

**Module Description, available in: EN**

## Predictive Modelling

### General Information

**Number of ECTS Credits**

3

**Module code**

FTP\_PredMod

**Valid for academic year**

2023-24

**Last modification**

2021-03-30

**Coordinator of the module**

Mirko Birbaumer (HSLU, mirko.birbaumer@hslu.ch)

**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   |  |  |
|----------------------|----------|--|--|--------|----------|--|--|
| <b>Instruction</b>   |          |  |  |        | X E 100% |  |  |
| <b>Documentation</b> |          |  |  |        | X E 100% |  |  |
| <b>Examination</b>   |          |  |  |        | X E 100% |  |  |

**Module Category**

FTP Fundamental theoretical principles

**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 acquired competencies

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.

### Contents of module with emphasis on teaching content

*Fundamental concepts of probability and statistics (repetition of basic courses):* concept of random variable, important probability distributions, covariance, parameter estimation, hypothesis testing, and confidence intervals.

*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, and variable selection.

*Classification:* Concepts of classification, logistic regression, CART, random forests, Support Vector Machines, and model evaluation by cross-validation.

*Time series analysis:* STL decomposition, confidence and prediction bands, AR models with parameter estimation, confidence and prediction bands, autocorrelation, and model selection.

### 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 the standard final exams for modules and also all resit exams are to be in written form**

### Standard final exam for a module and written resit exam

#### Kind of exam

written

#### 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 20 pages.

### Special case: Resit exam as oral exam

#### Kind of exam

oral

**Duration of exam**

30 minutes

**Permissible aids**

No aids permitted