Course guide
270958 - MUD - Mining Unstructured Data

Unit in charge: Barcelona School of Informatics
Teaching unit: 723 - CS - Department of Computer Science.
Degree: MASTER'S DEGREE IN DATA SCIENCE (Syllabus 2021). (Compulsory subject).
Academic year: 2022  ECTS Credits: 6.0  Languages: English

LECTURER
Coordinating lecturer: JORGE TURMO BORRÁS
Others: Segon quadrimestre:
CARLOS ESCOLANO PEINADO - 11, 12
SALVADOR MEDINA HERRERA - 11, 12
JORGE TURMO BORRÁS - 11, 12

PRIOR SKILLS
Advanced skills on python programming
Math and statistics skills to the level of an engineering/tech/science university degree
Fundamentals of machine learning

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES
Specific:
CE11. Analyze and extract knowledge from unstructured information using natural language processing techniques, text and image mining
CE12. Apply data science in multidisciplinary projects to solve problems in new or poorly explored domains from a data science perspective that are economically viable, socially acceptable, and in accordance with current legislation
CE13. Identify the main threats related to ethics and data privacy in a data science project (both in terms of data management and analysis) and develop and implement appropriate measures to mitigate these threats
CE6. Design the Data Science process and apply scientific methodologies to obtain conclusions about populations and make decisions accordingly, from both structured and unstructured data and potentially stored in heterogeneous formats.
CE7. Identify the limitations imposed by data quality in a data science problem and apply techniques to smooth their impact

Generical:
CG2. Identify and apply methods of data analysis, knowledge extraction and visualization for data collected in disparate formats

Transversal:
CT1. ENTREPRENEURSHIP AND INNOVATION: Know and understand the organization of a company and the sciences that govern its activity; Have the ability to understand labor standards and the relationships between planning, industrial and commercial strategies, quality and profit. Being aware of and understanding the mechanisms on which scientific research is based, as well as the mechanisms and instruments for transferring results among socio-economic agents involved in research, development and innovation processes.
CT4. INFORMATION LITERACY: Capacity for managing the acquisition, the structuring, analysis and visualization of data and information in the field of specialisation, and for critically assessing the results of this management.
CT5. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.
Basic:
CB10. Possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context.
CB6. Ability to apply the acquired knowledge and capacity for solving problems in new or unknown environments within broader (or multidisciplinary) contexts related to their area of study.
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CB8. Capability to communicate their conclusions, and the knowledge and rationale underpinning these, to both skilled and unskilled public in a clear and unambiguous way.
CB9. Possession of the learning skills that enable the students to continue studying in a way that will be mainly self-directed or autonomous.

TEACHING METHODOLOGY

Participative lectures with theoretical and practical content
Practical sessions with student participation for the resolution of exercises related to the course contents
lab project - team work
Consulting sessions

LEARNING OBJECTIVES OF THE SUBJECT

1. Know and understand basic NLP tasks and their application to text analysis.
2. Know, understand, and apply text mining techniques, including entity recognition, sentiment analysis, and document retrieval.
3. Know, understand, and apply basic principles of deep learning in unstructured data tasks, such as natural language processing, or computer vision.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Self study</td>
<td>96,0</td>
<td>64.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>27,0</td>
<td>18.00</td>
</tr>
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<td>27,0</td>
<td>18.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h

CONTENTS

Natural language processing and its application to text analysis

Description:
Introduction: What is NLP and its applications

natural language processing stages

Description:
Text segmentation: sentence splitting, tokenization; morphological analysis, PoS tagging, syntactic parsing
<table>
<thead>
<tr>
<th><strong>text classification, text similarity.</strong></th>
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| **Description:**
| Text classification: Sentiment analysis |

<table>
<thead>
<tr>
<th><strong>Information extraction: Entity recognition, relation extraction</strong></th>
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<tr>
<th><strong>Deep learning techniques for the analysis of non-structured data</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong> Word embeddings, neural language processing</td>
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<th><strong>Main deep learning architectures for non-structured data</strong></th>
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</thead>
<tbody>
<tr>
<td><strong>Description:</strong> Recurrent NN, Convolutional NN, Transformers</td>
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</table>
**ACTIVITIES**

**lab project**

**Specific objectives:**

3

**Related competencies:**

CG2. Identify and apply methods of data analysis, knowledge extraction and visualization for data collected in disparate formats

CE13. Identify the main threats related to ethics and data privacy in a data science project (both in terms of data management and analysis) and develop and implement appropriate measures to mitigate these threats

CE6. Design the Data Science process and apply scientific methodologies to obtain conclusions about populations and make decisions accordingly, from both structured and unstructured data and potentially stored in heterogeneous formats.

CE11. Analyze and extract knowledge from unstructured information using natural language processing techniques, text and image mining

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CB10. Possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context.

**Full-or-part-time:** 52h

Self study: 52h
Final exam

Specific objectives:
1, 2

Related competencies:
CG2. Identify and apply methods of data analysis, knowledge extraction and visualization for data collected in disparate formats
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Full-or-part-time: 53h
Guided activities: 3h
Self study: 50h
NLP and its applications

Description:
Introduction. What is NLP, tasks, components, and applications.

Specific objectives:
1

Related competencies:
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Full-or-part-time: 2h
Theory classes: 2h
natural language processing stages

Description:
Text segmentation: sentence splitting/tokenization; morphological analysis; PoS tagging; syntactic parsing.

Specific objectives:
1

Related competencies:
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Full-or-part-time: 11h 30m
Theory classes: 8h 30m
Practical classes: 3h
Text classification, text similarity

Description:
Text classification: Sentiment analysis

Specific objectives:

2

Related competencies:
CE12. Apply data science in multidisciplinary projects to solve problems in new or poorly explored domains from a data science perspective that are economically viable, socially acceptable, and in accordance with current legislation
CE11. Analyze and extract knowledge from unstructured information using natural language processing techniques, text and image mining
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Full-or-part-time: 2h
Theory classes: 1h 30m
Practical classes: 0h 30m
Specific objectives:
1, 2

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Full-or-part-time: 2h
Theory classes: 1h 30m
Practical classes: 0h 30m
Deep learning techniques for the analysis of non-structured data

Description:
Word embeddings, neural language processing

Specific objectives:
3

Related competencies:
CG2. Identify and apply methods of data analysis, knowledge extraction and visualization for data collected in disparate formats
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Full-or-part-time: 7h
Theory classes: 5h
Practical classes: 2h
Main deep learning architectures for non-structured data

Description:
Recurrent NN, Convolutional NN, Transformers

Specific objectives:
3

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Full-or-part-time: 5h 30m
Theory classes: 4h
Practical classes: 1h 30m
Lab project on Named Entity Recognition.

Specific objectives:
1, 2

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Full-or-part-time: 5h
Laboratory classes: 5h
Lab project on relation extraction

Specific objectives:
1, 2

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Full-or-part-time: 5h
Laboratory classes: 5h
lab project on Neural Networks

Specific objectives:

3

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Full-or-part-time: 5h
Laboratory classes: 5h

GRADING SYSTEM

Lab project 50% + final exam 50%

BIBLIOGRAPHY

Basic:
- Manning, C.; See, A. Natural language processing with deep learning. Stanford University, 2022.