GHENT UNIVERSITY

Course Specifications

Valid in the academic year 2022-2023

Recommender Systems (E018230)

Course size *(nominal values; actual values may depend on programme)*

Credits 6.0	**Study time 180 h**	**Contact hrs**	60.0h

Course offerings and teaching methods in academic year 2022-2023

A (semester 2)	English	Gent	lecture	30.0h

Lecturers in academic year 2022-2023

Martens, Luc	TWO5	lecturer-in-charge
De Pessemier, Toon	TWO5	co-lecturer

Offered in the following programmes in 2022-2023	**crdts**	**offering**
Master of Science in Computer Science	6	A
Master of Science in Computer Science Engineering	6	A
Master of Science in Computer Science Engineering	6	A
Exchange Programme in Computer Science (master's level)	6	A

Teaching languages

English

Keywords

Personalization, profiling, self-learning systems, modelling user interests, data mining

Position of the course

Recommender systems are techniques and algorithms that generate content suggestions based on personal interests of the user. These systems are typically used to cope with the problem of information overload on many online services such as Amazon, Netflix and Facebook.
Research on recommender systems is a recent domain, originating from research on information retrieval, machine learning and data mining. As with search engines, information or content will be retrieved (information retrieval) and presented to the end user. Unlike search engines that use the entered search terms, recommender systems will select content based on personal interests. A recommender system will automatically learn these personal interests (machine learning) based on the user behavior and interactions with the service and any feedback. Learning these personal preferences is performed using large amounts of historical data in which specific patterns are identified (data mining).

Contents

- Background and objectives of recommender systems for the various stakeholders (user, service provider)
- Input for recommender systems
  - Processing implicit and explicit feedback
  - Scaling and normalization of data
  - Data sparsity problems
  - Unary data vs. rating data
- Output of recommender systems
  - Predictions vs. recommendations
- Social aspects
  - The filter bubble
  - Privacy aspects
- Non-personalized recommender systems
  - Product-association rules

- Popularity metrics
- Recommendation algorithms
  - Content-based recommender systems
    - Vector-Space model
    - Similarity metrics for content-based systems
    - Word2Vec
  - Collaborative filtering systems
    - Items-based vs user-based
    - Collective intelligence
    - Similarity metrics for collaborative filtering
    - Cold start and scalability problems
- Methods based on dimensionality reduction
  - Singular Value Decomposition
  - Funk SVD
- Advanced recommendation techniques
  - Algorithms based on social networking data
  - Rule-based systems and case-based reasoning
  - Algorithms based on trust and reputation of users
  - Combining algorithms in hybrid systems
  - Recommendations using neural networks
- Recommender systems in practice
  - Recommendation architectures
  - Implementation aspects
  - Optimizing calculations
  - Application domains
- Evaluation of recommender systems
  - Offline evaluation
    - Evaluation methodologies
    - Accuracy metrics
    - Decision-support metrics
    - Rank metrics
  - Online evaluation
    - User evaluation
    - A / B testing
  - Additional quality metrics
    - Serendipity
    - Diversity
    - Usefulness
    - Confidence
- Explaining recommendations (explanations)
  - Active learning for recommender systems
- Context-aware recommender systems
  - Context dimensions
  - Context generalization
  - Contextual pre-filtering, contextual post-filtering, contextual modelling
- Recommendations for groups
  - Aggregation of profiles vs aggregation of recommendations
  - Aggregation methods
- Attacks on recommender systems
  - Attack strategies
- Dialog-based recommender systems
  - Interaction between user and recommender system
  - Expert-based systems

Initial competences

Basic knowledge of math and programming (bachelor course Informatics)

Final competences

1 Modelling of user interests, interactions, and intentions.
2 Analysing and interpreting data originating from user interactions in the context of designing and developing a recommender system.
3 Designing a recommender system focused on a specific case.
4 Formulating an evaluation methodology in terms of the goals of the recommender system.

5 Reporting and critically evaluating the results of a recommender system.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Lecture

Extra information on the teaching methods

- Lectures (hoorcolleges): teaching students the fundamentals of recommender systems.
- Computer excercises: students gain practical knowledge about recommender systems by specific assignments.

Learning materials and price

Slides (free of charge, digital on Ufora), scientific publications, optional textbook: "Recommender Systems - An Introduction" - D. Jannach, et al.

References

- Recommender Systems - An Introduction, D. Jannach, M. Zanker, A. Felfernig, and G. Friedrich.
- Recommender Systems Handbook Second Edition, F. Ricci, L. Rokach, and B. Shapira.

Course content-related study coaching

The teacher(s) or his assistant(s) will be available during and in between lectures and computer excercises for further explanation. The standard functionalities of the electronic learning platform will also be used.

Assessment moments

end-of-term and continuous assessment

Examination methods in case of periodic assessment during the first examination period

Written examination

Examination methods in case of periodic assessment during the second examination period

Written examination

Examination methods in case of permanent assessment

Skills test, Report

Possibilities of retake in case of permanent assessment

examination during the second examination period is possible

Extra information on the examination methods

- Written exam: periodic evaluation, aimed at understanding and being able to apply the course material.
- Computer excercises: permanent evaluation, aimed at being able to apply the theory in practice. The students will implement some recommendation algorithms and evaluate and interpret the results. The focus is on applying the knowledge gained in the lectures in practice by implementing a recommender systems. The students will complete the full cycle of deploying a recommender system: problem analysis, design, development, evaluation, and interpretation of results.

Calculation of the examination mark

- Written exam: 40%
- Computer excercises: 60%

Facilities for Working Students

Timing of the computer excercises can be changed for working students.