

SYLLABUS

1. Information regarding the programme

| | |
|-------------------------------------|---|
| 1.1 Higher education institution | Babeş-Bolyai University |
| 1.2 Faculty | Faculty of Mathematics and Computer Science |
| 1.3 Department | Department of Mathematics and Computer Science of the Hungarian Line |
| 1.4 Field of study | Computer Science |
| 1.5 Study cycle | Master |
| 1.6 Study programme / Qualification | Data Analysis and Modelling |

2. Information regarding the discipline

| | | | | | | | |
|-----------------------------|---|--------------|---|-------------------------|---|------------------------|------------|
| 2.1 Name of the discipline | Information retrieval / Információ-visszakeresés / Regăsirea informației | | | | | | |
| 2.2 Course coordinator | Assoc. prof. dr. Bodó Zalán-Péter | | | | | | |
| 2.3 Seminar coordinator | Assoc. prof. dr. Bodó Zalán-Péter | | | | | | |
| 2.4. Year of study | 2 | 2.5 Semester | 3 | 2.6. Type of evaluation | E | 2.7 Type of discipline | Compulsory |
| 2.8. Code of the discipline | MME8032 | | | | | | |

3. Total estimated time (hours/semester of didactic activities)

| | | | | | |
|---|-------|----------------------|----|------------------------|----|
| 3.1 Hours per week | 3 | Of which: 3.2 course | 2 | 3.3 seminar/laboratory | 1 |
| 3.4 Total hours in the curriculum | 42 | Of which: 3.5 course | 28 | 3.6 seminar/laboratory | 14 |
| Time allotment: | hours | | | | |
| Learning using manual, course support, bibliography, course notes | 50 | | | | |
| Additional documentation (in libraries, on electronic platforms, field documentation) | 44 | | | | |
| Preparation for seminars/labs, homework, papers, portfolios and essays | 50 | | | | |
| Tutorship | 8 | | | | |
| Evaluations | 6 | | | | |
| Other activities: | - | | | | |
| 3.7 Total individual study hours | 158 | | | | |
| 3.8 Total hours per semester | 200 | | | | |
| 3.9 Number of ECTS credits | 8 | | | | |

4. Prerequisites (if necessary)

| | |
|-------------------|--|
| 4.1. curriculum | None |
| 4.2. competencies | Algorithms, programming skills, basic math (algebra, probability theory, statistics) |

5. Conditions (if necessary)

| | |
|--------------------------------------|---|
| 5.1. for the course | Video projector and blackboard/whiteboard |
| 5.2. for the seminar /lab activities | Laboratory with computers; high level programming language environment(s) (e.g. .NET, Java, Python); Matlab |

6. Specific competencies acquired

| | |
|----------------------------------|--|
| Professional competencies | <ul style="list-style-type: none"> • Understanding the concepts, methods and models used in Information Retrieval (IR). • Understanding the principles, design and implementation of data storage techniques, conversion between formats. • Study and analysis of algorithms, that retrieve/extract information from textual databases. |
| Transversal competencies | <ul style="list-style-type: none"> • Responsible execution of lab assignments, research and practical reports. • Application of efficient and rigorous working rules. • Manifest responsible attitudes toward the scientific and didactic fields. • Respecting the professional and ethical principles. |

7. Objectives of the discipline (outcome of the acquired competencies)

| | |
|--|---|
| 7.1 General objective of the discipline | <ul style="list-style-type: none"> • To present the field of IR, studying and analyzing the algorithms used in IR. |
| 7.2 Specific objective of the discipline | <ul style="list-style-type: none"> • The basics of IR: <ul style="list-style-type: none"> ◦ Basic concepts: document and term lists, document-term, term-document matrices, posting lists, indices ◦ Building indices ◦ Binary IR ◦ Probabilistic models in IR ◦ The Vector Space Model (VSM) ◦ Supervised and unsupervised learning in IR ◦ Web search, link analysis • Design and application of search engines |

