COURSE DESCRIPTION – ACADEMIC YEAR 2019/2020

Course title	**Recommender Systems**
Course code	73034
Scientific sector	INF/01
Degree	Master in Computational Data Science (LM-18)
Semester	2
Year	1 and 2
Credits	6
Modular	No

Total lecturing hours	40
Total lab hours	20
Attendance	Recommended
Prerequisites	Introductory courses on: data structures and algorithms, linear algebra, probability theory, and data mining
Course page	https://ole.unibz.it/

Specific educational objectives	The course belongs to the type "caratterizzanti – discipline informatiche" in the curricula "Data Analytics" and "Data Management" and it is designed for acquiring professional skills and knowledge. The first objective of this course is to present the scientific underpinnings of the field of Recommender Systems. The student will study first fundamental, mathematically sophisticated concepts for graph mining (Social Network Analysis, Similarity inference in Graphs, Similarity Ranking, Random Walks over Graphs etc.) and then more advanced concept for recommender systems such as Explainability, and Novelty, Fairness, Trasparency and Privacy, and evaluation of recommender systems. The second objective of this course is to provide to the student a rich and comprehensive catalogue of recommendation algorithms (Sequence-aware approaches, Recurrent Neural Networks, Matrix Factorization, Stochastic Gradient Descent, Neural Networks, Multilayer Perceptrons (MLPs), Neural Matrix Factorization, and other state-of-the-art techniques) that can be employed in the design and implementation of a recommendation system for a web platform, such an eCommerce or eGovernment application for job seekers or tv entertainment or health. The third objective is to develop the capacity to use, manipulate and extend the studied algorithms. This means that the student must be able to solve new problems using the illustrated techniques. For instance must be able to define a new recommendation method for suggesting items to users, and evaluate the performance of these recommendations in terms of accuracy, novelty, and explainability.

Lecturer	Panagiotis Symeonidis
Contact	Piazza Domenicani 3, Faculty of Computer Science Room 2.11, psymeonidis@unibz.it

Scientific sector of lecturer	INF/01
Teaching language	English
Office hours	During the lecture time span, Wednesday 16:00 - 18:00, prior arrangement with email
Lecturing Assistant (if any)	--
Contact LA	--
Office hours LA	--
List of topics	• Collaborative Filtering • Content-Based and Semantic-Based Methods • Graph-Based Approaches • Context-aware systems • Conversational Systems • Decision Making
Teaching format	Frontal lectures, inverted classroom model, exercises and discussions in the lab, and projects in teams.

Learning outcomes	Applying knowledge and understanding: • D1.2 - Understanding of the skills, tools and techniques required for an effective use of data science • D1.7 - Knowledge of artificial intelligence techniques and methods for the implementation of intelligent systems Applying knowledge and understanding: • D2.1 - Practical application and evaluation of tools and techniques in the field of data science • D2.2 - Ability to address and solve a problem using scientific methods • D2.6 - Ability to apply innovative techniques of data mining and machine learning to extract knowledge from complex and heterogeneous data Making judgments • D3.2 - Ability to autonomously select the documentation (in the form of books, web, magazines, etc.) needed to keep up to date in a given sector Communication skills • D4.1 - Ability to use English at an advanced level with particular reference to disciplinary terminology • D4.3 - Ability to structure and draft scientific and technical documentation Learning skills • D5.2 - Ability to autonomously keep oneself up to date with the developments of the most important areas of data science • D5.3 - Ability to deal with problems in a systematic and creative way and to appropriate problem solving techniques.

Assessment	The assessment of the course consists of the following parts: • Oral Presentation of a research article (max. 2 students), 20% • Project in a small team (max. 2 students), 40% • Final exam, written, 40% of mark
Assessment language	English

Assessment Typology	Monocratic
Evaluation criteria and criteria for awarding marks	The oral presentation will be carried out in the context of a research article for recommender systems. The oral presentation's deliverable is a ppt presentation file around 25 slides. The project will be carried out in the context of recommendation systems. The project results are a written report (~ 5.000 words), with the data sets description, the description of the algorithms used, the evaluation results of the algorithms' comparison, and the code in digital form and a presentation. The oral presentation and the project will be evaluated at the end of the semester and it is a prerequisite for attending the written exam. The oral presentation is aimed at assessing the level of understanding basic concepts of the literature in recommender systems, the ability of the learner to acquire communication skills, learn and comprehend advance concepts. The project is aimed at assessing to what extent the student has achieved the abovementioned learning outcomes related to: applying knowledge and understanding, making judgments, analyzing a problem in parts, and creativity in solving real life problems. The written exam will assess to what extent the student has achieved above-mentioned learning outcomes related to: knowledge and understanding, applying knowledge and understanding, ability to learn and comprehend.

Required readings	The suggested books for recommender systems topics are: ● Aggarwal, C. Recommender Systems: The Textbook, Springer, 2016 ● Ricci, F.; Rokach, L.; Shapira, B. (Eds.). Recommender Systems Handbook. Berlin: Springer, 2015. All the required reading material will be provided during the course and will be available in electronic format. Copy of the slides will be available as well.
Supplementary readings	● P. Symeonidis, D. Ntempos, Y. Manolopoulos: "Recommender Systems for Location-based Social Networks" ● P. Symeonidis, A. Zioupos: "Matrix and Tensor Factorization Techniques for Recommender Systems", Springer Briefs in Computer Science, 2017
Software used	Python