Freie Universität Bozen
Libera Università di Bolzano
Università Liedia de Bulsan

CORSO DI LAUREA MAGISTRALE IN INGENERIA DEL SOFTWARE

MASTER IN SOFTWARE ENGINEERING

MASTER OF SCIENCE IN SOFTWARE ENGINEERING

Contenuto degli insegnamenti
Inhalt der Lehrveranstaltungen
Content of the courses

Agile Software Development • Origin and evolution of agile software development and modern agile • Major agile frameworks and hybrid approaches • Key agile engineering and project management practices • People-centric and teamwork in agile software development • Continuous experimentation using agile approaches • Scaling agile: distributed and/or large agile software development projects
Cloud Computing and Distributed Systems • Virtualisation • Distributed Systems Algorithms • Network Technologies • Cloud Systems • Storage • Cloud Security
Contemporary Software Development • Software development environments • Configuration management • Software artifact management • Design and programming techniques in practice • +Tools and techniques for process management and quality assurance • Continuous integration
Design and Development of Business Software • Introduction to Business Software • Modelling business process • Enterprise applications: ERP, CRM, SCM • Transactional systems (OLTP) for business processes • Systems for small/medium business • Business intelligence dashboards and online analytic processing

Data Visualisation and Exploration

- Languages for programming data and data visualization
- Exploratory data analytics, data exploration, and feature engineering
- Human perception for effective visualization
- Data types and visual encodings
- Visualization idioms
- Advanced libraries for data visualization

Embedded Systems Design and Implementation

- Fundamental notions of embedded and cyber-physical systems
- Architectures of embedded and cyber-physical systems
- Control and management of time and hardware interfaces
- Design and programming of real-time software
- Hardware architectures including MPU/MCUs, DSPs, FPGAs and ASICs
- Practical aspects of real-world implementation and engineering aspects

Entrepreneurial Software Engineering

- Nature and characteristics of software start-ups
- Problem and solution identification and validation
- Building minimum viable products
- Lean analytics and pivoting
- Continuous retrospectives for start-up team learning
- Scaling software start-ups

Extended Reality: Augmented, Virtual and Mixed Reality

- General Overview, current trends and future applications of XR technologies
- Introduction to Computer Graphics – The rendering pipeline
- Working with a graphics engine (e.g. OpenGL, Unity3d)
- Input devices – controllers, motion trackers and motion capture technologies for tracking
- Output devices – Head Mounted VR Displays, Augmented and Mixed reality glasses
- Rapid XR prototyping

Human Computer Interaction

- PACT framework: People Activities Context Technology
- Design principles
- Quality metrics: usability, user experience, engagement
- Cognitive processes: attention, perception and memory
- Evaluation and empirical research
- Data analysis and visualisation: statistical considerations

Information Retrieval

- Document Indexing
- Vector Space Model
- Web Search
- Text Classification
- Topic Modelling
- Introduction to text mining

Parallel Computing

- Introduction to architectures for parallel and distributed systems
- Shared memory model and GPU Computing
- Distributed memory model: introduction to Message Passing Interface
- Principle and design of parallel algorithms
- Selection of parallel algorithms
- Performance Analysis, optimization and tuning

Microcontroller Programming (name in S&T: Fundamentals of Information Science and Microcontroller Programming)

- Basic programming syntax and structure in C
- Functions
- Conditional control structures
- Arithmetic, comparison and Boolean operators
- Pointers and addressing
- Data types
- Interrupts
- Simple electronic circuits

Mobile Robotics

- Functional architecture of unmanned systems.
- Vehicle dynamics and modeling.
- Common navigation sensors.
- Low-level, control.
- State & disturbance estimation.
- Path generation & waypoint navigation.

Programmable Logic Controllers (new name in S&T: Programmable Controllers for Industrial Automation, syllabus not available)

- Elementary switching theory
- Logical functions and ladder diagrams
- Basic of Programmable Logic Controller (PLC)
- PLC Programming

Programming for Data Science

- Integrated Development Environments for Data Science
- Data wrangling, cleaning, and preprocessing
- Advanced libraries for linear algebra and statistics
- Data science pipelines, from data ingestion to models and analysis
- Model tuning, validation, and testing
- Reproducible analysis practices

Research Methods and Technology Transfer

- Quantitative, qualitative, and mixed-method research
- Systematic literature review, Systematic mapping study
- Survey research
- Experimental research
- Case study

- Technology transfer and dissemination

Seminar in Software Engineering Advances

- Responsible Software Engineering
- AI and Software Engineering
- Remote/Hybrid Software Engineering

Software and Systems Security

- Computer Security Technology and Principles
- Data security
- Software and Network Security and Trusted Systems
- Social security
- System Vulnerabilities and Attacks
- Security Management

Software Design and Implementation

M1: Requirements Engineering

- Functional and Non-Functional Requirements
- Requirements Engineering Processes
- Requirements Elicitation and Analysis
- Requirements Specification
- Validation of Requirements
- Requirements Change

M2: Advanced Software Design Techniques

- Design Patterns Application and Interaction
- Evolutionary Design Techniques (TDD, BDD, Refactoring)
- Domain Modeling (DDD)
- Components and Modularization
- Framework Development (Extension Points, Reflection, Metadata)
- Software Design Evaluation (Code Metrics, Code Smells, Software Visualization)

Software Maintenance and Evolution

- Introduction to software maintenance and evolution
- Software Refactoring
- Mining software repositories
- Machine learning for software engineering
- Using software metrics to assess and monitor the quality of software systems
- Using textual analysis techniques in the context of software maintenance and evolution

Software Quality and Metrics

- Importance of quality
- Software product quality
- Software process quality
- Software quality metrics
- Measurement techniques for monitoring software quality
- Total Quality Management tools and techniques and their application to software

Verification and Reliability

- Dependable properties of systems
- Software and software systems testing
- Techniques for verification of software systems
- Advances in test design and implementation
- Search Based testing
- HW and SW reliability models