



UNIVERSITY  
OF SKÖVDE

## COURSE SYLLABUS

# Probabilistic Modeling, third-cycle level

## 7.5 credits

TRANSLATION FROM SWEDISH

**Course code:** IT0949F

**Version number:** 2.1

**Valid from:** 1 July 2024

**Ratified by:** Curriculum Committee for Third-cycle Studies

**Date of ratification:** 11 March 2024

### 1. General information about the course

The course is provided by the University of Skövde and is named Probabilistic Modeling, third-cycle level (Probabilistisk modellering, forskarnivå). It comprises 7.5 credits .

The course is a part of the third-cycle subject area of Informatics.

### 2. Entry requirements

The prerequisites for this course are general entry requirements for third-cycle courses and study programmes, i.e. a second-cycle qualification or satisfied requirements for courses comprising at least 240 credits of which at least 60 credits were awarded in the second cycle (or the equivalent).

In order to fulfil the specific entry requirements, the applicant must have completed course requirements of at least 60 credits, including an independent project of at least 15 credits at the second cycle, within the subject Informatics, applicable areas of a similar kind or other fields assessed as directly relevant for thesis work in the subject Informatics.

An additional requirement is proof of skills in English equivalent of studies at upper secondary level in Sweden, known as the Swedish course English 6. This is normally demonstrated by means of an internationally recognized language test, e.g. IELTS or TOEFL or the equivalent.

### 3. Course content

The course cover the area probabilistic modeling from the perspective that is present within the areas artificial intelligence, machine learning and data science where the goal often is to extract knowledge or use models for decision making or prediction. The course will in general be based on Bayesian theory since this is the commonly used base for probabilistic modeling within these areas.

The course starts with a positioning of the area within a context and introducing central terms and tools for probabilistic programming. Programming for efficient handling of data as well as for building models, so called probabilistic programming, will be covered. Furthermore, important probabilistic terms will be highlighted and illustrated. Terms and concepts, such as prior, likelihood and posterior, within Bayesian theory will be introduced at different level of details in several of the lectures.

Great emphasis within the course will be put on intuitive understanding of terms and concepts since these are required in order to understand consequences of different design choices for a model and its relation to data. Different types of training algorithms and its consequence when it comes to resulting model will be covered as well as a range of models of different complexity.

The course follows a structure where complexity when it comes to methods and terms within the area increases with the progression of the course. Hence, the first assignment aims at securing that a certain level within methods and terms has been achieved. The following assignment as well as the project work aims at applying and further develop this level.

## 4. Objectives

After completed course the doctoral student should be able to:

- demonstrate the use of tools for probabilistic programming;
- analyze and judge training results of a probabilistic model;
- demonstrate use of methods for evaluation of fit for a given probabilistic model with respect to certain data set;
- critically reflect regarding different models and their fit to data; and
- argue for different choices within the modeling process for both design choices with respect to probabilistic model but also approach within the modeling process.

## 5. Examination

The course is graded G (Pass) or U (Fail).

To receive the grade Pass on the course, all examination parts have to be graded Pass.

The examinations of the course consist of the following modes of assessment:

- **Assignment 1**  
1.5 credits, grades: G/U
- **Assignment 2**  
2 credits, grades: G/U
- **Project report**  
4 credits, grades: G/U

Doctoral students with a permanent disability who have been approved for directed educational support may be offered adapted or alternative modes of assessment.

## 6. Types of instruction and language of instruction

The teaching is comprised of exercises, presentations, lectures and project work.

The teaching is conducted in English.

## 7. Course literature and other educational materials

Scientific publications and other specified material according to the teacher.

## 8. Doctoral student influence

Doctoral student influence in the course is ensured by means of course evaluation. The students are informed about the results of the evaluation and potential measures that have been taken or are planned, based on the course evaluation.

## 9. Additional information

Further information about the course, as well as national and local governing documents for higher education, is available on the website of the University of Skövde.