University of St.Gallen

Course and Examination Fact Sheet: Autumn Semester 2020

7,044: Introduction to Artificial Intelligence and Machine Learning

ECTS credits: 6

Overview examination/s

(binding regulations see below)
Central - Written examination (100%, 120 mins.)
Examination time: inter-term break

Attached courses

Timetable -- Language -- Lecturer
7,044,1.00 Introduction to Artificial Intelligence and Machine Learning -- Englisch -- Borth Damian

Course information

Course prerequisites

No prerequisites are required. Students will require a computer for tutorials. A good background in mathematics, algorithms and data structures will be beneficial for this lecture.

Learning objectives

Artificial Intelligence (AI):

- Students know the definition of Artificial Intelligence (AI) with respect to strong AI and weak AI and its link to the Turing Test
- Students understand the relation between Artificial Intelligence, Machine Learning and Deep Learning and can differentiate between them
- Students learn how to analyze a task according to PEAS and its Environment description.
- Students have an understanding of different agent designs and can link this to the PEAS and Environment description
- Students understand the principles of Trustworthy AI

Machine Learning (ML):

- Students know how a standard ML process can be setup, including best practice for training, validation, and test setups to prevent overfitting
- Evaluation Metrics of Classification and Retrieval
- Students understand feature representation for images
- Supervised Learning including: Bayes, CCD, Decision Trees, K-NN, Log. Regression
- Unsupervised Learning including the following approaches: k-means, Hierarchical Clustering

Deep Learning (DL):

- Students understand End-to-End learning as compared to traditional ML setups
- Students understand Neural Networks and the principles behind backpropagation
- Students know different deep neural networks architectures and its application domains
- Students learn about ImageNet and CNN for Image Recognition in particular

Course content

Over the last years, Artificial Intelligence (AI) has seen a steep rise to the top with large tech companies such as Google, Facebook and Amazon investing heavily in research and development. From chatbots, face recognition algorithm to self-driving cars, AI is quickly transforming technology, business and society. The driving factors behind the this momentum are recent advances in machine learning and in particular deep learning.

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This lecture aims to introduce the concepts of Artificial Intelligence (AI) and Machine Learning (ML). The goal is to provide a broad overview in this field, understand the relationship between AI and ML, and to cover major application areas of AI and ML. After the successful completion of this lecture, students should have acquired a terminology in AI and ML and be able to understand its basic concepts. Further, some coding experience in Python should have been acquired during self-study and exercises by the implementation of approaches in this field.

Topics covered include:
- Problem Solving / Search Space
- Knowledge, Reasoning, and Planning
- Supervised learning
- Unsupervised learning
- Deep Learning (NN, CNN, LSTM)
- Autoencoder

Course structure

Theoretical content presented in the lecture will be linked to practical programming work in the exercises. In addition, group discussions about recent AI development and innovation potential will connect the topic to real-world events.
The lecture will take place weekly with bi-weekly lab exercises structured as a coding challenge. Exercises can be handed in as group work.

Course literature

- Russel, S., Norvig, P.: Artificial Intelligence - A Modern Approach, Prentice Hall, 1999
- Goodfellow I, Benjo Y., Courville A., Courville A, Deep Learning, MIT Press, 2016
- Duda R., Hart P., Stork D.: Pattern Classification, 2nd edition, Wiley, 2001

Additional course information

Useful Python packages to be used for the exercises:
http://jupyter.org/
http://www.numpy.org/
https://www.scipy.org/
https://www.tensorflow.org
https://pytorch.org

In the case of the President's Board having to implement new directives due to the SARS-CoV-2 pandemic in fall 2020, the course information listed above will be changed as follows:
- The course is conducted entirely online via the platform Zoom;
- The recordings of the course are available for 7 days;
- The lecturer informs via StudyNet on the changed implementation modalities of the course;

The examination information listed below would be changed as follows:
No adjustments to the exam information are required for centrally organised exams.

Examination information

Examination sub part/s

1. Examination sub part (1/1)

Examination time and form

Central - Written examination (100%, 120 mins.)
Examination time: inter-term break

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Remark
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Examination-aid rule
Extended Closed Book
The use of aids is limited; any additional aids permitted are exhaustively listed under "Supplementary aids". Basically, the following is applicable:

- At such examinations, all the pocket calculators of the Texas Instruments TI-30 series and mono- or bilingual dictionaries (no subject-specific dictionaries) without hand-written notes are admissible. Any other pocket calculator models and any electronic dictionaries are inadmissible.
- In addition, any type of communication, as well as any electronic devices that can be programmed and are capable of communication such as notebooks, tablets, mobile telephones and others, are inadmissible.
- Students are themselves responsible for the procurement of examination aids.

Supplementary aids
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Examination languages
Question language: English
Answer language: English

Examination content
Topics covered include:
• Problem Solving / Search Space
• Knowledge, Reasoning, and Planning
• Uncertainty & Bayesian inference
• Supervised learning
• Unsupervised learning
• Deep Learning (NN, CNN, LSTM)
• Autoencoder

Examination relevant literature
Lecture slides and lecture literature:
• Russel, S., Norvig, P.: Artificial Intelligence - A Modern Approach, Prentice Hall, 1999
• Goodfellow I, Benjo Y., Courville A., Courville A, Deep Learning, MIT Press, 2016
• Duda R., Hart P., Stork D.: Pattern Classification, 2nd edition, Wiley, 2001

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Please note

Please note that only this fact sheet and the examination schedule published at the time of bidding are is binding and takes precedence over other information, such as information on StudyNet (Canvas), on lecturers' websites and information in lectures etc.

Any references and links to third-party content within the fact sheet are only of a supplementary, informative nature and lie outside the area of responsibility of the University of St.Gallen.

Documents and materials are only relevant for central examinations if they are available by the end of the lecture period (CW51) at the latest. In the case of centrally organised mid-term examinations, the documents and materials up to CW 42 are relevant for testing.

Binding nature of the fact sheets:

- Course information as well as examination date (organised centrally/decentrally) and form of examination: from bidding start in CW 34 (Thursday, 20 August 2020);
- Examination information (regulations on aids, examination contents, examination literature) for decentralised examinations: in CW 42 (Monday, 12 October 2020);
- Examination information (regulations on aids, examination contents, examination literature) for centrally organised mid-term examinations: in CW 42 (Monday, 12 October 2020);
- Examination information (regulations on aids, examination contents, examination literature) for centrally organised examinations: two weeks before the end of the registration period in CW 44 (Thursday, 29 October 2020).