Module Description, available in: EN

Multimodal Recommendation Systems and Complex Networks

General Information

Number of ECTS Credits

3

Module code

TSM_DataAnaCla

Valid for academic year

2025-26

Last modification

2024-10-17

Coordinator of the module

Michela Papandrea (SUPSI, michela.papandrea@supsi.ch)

Explanations regarding the language definitions for each location:

- Instruction is given in the language defined below for each location/each time the module is held.
- Documentation is available in the languages defined below. Where documents are in several languages, the percentage distribution is shown (100% = all the documentation).
- The examination is available 100% in the languages shown for each location/each time it is held.

	Lausanne			Lugano	Zurich		
Instruction				**X** E 100%			
Documentation				**X** E 100%			
Examination				**X** E 100%			

Module Category

TSM Technical scientific module

Lessons

2 lecture periods and 1 tutorial period per week

Entry level competences

Prerequisites, previous knowledge

- Machine Learning and Data Mining,
- Python programming
- basic calculus, linear algebra and statistics concepts

Brief course description of module objectives and content

The module will address the theoretical aspects behind the realisation of Recommendation Systems and will allow students to practice over different

use case scenarios. In particular it will address the following RecSys approaches:

- Traditional and Machine Learning based recommendation
- Deep Leanrning based recommendation
- Complex networks based recommendation.

Aims, content, methods

Learning objectives and competencies to be acquired

Students understand the theoretical aspects behind the realization of Recommendation Systems and they will learn how to build them over different use case scenarios.

They will learn how recommendation systems work, focusing on three different approaches:

- Traditional and Machine Learning based recommendation
- Deep Leanrning based recommendation
- Complex networks based recommendation.

They will learn how to deal with classical recommendation challenges like imbalanced data set problems, cold-start problems, and long tail problems. Additionally they will learn how to evaluate recommendation systems.

They will learn how to deal with complex networks and how to exploit network extracted information to enhance recommendation solutions.

Finally they will learn how to build multimodal recommendation systems exploiting social networks metrics and dynamics in order to deal with content spread and users engagement.

They know the current research directions within these domains.

They can reuse the material acquired in this course in their own working environment and apply them to solve their specific problems

Module content with weighting of different components

The content of the module includes 3 main topics:

Complex Networks:

- Network Elements (Handling Networks in Code, Density and Sparsity, Subnetworks, Degree, Multilayer and Temporal Networks, Network Representations)
- Network measures (Hubs, Centrality Measures, Centrality Distributions, The Friendship Paradox, Ultra-Small Worlds, Robustness, Core Decomposition, Transitivity, Similarity)
- Network models (Lattice, Random Networks, Small Worlds, Configuration Model, Preferential Attachment, Other Preferential Models)
- Community Detection
- Dynamic models (Ideas, Information, Influence, Epidemic Spreading, Opinion Dynamics, Search)
- Social Media as Networks (es. Twitter, Facebook and Reddit)

Recommendation Systems:

- Traditional and Machine Learning based Recommendation Systems (Collaborative Filtering, Content Based, Knowledge Based, Hybrid)
- Deep Learning based Recommendation Systems
- Reinforcement Learning based Recommendation Systems
- Evaluation of Recommendation Systems
- Handling challenges in Recommendation Systems (imbalanced data set problems, cold-start problems, long tail problems)

Multimodal Systems for Recommendation:

- Complex Networks/Social Networks integration
- Use case: Recommendation Systems for Social Networks content spread and users engagement.

Teaching and learning methods

Problem based learning. During the lesson the lecturer will introduce real world problems and the class will try to solve them together.

The lecturer will support the problem solving process, introducing new concepts and tools, as required.

Practical work will complement the theory, so that students can put in practice the studied arguments.

Literature

Lecture slides, references to internet resources and books

Assessment

Additional performance assessment during the semester

The module contains additional performance assessment(s) during the semester. The achieved mark of the additional performance assessment(s) applies to both the regular and the resit exam.

Description of additional performance assessment during the semester

The evaluation of solved practical projects will contribute to the final mark as 30% of the final grade.

Basic principle for exams

As a rule, all standard final exams are conducted in written form. For resit exams, lecturers will communicate the exam format (written/oral) together with the exam schedule.

Standard final exam for a module and written resit exam

Kind of exam

Written exam

Duration of exam

120 minutes

Permissible aids

No aids permitted

Exception: In case of an electronic Moodle exam, adjustments to the permissible aids may occur. Lecturers will announce the final permissible aids prior to the exam session.

Special case: Resit exam as oral exam

Kind of exam

Oral exam

Duration of exam

30 minutes

Permissible aids

No aids permitted