Module Description, available in: EN

Predictive Modelling

General Information

Number of ECTS Credits

3

Module code

FTP_PredMod

Valid for academic year

2024-25

Last modification

2021-03-30

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

FTP Fundamental theoretical principles

Profile Recommendations

This module is recommended for the following profiles:

	Zurich
Profile	BE, DS, Geo

Lessons

2 lecture periods and 1 tutorial period per week

Entry level competences

Prerequisites, previous knowledge

Basic knowledge of statistics on the level of an introductory stochastics course. Linear algebra: matrix-vector calculations. Basic Calculus. Familiarity and experience with programming, in particular with scripting languages like Matlab, Python or R. We will provide the students with a self-test to assess their prior knowledge in statistics and scripting.

Brief course description of module objectives and content

This course will provide an introductory review of the basic concepts of probability and statistics to understand probability distributions and to produce rigorous statistical analysis including estimation, hypothesis testing, and confidence intervals. Students will be introduced to the basic concepts of predictive modelling which by definition is the analysis of current and historical facts to make predictions about future events. Students will learn several techniques that account for many business and engineering applications of predictive modelling. These include regression techniques, time series models, and classification methods. Applicability and limitations of these methods will be illustrated in the light of data sets and analyses using the statistical software R or Python.

Please note: An MSE cursus may not contain both similar statistics modules FTP_AppStat and FTP_PredMod. Students can only choose one of these modules.

Aims, content, methods

Learning objectives and competencies to be acquired

Students are able to analyze data by means of regression analysis. They are familiar with important statistical forecasting methods and are able to calculate, evaluate and interpret predictions. They are able to choose an appropriate statistical method for a regression, classification or time series problem. They are able to evaluate and compare statistical models.

Module content with weighting of different components

Regression analysis: Simple linear regression with parameter estimation, graphical model validation, transformation of variables, confidence and prediction intervals for parameters. Multiple linear regression with parameter estimation, statistical tests and confidence intervals for parameters, variable selection, and regularization methods.

Classification: Concepts of classification, logistic regression, model evaluation metrics and cross-validation, boosting, model-agnostic feature importance analysis

Time series analysis: STL decomposition; ARMA, seasonal and non-seasonal ARIMA, Holt-Winters models with parameter estimation, confidence and prediction bands, autocorrelation, and model selection; anomaly detection; spectral analysis. Use-cases in economics, finance, and engineering.

Teaching and learning methods

Lecture and practical work on computer with the statistics software R or Python.

Literature

Lecture notes will be available in addition to recommended book chapters.

Assessment

Certification requirements

Module does not use certification requirements

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

Statistical software R or Python and calculator.

Other permissible aids

Personal handwritten summary of 10 pages.

Special case: Resit exam as oral exam

Kind of exam

Oral exam

Duration of exam

30 minutes

Permissible aids

No aids permitted