



## Course and Examination Fact Sheet: Spring Semester 2021

### 8,330: Machine Learning

ECTS credits: 4

#### Overview examination/s

(binding regulations see below)

Decentral - Group examination paper (all given the same grades) (40%)

Examination time: term time

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#### Attached courses

Timetable -- Language -- Lecturer

[8,330,1.00 Machine Learning](#) -- Englisch -- [Horlemann Anna-Lena](#)

#### Course information

#### Course prerequisites

- Basic mathematical knowledge from the assessment level.
- It is advantageous to have preliminary knowledge in programming with R. However, we will have a quick introduction to programming with R during the course, and with some motivation it is possible to acquire these skills in the first week of the semester.

#### Learning objectives

At the end of the course the students will be able to understand the (mathematical) functionality of basic machine learning techniques. They are able to program their own algorithms, as well as understand and use existing algorithms to analyze data sets. Furthermore, they are able to compare the predictive quality of different methods.

#### Course content

Machine Learning and Artificial Intelligence are universal techniques for data-based prediction and decisions. The applications are manifold: prediction of macro- and micro-economic variables, business planning, marketing, clinical diagnosis, automatic translation, text and speech recognition, self-driving cars, and many more.

This class deals with the fundamental concepts and algorithmic ideas of machine learning. How can an abstract system "learn"? What exactly does "learning" mean? How can you visualize a step-by-step learning process? How good does a system learn; and when is a learning problem practically unfeasible?

The fundamental knowledge of machine learning algorithms you will acquire during the course will help you to answer questions that might arise in your future work environment, such as:

- Where can your organization potentially use machine learning methods?
- What type of methods are there for a given problem?
- What are the potential risks of using machine learning?

During class and as homework exercises you will program your own machine learning algorithms in R, to get a better understanding of the learning methods. Some of these algorithms will be visualized by graphics. The main topics will be the following:

- Prediction via regression
- (Stochastic) gradient descent



- Classification and decision boundaries
- Simple neural networks
- Decision trees
- Logistic regression
- Loss functions
- Model validation via training and testing

To get a first idea of the above topics, you can have a look at the respective Wikipedia entries.

## Course structure

There will be one class of two hours each week. In the lecture we will usually learn theoretical results, that should be applied in programming algorithms in R as homework. Moreover, there will be an (optional) introduction to programming in R.

## Course literature

Lecture notes, online resources. Further literature recommendations will be announced on StudyNet (Canvas).

## Additional course information

In the case of the President's Board having to implement new directives due to the SARS-CoV-2 pandemic in SpS2021, the course information listed above will be changed as follows:

- The course is conducted online via the platform Zoom;
- The recordings of the course will not be saved;
- The lecturer informs via StudyNet on the changed implementation modalities of the course.

The examination information listed below would be changes as follows:

- There are no changes necessary to the examination information.

## Examination information

### Examination sub part/s

#### 1. Examination sub part (1/2)

##### Examination time and form

Decentral - Group examination paper (all given the same grades) (40%)

Examination time: term time

##### Remark

Homework exercises

##### Examination-aid rule

Term papers

Term papers must be written without anyone else's help and in accordance with the known quotation standards, and they must contain a declaration of authorship which is a published template in StudentWeb.

The documentation of sources (quotations, bibliography) has to be done throughout and consistently in accordance with the chosen citation standard such as APA or MLA.

For papers in law, the legal standard is recommended (by way of example, cf. FORSTMOSER, P., OGOREK R. et SCHINDLER B., Juristisches Arbeiten: Eine Anleitung für Studierende, newest edition respectively, or according to the recommendations of the Law School).

The indications of the sources of information taken over verbatim or in paraphrase (quotations) must be integrated into texts in accordance with the precepts of the applicable quotation standard, while informative and bibliographical notes must be added as footnotes (recommendations and standards can be found, for example, in METZGER, C., Lern- und Arbeitsstrategien, newest



edition respectively.

For any work written at the HSG, the indication of the page numbers is mandatory independent of the chosen citation standard. Where there are no page numbers in sources, precise references must be provided in a different way: titles of chapters or sections, section numbers, acts, scenes, verses, etc.

## Supplementary aids

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## Examination languages

Question language: English

Answer language: English

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## 2. Examination sub part (2/2)

### Examination time and form

Decentral - Group examination paper (all given the same grades) (60%)

Examination time: term time

### Remark

Final project

### Examination-aid rule

Term papers

Term papers must be written without anyone else's help and in accordance with the known quotation standards, and they must contain a declaration of authorship which is a published template in StudentWeb.

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## Supplementary aids

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## Examination languages

Question language: English

Answer language: English

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## Examination content

- There will be regular homework exercises that may be solved in groups of up to three participants. The exercises will mainly involve programming the content learned in class.
- For the final term paper, every group of three/four participants will work on an advanced machine learning algorithm and apply it to a data set (chosen yourself).



## Examination relevant literature

Lecture notes, online resources

- For the homework exercises no additional literature is needed.

### Please note

Please note that only this fact sheet and the examination schedule published at the time of bidding are binding and takes precedence over other information, such as information on StudyNet (Canvas), on lecturers' websites and information in lectures etc.

Any references and links to third-party content within the fact sheet are only of a supplementary, informative nature and lie outside the area of responsibility of the University of St.Gallen.

Documents and materials are only relevant for central examinations if they are available by the end of the lecture period (CW21) at the latest. In the case of centrally organised mid-term examinations, the documents and materials up to CW 12 are relevant for testing.

Binding nature of the fact sheets:

- Course information as well as examination date (organised centrally/decentrally) and form of examination: from bidding start in CW 04 (Thursday, 28 January 2021);
- Examination information (regulations on aids, examination contents, examination literature) for decentralised examinations: in CW 12 (Monday, 22 March 2021);
- Examination information (regulations on aids, examination contents, examination literature) for centrally organised mid-term examinations: in CW 12 (Monday, 22 March 2021);
- Examination information (regulations on aids, examination contents, examination literature) for centrally organised examinations: two weeks before the end of the registration period in CW 14 (Thursday, 8 April 2021).