



Subject: Web Mining (WM)
Code: 32423
Institution: Escuela Politécnica Superior
Degree: Master's program in Research and Innovation in Information and Communications Technologies (I²-ICT)
Level: Master
Type: Elective [computational intelligence]
ECTS: 6

COURSE GUIDE: Web Mining (WM)

Academic year: 2017-2018

Program: Master's program in Research and Innovation in Information and Communications Technologies (I²-ICT)

Center: Escuela Politécnica Superior

University: Universidad Autónoma de Madrid

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1. ASIGNATURA / COURSE (ID)

Minería Web
Web Mining (WM)

1.1. Programa / program

Máster Universitario en Investigación e Innovación en Tecnologías de la Información y las Comunicaciones (I²-TIC)

Master in Research and Innovation in Information and Communications Technologies (I²-ICT) [Officially certified]

1.2. Course code

32423

1.3. Course areas

Computer Science and Artificial Intelligence

1.4. Tipo de asignatura / Course type

Optativa	[itinerario: Inteligencia computacional]
Elective	[itinerary: Computational Intelligence]

1.5. Semester

Second semester

1.6. Credits

6 ECTS

1.7. Language of instruction

The lecture notes and the assignments and exam statements are in English. The lectures are mostly in Spanish. Some of the lectures and seminars may be in English. All the students' work can be presented in either Spanish or English.



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1.8. Recommendations / Related subjects

Knowledge of probability and statistics at an introductory level is useful to follow the course.

Related subjects are:

- Aprendizaje Automático: teoría y aplicaciones [Machine Learning: Theory and applications]
- Recuperación de Información [Information Retrieval]
- Métodos Bayesianos aplicados [Applied Bayesian Methods]

1.9. Lecturers

Add @uam.es to all email addresses below.

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1.10. Objetivos de la asignatura / Course objectives

La asignatura capacita al estudiante en el conocimiento y manejo de técnicas y tecnologías del ámbito de la minería de datos, análisis y clasificación, y métodos estadísticos aplicados al contexto de la Web, las redes sociales y otros entornos



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emergentes de la Web social y semántica. En esta asignatura se estudian la extracción y procesamiento de datos en la Web, la minería de texto, el análisis de logs Web, la minería de opinión, la extracción y explotación de datos semánticos (semi-) estructurados, la minería de contenidos creados por usuarios, y las redes sociales: análisis y métricas para redes sociales, redes de mundo pequeño, descubrimiento de comunidades, predicción de enlaces, y fenómenos de propagación.

In this course the student learns the knowledge and use of techniques and technologies in the scope of data mining, analysis, classification, and statistical methods, applied in the context of the Web, social networks, and emerging media in the Social Semantic Web. The course contents include Web data extraction and processing, text mining, Web log analysis, opinion mining, extraction and exploitation of semantic (semi-) structured data, user-created content mining, and social networks: social network analysis and metrics, small world networks, community discovery, link prediction, and propagation phenomena.

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

UNIT BY UNIT SPECIFIC OBJECTIVES	
UNIT 1.- Introduction to Web Mining	
1.1	Characterize the origin, evolution and current status and structure of the World Wide Web
1.2	Know fundamental issues of Data Mining, Machine Learning, and Information Retrieval applied in the context of the Web
1.3	Characterize the main types of Web Mining, namely Web structure mining, Web content mining, and Web usage mining
BLOCK 1	
UNIT 2.- Web data extraction and processing	
2.1	Know the fundamentals of Web crawling, and main design principles of Web crawlers and wrappers
2.2	Characterize the different types of Web crawlers, from all-purpose crawlers to topic specific crawlers
2.3	Know main challenges and legal conflicts about Web crawling
2.4	Know main tasks and techniques for processing Web documents
UNIT 3.- Mining web usage data	
3.1	Characterize the different types of usage mining data
3.2	Know main mining techniques to analyze usage data from the Web
3.3	Know different techniques for identifying and extracting usage patterns in log data
3.4	Know the existing types of user-generated contents in the Web, and principal mining techniques and applications for them



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BLOCK 2	
UNIT 4.- Opinion mining	
4.1	Know main opinion mining tasks and approaches
4.2	Understand the challenges and limitations of current opinion mining techniques
4.3	Know main natural language processing tasks and approaches
4.4	Use existing resources and tools for natural language processing, and searching, extracting and processing information about opinions and sentiments in text contents
UNIT 5.- Mining structured web data	
5.1	Know the existing main types of semi-structured data in the Web
5.2	Characterize the origin, evolution, and current status and structure of the so called Semantic Web (or Web of Data)
5.3	Explain the benefits of using semantic-based approaches in information access and retrieval applications in the Web
5.4	Know existing techniques, resources, and tools for automatically extracting structured data from the Web
5.5	Use some existing resources and tools to exploit structured knowledge sources in the (Semantic) Web
BLOCK 3	
UNIT 6.- Mining online social network data	
6.1	Know main principles of online social networks, and characterize the application of Web mining techniques to online social networks
6.2	Know techniques, models, and metrics for analyzing online social networks
6.3	Characterize the existing algorithms for graph node and link ranking, and know how to apply these algorithms in real world problems
6.4	Characterize the different types of information diffusion and know different techniques for analyzing information propagation in online social networks.
6.5	Understand and use techniques for detecting communities in social networks.



