefulness of adaptation in some application domains such as e-commerce, mobile guidance or news access.
4.4.	Select useful methods and techniques for adaptation in different domains.
4.5.	Know the utility of adaptive systems for all (users with special needs).
<b>UNIT 5.- Evaluation of adaptive systems</b>	
5.1.	Characterize different methods to evaluate adaptive systems: empirical evaluation, user-centered and layered evaluation.
5.2.	Use data mining techniques to evaluate adaptive e-learning environments.
5.3.	Evaluate adaptive systems.

## 1.11. Course contents

1. Introduction to adaptive systems
  - a. Brief examples of adaptive systems
  - b. Adaptation Methods and Techniques
    - i. Adaptive navigation
    - ii. Adaptive presentation
    - iii. Application domains
2. User modeling
  - a. Generic user modeling
  - b. Data mining for user modeling
  - c. Trends to acquire specific user features automatically
    - i. Learning styles
    - ii. Personality
    - iii. Emotions
  - d. Sharing user models
3. Authoring and visualization
  - a. Authoring adaptive systems
  - b. Visualization of adaptive structures
4. Applications
  - a. Adaptive e-learning
    - i. Student modeling
    - ii. Course dynamic generation
      1. Course structures and activity recommendation
      2. Content adaptation



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- 3. Automatic workspace generation
- iii. Collaboration
  - 1. Collaborative activities
  - 2. Automatic workspace generation
  - 3. Dynamic group formation
- iv. Adaptive feedback
  
- b. Other Applications
  - i. Web-based adaptive mobile guides
  - ii. Adaptive news access
  - iii. Adaptive systems for all
  
- 5. Evaluation of adaptive systems
  - a. Empirical, user-centered and layered evaluation
  - b. Educational data mining

## 1.12. Course bibliography

[Bibliography available at the library's catalog \(click here\)](#)

1. User Modeling and User-Adapted Interaction. The Journal of Personalization Research. Vol. 22, numbers 1-2 (plus articles from different volumes to be announced in class). April (2012). Online access: <http://www.umuai.org/>
2. User Modeling and User Adapted Interaction, (Alfred Kobsa, ed.) 11 (1/2)
3. The Adaptive Web: Methods and Strategies of Web Personalization. Brusilovsky, P., Kobsa, A., Neidl, W. (eds.) Lecture Notes in Computer Science, Vol. 4321. Springer-Verlag, Berlin (2007)
4. User Modeling and Adaptation for Daily Routines. Providing Assistance to People with Special Needs. Martín, E., Haya, P., Carro, R.M. (Eds.). Human-Computer Interaction Series. Springer-Verlag London (2013), DOI 10.1007/978-1-4471-4778-7.
5. Methods and techniques for the evaluation of user-adaptive systems. Gena, C. Knowl. Eng. Rev. 20, 1 (Mar. 2005), 1-37. DOI= <http://dx.doi.org/10.1017/S0269888905000299>.
6. User Modeling, Adaptation and Personalization. Procs. of the 22nd International Conference UMAP 2014, Aalborg, Denmark, July 7-11, 2014. Dimitrova, V.; Kuflik, T.; Chin, D.; Ricci, F.; Dolog, P.; Houben, G. (Eds.) Lecture Notes in Computer Science, Vol. 8538. Springer-Verlag, Berlin (2014)
7. User Modeling, Adaptation and Personalization. Procs. of the 21st International Conference UMAP 2013, Rome, Italy, June 10-14, 2013. Carberry, S.; Weibelzahl, S.; Micarelli, A.; Semeraro, G. (Eds.) Lecture Notes in Computer Science, Vol. 7899. Springer-Verlag, Berlin (2013)
8. User Modeling, Adaptation and Personalization. Procs. of the 20th International Conference UMAP 2012, Montreal, Canada, July 16-20, 2012. Masthoff, J., Mobasher, B., Desmarais, M.C., Nkambou, R. (Eds.) Lecture Notes in Computer Science, Vol. 7379. Springer-Verlag, Berlin (2012)
9. User Modeling, Adaptation and Personalization. Procs. of the 19th International Conference UMAP 2011, Girona, Spain, July 11-15, 2011.



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- Konstan, J.; Conejo, R.; Marzo, J.L.; Oliver, N. (Eds.) Lecture Notes in Computer Science, Vol. 6787. Springer-Verlag, Berlin (2011)
10. User Modeling, Adaptation, and Personalization. Procs. of the 18th International Conference UMAP 2010, Big Island, HI, USA, June 20-24, 2010. De Bra, Paul; Kobsa, Alfred; Chin, David (Eds.) Lecture Notes in Computer Science, Vol. 6075. Springer-Verlag, Berlin (2010)
  11. Yacef, K., Zaïane, O., Hershkovitz, H., Yudelso, M., and Stamper, J. (eds.) Proceedings of the 5th International Conference on Educational Data Mining.: [http://educationaldatamining.org/EDM2012/uploads/procs/EDM\\_2012\\_proceedings.pdf](http://educationaldatamining.org/EDM2012/uploads/procs/EDM_2012_proceedings.pdf)
  12. Proceedings of the workshops of UMAP 2012: <http://ceur-ws.org/Vol-872>
  13. Proceedings UMAP 2011 workshops: <http://www.umap2011.org/proceedings/>

Note: The specific papers to be read, either from the proceedings cited here or from additional sources, will be announced in class.

### 1.13. Coursework and evaluation

The course involves lectures, lab practice, reading assignments, reports, oral presentations and one exam.

In both the ordinary and the extraordinary exam period it is necessary to have a pass grade ( $\geq 5$ ) in the exam to pass the course.

- In the ordinary exam period, the evaluation will be made according to the following scheme
  - 10 % Class participation
  - 20 % Lab work
  - 20% Research reading, summary and presentation
  - 30 % Individual work report and presentation
  - 20 % Exam

The grades of the individual parts are kept for the extraordinary exam period.

- In case of a fail grade in the ordinary exam period, in the extraordinary exam period, the student has the opportunity to
  - Turn in the lab assignments.
  - Turn in the report on existing research read.
  - Turn in the report on the individual work done.

The grade will be determined by

- Oral examination
  - 10 % Lab assignments [only if they are turned in]
  - 20 % Report on existing research [only if it is turned in]
  - 20 % Report on individual proposal [only if it is turned in]



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If the student does not turn in some of these items, the grades used will be those corresponding to the ordinary exam period.

- 50 % written exam [mandatory]