

# Introduction to Machine Learning and Data Mining

**Subject area:** Computer Science/ICT

<b>University:</b>	DTU
<b>Level:</b>	BA2, BA3, BA4, MA all years
<b>Teaching mode:</b>	hybrid: some students participate online, other students attend real-life
<b>Instructor(s):</b>	Morten Mørup, Mikkel N. Schmidt, Tue Herlau, Jes Frelsen, Bjørn Sand Jensen

## Short description

Structured data modelling. Feature extraction and dimensionality reduction. Similarity measures and summary statistics. Visualization and interpretation of models. Overfitting and generalization. Regression and classification (decision trees, nearest neighbor, naive Bayes, neural networks, and ensemble methods). Clustering (k-means, hierarchical clustering, and mixture models). Association rules. Density estimation and outlier detection. Applications in a broad range of engineering sciences.

## Full description

<https://kurser.dtu.dk/course/02450>

## Learning outcomes

At the end for the course, the learning will be able to::

- + Describe the major steps involved in data modeling from preparing the data, modeling the data to evaluating and disseminating the results.
- + Discuss key machine learning concepts such as feature extraction, cross-validation, generalization and over-fitting, prediction and curse of dimensionality.
- + Sketch how the data modeling methods work and describe their assumptions and limitations.
- + Match practical problems to standard data modeling problems such as regression, classification, density estimation, clustering and association mining.
- + Apply the data modeling framework to a broad range of application domains in medical engineering, bio-informatics, chemistry, electrical engineering and computer science.
- + Compute the results of the data modeling framework by use of Matlab, R or Python.
- + Use visualization techniques and statistics to evaluate model performance, identify patterns and data issues.
- + Combine and modify data modeling tools in order to analyze a data set of their own and disseminate the results of the analysis.

## General information

<b>Contact hours per week:</b>	4
<b>Total workload:</b>	140 (in student hours for the whole course)
<b>ECTS credits:</b>	5
<b>Language:</b>	English
<b>Course start date:</b>	29 August 2022
<b>Course end date:</b>	02 December 2022
<b>Add. info about start date:</b>	
<b>Weekly teaching day/time:</b>	Every Tuesday from 1 PM - 5 PM (+1 UTC)
<b>Time zone:</b>	CET (Denmark, Germany, France, Netherlands, Switzerland, Czech Republic)

## Further information:

<b>Prerequisites:</b>	Introductory mathematics (including linear algebra), introductory programming in Python/R/Matlab, introductory statistics
<b>Activities and methods:</b>	Lectures, Group work, Exercises
<b>Presence on campus:</b>	Presence on campus not required

## Final examination

<b>Form:</b>	Date will be announced but final examination between 5/12 2022 - 22/12 2022
<b>Date:</b>	
<b>Location/format:</b>	online
<b>Re-sit possibility:</b>	yes
<b>Transcript available:</b>	end of semester
<b>Add. info/requirements:</b>	

## Registration

To register for this course, follow the registration requirements of your **home university** as specified here: [www.euroteq.eu/courses-registration](http://www.euroteq.eu/courses-registration).

## Administration

<b>Number of places:</b>	5
<b>Minimum participants:</b>	
<b>Internal course code:</b>	02450
<b>Contact:</b>	mmor@dtu.dk, bje@dtu.dk, jefr@dtu.dk

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*This course is part of the EuroTeQ Engineering University joint course catalogue 2022/2023. This is a collaborative activity of the partner universities DTU, L'X, TU/e, TalTech, CTU, TUM as well as Technion. Students from these universities can participate in the offered courses. It is the responsibility of the student to check if you fulfil the requirements to participate in a specific course. Students are also advised to check with their home institution how to get recognition of the ECTS credits gained in courses of the EuroTeQ course catalogue. For further information about EuroTeQ Engineering University, visit [www.euroteq.eu](http://www.euroteq.eu) or get in touch with the above-mentioned point of contact.*