

Module Description

39-M-Inf-ADS Auditory Data Science

Faculty of Technology

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This module guide reflects the current state and is subject to change. Up-to-date information and the latest version of this document can be found online via the page

<https://ekvv.uni-bielefeld.de/sinfo/publ/modul/210149228>

The current and valid provisions in the module guide are binding and further specify the subject-related regulations (German "FsB") published in the Official Announcements of Bielefeld University.

Non-official translation of the module descriptions. Only the German version is legally binding.

39-M-Inf-ADS Auditory Data Science

Faculty

Faculty of Technology

Person responsible for module

Dr. rer. nat. Thomas Hermann

Regular cycle (beginning)

Every summer semester

Credit points

5 Credit points

Competencies

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The goal is to give an overview and transfer knowledge of foundations and interrelations in the area of auditory displays, including key definitions, taxonomy, organization system and the conceptual and practical implementation of different sonification methods. Participants will learn criteria for the selection of sonification methods for given problems as well as guidelines for the parameterization of sonification methods. The scientific analytic listening competence will be developed and trained with help of many sonification examples, with focus on the discrimination of structures in sound. Furthermore participants will develop practical competences in sonification, including programming skills in the sound programming language SuperCollider and interactive coding in the NumPy/SciPy ecosystem, with visualizations and method development in python.

Content of teaching

The lecture introduces into the research field of Auditory Data Science which connects Data Mining to Audio Technology via methods of Sonification, i.e., 'auditory data representations'. Here, sound is the medium for exploratory data analysis of complex data, for monitoring changes in complex data streams, for discriminating complex time series that are difficult to understand from visualization alone, for supporting exploratory interactions with complex data, to enhance our insight into data by teaming up visualization and sonification towards multimodal data exploration or perceptualization. Sonification, the systematic, reproducible representation of data as sound is the key to auditory data science and thus is first comprehensively introduced and defined. In turn, sonification techniques will be presented and discussed: Earcons, Auditory Icons, Audification, Parameter-Mapping Sonification, Model-based Sonification and Wave Space Sonification. Furthermore, selected techniques for inductive data mining, such as estimation of intrinsic dimensionality, topology or clustering of high-dimensional data will be introduced in order to use them within sonification processes. At hand of selected real-world examples for auditory data analysis we will discuss the potential of auditory data science, e.g. sonification of medical data for diagnosis, monitoring and therapy.

Recommended previous knowledge

Useful but not mandatory: Knowledge of data mining

Cross-references to: Introduction to Sound Synthesis, Ambient Interfaces

Necessary requirements

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Explanation regarding the elements of the module

Module structure: 1 bPr¹

Courses

Title	Type	Regular cycle	Workload ⁵	LP ²
Auditory Data Science	lecture	SoSe	60 h (30 + 30)	2 [Pr]
Übung zu Auditory Data Science	exercise	SoSe	60 h (15 + 45)	2

Examinations

Allocated examiner	Type	Weighting	Workload	LP ²
Teaching staff of the course Auditory Data Science (lecture) <i>Oral examamination (15-25 min.) or written examination (60-90 min.) about the contents of the lecture.</i>	Klausur o. mündliche Prüfung	1	30h	1

Legend

- 1 The module structure displays the required number of study requirements and examinations.
 - 2 LP is the short form for credit points.
 - 3 The figures in this column are the specialist semesters in which it is recommended to start the module. Depending on the individual study schedule, entirely different courses of study are possible and advisable.
 - 4 Explanations on mandatory option: "Obligation" means: This module is mandatory for the course of the studies; "Optional obligation" means: This module belongs to a number of modules available for selection under certain circumstances. This is more precisely regulated by the "Subject-related regulations" (see navigation).
 - 5 Workload (contact time + self-study)
- SoSe** Summer semester
- WiSe** Winter semester
- SL** study requirement
- Pr** Examination
- bPr** Number of examinations with grades
- uPr** Number of examinations without grades