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1.11. Course contents

1. Introduction

- 1.1. The World Wide Web
- 1.2. Web Data Mining
- 1.3. Data Mining foundations

2. Web data extraction and processing

- 2.1. Web crawling
- 2.2. Challenges of Web crawling
- 2.3. Web data model
- 2.4. Web scraping and data extraction approaches

3. Mining web usage data

- 3.1. Web log processing
- 3.2. Query log mining
- 3.3. Mining usage logs in e-commerce applications
- 3.4. Mining user-generated contents

4. Opinion Mining

- 4.1. Opinion Mining: motivation and problem definition
- 4.2. Natural Language Processing
- 4.3. Research issues on Opinion Mining
- 4.4. Text processing and Opinion Mining resources

5. Mining structured web data

- 5.1. The Semantic Web
- 5.2. Semantic Web data modeling and access
- 5.3. Building the Semantic Web
- 5.4. Semantic Web-based applications
- 5.5. Resources used for the Semantic Web

6. Mining online social network data

- 6.1. Online social network analysis
- 6.2. Information diffusion in online social networks
- 6.3. Community discovery in online social networks
- 6.4. Link prediction in online social networks



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1.12. Course bibliography

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

1. Liu, B. **Web Data Mining: Exploring Hyperlinks, Contents and Usage Data**. Springer-Verlag (2009)
2. Chakrabarti, S. **Mining the Web: Discovering Knowledge from Hypertext Data**. Morgan Kaufmann (2002)
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4. Feldman, R., Sanger, J. **The Text Mining Handbook**. Cambridge University Press (2006)
5. Brusilovsky, P., Kobsa, A., Nejdl, W. (Eds.). **The Adaptive Web: Methods and Strategies of Web Personalization**. Springer-Verlag (2007)
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12. Wasserman, S., Faust, K. **Social network analysis: Methods and applications**. Cambridge University press (1994).
13. Zafarani, R., Abbasi, M. A., Liu, H. **Social media mining: an introduction**. Cambridge University Press (2014).
14. Liben-Nowell, D., Kleinberg, J. **The link-prediction problem for social networks**. Journal of the American society for information science and technology 58.7: 1019-1031 (2007).
15. Broder, A., Kumar, R., Maghoul, F., Raghavan, P., Rajagopalan, S., Stata, R., Tomkins, A., Wiener, J. **Graph structure in the Web**. Computer Networks 33(1-6), pp. 309-320 (2000)



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16. Silvestri, F. **Mining Query Logs: Turning Search Usage Data into Knowledge**. Foundations and Trends in Information Retrieval 4(1-2), pp. 1-174 (2010)

1.13. Coursework and evaluation

The course involves lectures, six theory/lab assignments, a research project, and three exams/questionnaires. The assignments and research project could be done in pairs or individually.

The project will take some of the lecture sessions, and should address research topics related to those of the course. It may be proposed by the students under acceptance of the lecturers, or may be proposed by the lecturers. It will consist of two main stages:

- Developing a software implementation, attempting to reproduce and/or improve state of the art approaches, or to propose and evaluate novel approaches.
- Making an oral presentation in the classroom at the end of the course, explaining the work done and the results obtained.

The subject contents are split in three blocks, each of them with one or two units. Each block has two small theory/lab assignments and a (30 minutes) exam/questionnaire. The assignments will be done in both lecture and homework hours. The exams will be done in lecture hours at the end of the corresponding blocks.

In the ordinary evaluation period, the grade will be determined according to the following scheme:

- 45% for the theory/lab assignments
- 30% for the exams
- 25% for the project

If the student does not turn in some of these items, or if s/he fails any of them, in the extraordinary exam period, the student has the opportunity to:

- Turn in all the theory assignments with corrections
- Turn in all the lab assignments with corrections
- Turn in the project with corrections
- Do an extraordinary exam, in case s/he failed the ordinary exams

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

In the extraordinary exam period, the grade will be determined by:

- 30% for the theory/lab assignments
- 50% for the extraordinary exam
- 20% for the project