

Machine Learning (C003758)

Course size (nominal values; actual values may depend on programme)
Credits 6.0 Study time 180 h Contact hrs 60.0 h

Course offerings and teaching methods in academic year 2020-2021

A (semester 1)	English	lecture	30.0 h
		seminar: practical PC room classes	10.0 h
		seminar: coached	5.0 h
		exercises	
		project	15.0 h

Lecturers in academic year 2020-2021

Saeys, Yvan WE02 lecturer-in-charge

Offered in the following programmes in 2020-2021

	crdts	offering
Master of Science in Teaching in Science and Technology (main subject Computer Science)	6	A
Master of Science in Teaching in Science and Technology (main subject Mathematics)	6	A
Master of Science in Teaching in Science and Technology (main subject Physics and Astronomy)	6	A
Master of Science in Physics and Astronomy	6	A
Master of Science in Computer Science	6	A
Master of Science in Mathematics	6	A
Exchange Programme in Physics and Astronomy (Master's Level)	6	A
Exchange Programme in Computer Science (master's level)	6	A
Exchange Programme in Mathematics (master's level)	6	A

Teaching languages

English

Keywords

Machine learning, gesuperviseerd leren (classificatie en regressie), ongesuperviseerd leren (clustering), dimensionaliteitsreductietechnieken

Position of the course

Machine learning technieken stellen ons in staat om automatisch modellen op te stellen op basis van voorbeelddata. Deze technieken worden in onze huidige samenleving succesvol gebruikt om allerlei taken op te lossen, en zijn een essentiële basisvaardigheid van de moderne data-wetenschapper.

Contents

- Types machine learning technieken
- De bias-variance tradeoff
- Performantie-evaluatie (cross-validatie, area under ROC curve)
- Gesuperviseerd leren
 - Fisher LDA
 - Support Vector machines
 - Neurale netwerken en deep learning
 - Probabilistische modellen
 - K-Nearest Neighbours
- Ongesuperviseerd leren
 - Hierarchische clustering

- K-Means
- Density-gebaseerd clusteren
- Self-Organizing maps
- Gaussian mixture models en EM
- Bayesiaanse netwerken en Hidden Markov models
- Semi-supervised learning
- Dimensionaliteitsreductietechnieken
 - Het probleem van overfitting, the curse of dimensionality
 - Feature selectie
 - Feature transformatie
- Toepassingen van Machine Learning

Initial competences

Een goed begrip van datastructuren en algoritmen, een goede kennis van de basis van probabiliteitstheorie en basisprogrammeervaardigheden.

Final competences

- 1 Explain the differences among the three main styles of learning: supervised, reinforcement, and unsupervised. [Familiarity]
- 2 Implement simple algorithms for supervised learning, reinforcement learning, and unsupervised learning. [Usage]
- 3 Determine which of the three learning styles is appropriate to a particular problem domain. [Usage]
- 4 Compare and contrast each of the following techniques, providing examples of when each strategy is superior: decision trees, neural networks, and belief networks. [Assessment]
- 5 Evaluate the performance of a simple learning system on a real-world dataset. [Assessment]
- 6 Characterize the state of the art in learning theory, including its achievements and its shortcomings. [Familiarity]
- 7 Explain the problem of overfitting, along with techniques for detecting and managing the problem. [Usage]

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Lecture, project, seminar: coached exercises, seminar: practical PC room classes

Learning materials and price

Slides, tutorials en papers die dienen als cursusmateriaal worden beschikbaar gemaakt via Ufora.

References

Pattern Classification, 2nd Edition Richard O. Duda, Peter E. Hart, David G. Stork
ISBN: 978-0-471-05669-0

The Elements of Statistical Learning: Data Mining, Inference and Prediction (2nd edition)

Trevoer Hastie, Robert Tibshirani and Jerome Friedman

Course content-related study coaching

Persoonlijk contact met de lesgever, via e-mail of op afspraak.

Evaluation methods

end-of-term evaluation and continuous assessment

Examination methods in case of periodic evaluation during the first examination period

Written examination with open questions

Examination methods in case of periodic evaluation during the second examination period

Written examination with open questions

Examination methods in case of permanent evaluation

Oral examination, skills test, report

Possibilities of retake in case of permanent evaluation

examination during the second examination period is possible

Calculation of the examination mark

Niet-periodegebonden evaluatie: groepswerk (project) (40%) + periodegebonden: examen (60%). Om te kunnen slagen voor het opleidingsonderdeel moet een student minstens 10/20 behalen voor de niet-periodegebonden evaluatie. Is aan deze voorwaarde niet voldaan, dan kan een student niet meer dan 8/20 halen voor dit vak.