# Master of Science
# The Engineering of Internet Systems

# Courses description

## Development of Internet Applications (Java EE and .NET)

The course provides knowledge on the development of Internet applications, from the establishment of functional requirements to the proper design and development of specific modules, using current technologies (JEE and .NET Framework). The usual 3-tier model is considered first and then possibilities for the extension to the n-tier approach are analyzed. The widely used MVC (Model View Controller) paradigm is presented. The model component is described, using different techniques and ORM products. The view component is presented focusing on aspects relevant to improving the user experience by using AJAX technologies. The controller component is analyzed through its interaction with other two components, as well as by describing various ways for achieving specific business functions. Other topics related to designing solutions for content and users management, optimization methods to achieve scalable applications, security issues and preventing common attacks and building a set of relevant tests for a Web application are presented. Also, usual ways to interconnect applications using Web services (SOAP and REST) and communication via messages are described.

## Adaptive and Collaborative Systems

The course has as goals the assimilation of concepts, theories, algorithms and techniques specific to adaptive, personalized and collaborative systems. It begins with a comparative analysis of the web generations (Web1.0, Web2.0 – the Social Web, and Semantic Web), making a parallel between the cognitive and socio-cultural paradigms. The first half of the course is considering adaptive systems. It discusses user modeling: cognitive, conative and emotional. It presents the basis of personalized and adaptive systems, adaptive interfaces, hypertext adaptive systems, intelligent tutoring systems, and recommendation systems. The second part of the course deals with the theory and applications specific for the social web: Communities of practice, Activity Theory, the theory of collective memory, imaginary, social networks (analysis and metrics),

folksonomies, computer-supported cooperative work (CSCW), Groupware, Computer-Supported Collaborative Learning (CSCL).

## Multi-Agent Systems

The course is presenting theoretical and practical knowledge about intelligent agents and multi-agent systems. It contains: classification of agents and presentation of the various types of agents, multi-agent systems and architectures, reasoning methods for intelligent agents, coordination mechanisms, techniques for distributed search, distributed multi-agent planning, negotiation techniques, inter-agent communication languages and protocols, agent-oriented programming and methods for developing applications using multi-agent technologies. Application hours focus on designing and development of applications using intelligent agents, including personal and Internet agents, building multi-agent systems and developing applications using multi-agent systems.

## Semantic Web Applications

The course covers the following topics: What is the Semantic Web (description of the approach, evolution, Linked Data concept, and current research topics), ontology development methodologies, ontology development languages (RDF, RDFS, and OWL), semantic web vocabularies (FOAF, DC, …), querying the semantic web (SPARQL, reasoning upon OWL), data acquisition (writing a semantic web crawler), semantic web repositories (presentation of repositories and performance analysis – Virtuoso, OWLIM, Sesame, …), semantic data output (using RDFa, microformats), various tools (named entity recognition – Calais, Alchemy, database export tools – d2rq, linked data creation tools – SILK, ontology development – Protégé,…), social semantic web (discussion of its characteristics, typical applications, folksonomies), state of the art research – discussing some very recent articles in the domain.

## Distributed Processing in Internet

This course introduces the main concepts, models and techniques regarding the design and implementation of Web based distributed systems. The course covers important topics in distributed processing in computer networks domain, as well as new solutions for complex problems such as: inter process communication, efficient data management (storage, retrieval, sharing, replication), consistency, fault tolerance and security issues in distributed Internet systems. The topics mentioned above are being studied as part of

relevant distributed systems models: Peer-to-Peer, event based systems, Cloud computing, pervasive computing. The course is accompanied by practical applications whose purpose is to identify concrete problems in recent distributed systems and to implement efficient solutions, to provide skills and instruments for the design, implementation and evaluation of distributed systems. Student grading takes into account active course participation, individual study and presentation of selected scientific papers, working on a team project and writing a technical report and also a written final exam.

## Introduction to Information Retrieval

This course will familiarize students with the general industry principles used today in building search engines. It will cover all top relevant areas: Data collection, Index construction, Search results ranking, User interface design, Search engine evaluation, etc. All aspects will be primarily discussed within the perspective of web search engines such as Google, but enterprise and desktop search engines will be addressed as well. Last, but not least, students will learn adjacent technologies used in search engines such as Bayesian classifiers or Support Vector Machines.