Module Description, available in: EN

Information Visualization

General Information

Number of ECTS Credits

3

Module code

TSM_InfVis

Valid for academic year

2022-23

Last modification

2020-12-22

Coordinator of the module

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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

Profile Recommendations

This module is recommended for the following profiles:

	Zurich
Profile	Geo

Lessons

2 lecture periods and 1 tutorial period per week

Entry level competences

Prerequisites, previous knowledge

Basic programming knowledge (any programming language)

Basic knowledge of data visualization and data graphics (e.g. Wong 2010)

Brief course description of module objectives and content

More and more complex data is collected in a wide range of application areas. Thus, with the goal of gaining insight into the data and information as well as communicating the resulting knowledge, the need for efficient visual methods is growing rapidly. We need to know the options for effective and efficient visual representations, for example for communication and fact-based decision making, as well as to develop new methods for visual data exploration to gain insight and learn from the collected data. Specifically also new user interfaces are needed to allow the interaction with and exploration of big, dynamic and multidimensional data sets as well as contextual information.

The module Information Visualization builds on basic knowledge of data visualization and data graphics (e.g. Wong 2010). It starts with an introduction before going into the details of important concepts of information visualization as well as the options and techniques for the design of static and dynamic visual user interfaces. A specific focus is given to the visual analysis of uni- and multidimensional data as well as the communication of information (infographics). Typical questions that shall be answered through visual data analysis include the perspectives 'What?', 'When?', 'Where?' and also often 'With whom?'. Thematic, temporal, spatial and network data sets all have specific characteristics that need to be considered when designing suitable representations for visual analysis and communication. In addition to learning and teaching the basic and applied visualization knowledge, content from current research in information visualization are included in the module (advanced visualization topics).

The theoretical contents of the module are complemented with a series of exercises. These allow to deepen and broaden the theoretical knowledge through practical application. The visualization tools used in the module exercises are open. It is thus possible to try out a range of visualization tools (e.g. R, D3.js or Python Bokeh) or otherwise to select one and use it for (almost) all exercises.

Aims, content, methods

Learning objectives and competencies to be acquired

- The students can apply the theory and the knowledge of visualization methods for the support of efficient and effective visual analysis and communication of different data sets, including thematic (what), temporal (when), spatial (where) and network (with whom) data, from a range of scientific, technical and other application areas.
- The students understand and can apply the most important concepts of colour, layout, typography and other visualization dimensions as well as the knowledge of human perception and cognition for the design of suitable information visualizations.
- The students can apply their knowledge to implement iterative visualization projects to develop effective and goal- and user-oriented data and information visualizations for a range of application areas.
- The students understand different methods for the evaluation of information visualizations as well as their respective opportunities and limitations.
- The students know about the challenges of data preparations and problems such as missing data and can devise and apply suitable coping strategies.
- The students are able to use their knowledge of visualization methods, technologies and concepts to design, implement, and evaluate complex and advanced information visualizations for the analysis of specific data and research questions.
- The students know the current and ongoing topics and questions of information visualization research and are able to assess and suitably include new research results into their visualization work.

Module content with weighting of different components

- Repetition and overview of the basics of data and information visualization: data types, dimensions, analysis questions, purpose and audience, visual variables as well as data graphic types, colour, layout, typography, history of (information) visualization
- Principles of the human perception and cognition, applications and limitations, influences on the design of information representations and user interfaces
- Processes of visual data analysis and visual information communication, combination of visualization with other data analysis techniques (statistics, data mining), concepts and techniques of interaction
- Evaluation of information visualizations, usefulness, usability, utility, readability, efficiency and effectiveness
- Data preparation, strategies for missing and unsuitable data, concepts for the visualization of uncertainty
- Simple as well as more complex visualization types and techniques for the visualization of thematic, temporal, spatial, and network data to analyse the main questions of what, when, where and with whom and combinations thereof
- Applications and exercises of using the different concepts, methods and technologies for different questions and application areas, such as visual analytics, business intelligence, dashboards and information graphics

Teaching and learning methods

Lectures, exercises (individual and group work)

Literature

Dona M. Wong (2010). *The Wall Street Journal Guide to Information Graphics: The Dos and Don'ts of Presenting Data, Facts, and Figures*. W. W. Norton & Company, Inc.

Assessment

Certification requirements

Module uses certification requirements

Certification requirements for final examinations (conditions for attestation)

Submitted and accepted homework (visualization project module task)

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

Aids permitted as specified below:

Permissible electronic aids

Open book, all materials and documents

Other permissible aids

Open book, all materials and documents

Special case: Resit exam as oral exam

Kind of exam

Oral exam

Duration of exam

30 minutes

Permissible aids

No aids permitted