GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2018-2019

Deep Learning (F000884)

Course size (nominal values; actual values may depend on programme)

Credits	4.0	Study time	120 h	Contact hrs	40.0 h

Course offerings in academic year 2018-2019

Lecturers in academic year 2018-2019

Offered in the following programmes in 2018-2019	crdts	offering

Teaching languages

English

Keywords

Deep learning, artificial neural networks, artificial intelligence

Position of the course

We want to offer courses to "Master of Science in Marketing Analysis" students that reflect the state-of-the-art in research methodology.
Deep learning is one of the most succesful techniques in artificial intelligence (machine learning) today. Like all techniques in machine learning, deep learning builds a model from example data. It does this by modeling the world in terms of a hierarchy of concepts, with each concept defined in terms of its relation to simpler concepts. This approach avoids having to formally specify all of the knowledge that the system needs. In this course, we give the students a solid understanding and hands-on experience of the possibilities of deep learning for practical applications in industry and marketing. After following this course, you are ready to use deep learning in practice, to understand and re-implement state-of-the-art techniques and adapt them to the needs of your application.

Contents

Deep learning builds on machine learning and artificial neural networks, hence, this course starts out with a summary of the basic concepts of machine learning and an in-depth explanation of ANNs, including convolutional neural networks and recurrent neural networks.
This course stresses:
1 The benefits of neural networks over other learning algorithms
2 The benefits of “deep” neural networks over “shallow” architectures
3 The practical steps in designing a suitable neural network for a given application
We apply simple and advanced neural network architectures to cases with economical relevance. We use deep learning on different types of data sets, such as: image processing, NLP (natural language processing), or time series prediction.
Case studies will be performed in Pyton, using common libraries such as scikit-Learn and Keras.

Initial competences

Programming skills (preferably in Python)
Basic mathematics:
- linear algebra: matrices,
- calculus: derivatives,
- geometry: vectors and inner products

Final competences

1 Determining when and how to use Deep Learning for solving complex business

problems (in marketing and/or R&D).
2 Using Deep Learning on complex data (e.g., images, audio, video, text).
3 Systematic design and optimization of deep neural network architectures and analysis of their performance, reliability and robustness.
4 Understanding scientific literature about applications of Deep Learning. Validating the results of one's own research in comparison with the state-of-the-art for similar problems.

Conditions for credit contract

This course unit cannot be taken via a credit contract

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Guided self-study, group work, lecture, seminar: practical PC room classes

Extra information on the teaching methods

The concepts discussed in class are demonstrated in Jupyter notebooks, which can be altered by the students in order to get an active understanding.
In three graded programming assignments, they have to apply these concepts to unseen data sets. The results are discussed collectively in class, as well as individually, per group.

Learning materials and price

Learning materials: slides, Jupyter notebooks, a selection of online sources for specific topics.Scientific papers:
- Bengio, Yoshua; LeCun, Yann; Hinton, Geoffrey (2015). "Deep Learning". *Nature* **521**: 436–444

References

Goodfellow I, Bengio Y., Courville A. (2016), "Deep Learning", MIT Press.

Course content-related study coaching

Numerous exercises are being solved during sessions. In addition, assignments (to be solved in teams) are handed out.
Students receive coaching in the process of solving the assignments and feedback afterwards (collectively, by team and individually).

Evaluation methods

continuous assessment

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

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

Examination methods in case of permanent evaluation

Oral examination, participation, assignment, report

Possibilities of retake in case of permanent evaluation

examination during the second examination period is possible in modified form

Extra information on the examination methods

There are three graded assignments. There is one individual oral discussion in order to assess whether each group member has acquired the necessary understanding and practical knowledge.

Calculation of the examination mark

Individual exercises and group work (50%)
Oral interrogation: 50%
For each of both parts a score of at least 9/20 must be obtained. If this is not the case, the final score will be reduced to 7/20.