University of St.Gallen

Course and Examination Fact Sheet: Spring Semester 2024

8,384: Quantitative Analysis: Statistical Learning

ECTS credits: 4

Overview examination/s
(binding regulations see below)
decentral - Written work, Digital, Individual work individual grade (60%)
Examination time: Term time
decentral - Programming, Digital, Individual work individual grade (40%)
Examination time: Term time

Attached courses
Timetable -- Language -- Lecturer
8,384,1.00 Quantitative Analysis: Statistical Learning -- English -- Vergioglou Ioannis

Course information

Course prerequisites

Basic familiarity with R is a strong asset in this course. However, the course structure enables students to progress gradually and improve their programming skills.

For a refresher on R see:
• Wickham, Hadley, and Garrett Grolemund. 2016. R for data science. O'Reilly Media, Inc. Freely available at
https://r4ds.had.co.nz/

Learning objectives

Students will learn to implement and evaluate machine-learning techniques for real-world applications in the fields of Political Science, Economics, and International Relations. Upon completion of the course, students will have an understanding of modern computational methods for prediction and classification.

Course content

Introduction:

- Overview of statistical learning and its applications.
- Introduction to key concepts and terminology.

Statistical Learning:

- Basics of supervised and unsupervised learning.
- Overview of the bias-variance trade-off.

Linear Regression:

- Introduction to simple and multiple linear regression.
- Model assessment and selection.

Classification:

- Basics of classification methods.
- Logistic regression, LDA, and K-Nearest Neighbors.

Resampling Methods:

- Cross-validation and bootstrapping techniques.

Linear Model Selection and Regularization:

- Subset selection, ridge regression, and lasso.

Moving Beyond Linearity:

- Polynomial regression and splines.

Tree-Based Methods:

- Decision trees, bagging, and random forests.

Support Vector Machines:

- Basics of support vector machines for classification and regression.

Deep learning:

- Deep Learning applications with neural networks

Course structure and indications of the learning and teaching design

The course is structured in weekly seminars.

Course literature

James, G., Witten, D., Hastie, T., & Tibshirani, R. (2013). *An Introduction to Statistical Learning with Applications in R*. Springer.

The latest version is kindly provided by the authors free of charge (and legally) here:
https://hastie.su.domains/ISLR2/ISLRv2_corrected_June_2023.pdf.download.html

Additional course information

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Examination information

Examination sub part/s

1. Examination sub part (1/2)

Examination modalities

Examination type	Written work
Responsible for organisation	decentral
Examination form	Written work
Examination mode	Digital
Time of examination	Term time
Examination execution	Asynchronous
Examination location	Off Campus
Grading type	Individual work individual grade
Weighting	60%

Duration   --

Examination languages
Question language: English
Answer language: English

Remark
Prediction Task

Examination-aid rule
Free aids provision

Basically, students are free to choose aids. Any restrictions are defined by the faculty members in charge of the examination under supplementary aids.

Supplementary aids
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2. Examination sub part (2/2)

Examination modalities

Examination type	Programming
Responsible for organisation	decentral
Examination form	Practical test
Examination mode	Digital
Time of examination	Term time
Examination execution	Asynchronous
Examination location	Off Campus
Grading type	Individual work individual grade
Weighting	40%
Duration	--

Examination languages
Question language: English
Answer language: English

Remark
Regular coding assignments

Examination-aid rule
Free aids provision

Basically, students are free to choose aids. Any restrictions are defined by the faculty members in charge of the examination under supplementary aids.

Supplementary aids
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Examination content

Weekly individual assignments are expected to be submitted before the following lecture. The coding assignments will involve applying the concepts covered in each week's material. Assignments are designed to reinforce theoretical concepts, develop coding skills, and encourage critical thinking. Students are encouraged to work in groups to solve coding problems but should not copy code and/or interpretations from each other. Students will receive regular feedback. It is advised to construct assignments using R Markdown, utilizing the provided template. Submissions should consist of a singular PDF file. More instruction will be given in class.

The final assignment will consist of a prediction "competition". In this final assignment, students will be given a dataset and

asked to produce a modeling strategy to predict a binary outcome.

Examination relevant literature

James, G., Witten, D., Hastie, T., & Tibshirani, R. (2013). *An Introduction to Statistical Learning with Applications in R.* Springer.

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 13 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, 25 January 2024);
- Examination information (supplementary aids, examination contents, examination literature) for decentralised examinations: in CW 12 (Monday, 18 March 2024);
- Examination information (supplementary aids, examination contents, examination literature) for centrally organised mid-term examinations: in CW 13 (Monday, 25 March 2024);
- Examination information (regulations on aids, examination contents, examination literature) for centrally organised examinations: Starting with de-registration period in CW 15 (Monday, 08 April 2024).