8. Content

| 8.1 Course | Teaching methods | Remarks |
|---|---|---------|
| 1. Introductory concepts, definitions, introduction to information retrieval systems. | interactive exposure, explanation, conversation, didactical demonstration | |
| 2. Indexing techniques. | interactive exposure, explanation, conversation, didactical demonstration | |
| 3-4. The Vector Space Model (VSM). | interactive exposure, explanation, conversation, didactical demonstration | |
| 5. Evaluation of IR systems. | interactive exposure, explanation, conversation, didactical demonstration | |
| 6. Probabilistic models in IR. | interactive exposure, explanation, conversation, didactical demonstration | |
| 7. Language models in IR. | interactive exposure, | |

| | | |
|--|--|--|
| | explanation, conversation, didactical demonstration | |
| 8-9. Classification methods in IR: Naive Bayes, Rocchio's algorithm, regularized least squares (RLS), support vector machines (SVM), etc. | interactive exposure, explanation, conversation, didactical demonstration | |
| 10-11. Unsupervised methods in IR, clustering algorithms. | interactive exposure, explanation, conversation, didactical demonstration | |
| 12-13. Methods of dimensionality reduction, matrix factorization techniques. | interactive exposure, explanation, conversation, didactical demonstration | |
| 14. Web search, link analysis. | interactive exposure, explanation, conversation, didactical demonstration | |

Bibliography

- [1] Manning C.D., Raghavan P., Schütze H. *Introduction to Information Retrieval*. Cambridge University Press, 2009.
- [2] BAEZA-YATES R., RIBEIRO-NETO B. *Modern Information Retrieval*. Addison-Wesley, 1999.
- [3] VAN RIJSBERGEN C. J. *Information Retrieval* (2nd ed.). Butterworths, 1979.
- [4] DOMINICH S. *The Modern Algebra of Information Retrieval*. Springer, 2008.
- [5] BODON F. *Adatbányászati algoritmusok*. GNU Free Documentation License, 2010 (<http://www.cs.bme.hu/~bodon/magyar/adatbanyaszat/tanulmany/adatbanyaszat.pdf>).

| 8.2 Seminar / Laboratory | Teaching methods | Remarks |
|---|--|---|
| 1. Introduction to Perl and/or Python programming. | documentation, explanation, conversation | |
| 2. Famous classification algorithms in IR: Naive Bayes, Rocchio, SVM, etc. | documentation, explanation, conversation | |
| 3-4. The Apache Solr indexing/search engine. | documentation, explanation, conversation | |
| 5-6. The Apache Hadoop software library. | documentation, explanation, conversation | |
| 7. Summary, project presentations. | | Student presentations on selected related topics. |

Bibliography

- [1]–[5] +
- [6] MANNING C. D., SCHÜTZE H. *Foundations of statistical language processing*. MIT Press, Cambridge, 1999.
- [7] SEBASTIANI F. Machine Learning in Automated Text Categorization. *ACM Computing Surveys*, 2002, vol. 34, pp. 1–47.
- [8] <http://nlp.stanford.edu/IR-book/>
- [9] <http://www.stanford.edu/class/cs276/>

9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

The content of the discipline is consistent with the course "Information Retrieval and Web Search" at Stanford University (<http://web.stanford.edu/class/cs276/>), and is based on the book "Introduction to Information Retrieval" by Manning, Raghavan and Schütze (<http://nlp.stanford.edu/IR-book/>, see also the bibliography above).

10. Evaluation

| Type of activity | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Share in the grade |
|--|---|---------------------------|-------------------------|
| 10.4 Course | Written exam at the end of the semester | Written exam | 50% |
| 10.5 Seminars/laboratory | Presentation of the software projects | Evaluation of the project | 50% |
| 10.6 Minimum performance standards | | | |
| At every evaluation, minimum half of the points needs to be collected. | | | |

Date

Signature of course coordinator

Signature of seminar coordinator

15.04.2023

Dr. Bodó Zalán-Péter

Dr. Bodó Zalán-Péter

Date of approval

Signature of the head of department

15.04.2023

Dr. András Szilárd