

COMPSCI 760 S2 2018

Machine Learning and Data Mining

Department of Computer Science

1 Course Description

Machine learning techniques are widely used in many computing applications; for example, in web search engines, spam filtering, speech and image recognition, computer games, machine vision, credit card fraud detection, stock market analysis and product marketing applications. Machine learning implies that there is some improvement that results from the learning program having seen some data. The improvement can be in terms of some performance program (e.g., learning an expert system or improving the performance of a planning or scheduling program), in terms of finding an unknown relation in the data (e.g., data mining, pattern analysis), or in terms of customizing adaptive systems (e.g., adaptive user-interfaces or adaptive agents).

Yun Sing Koh's part of the paper will cover a number of techniques and algorithms commonly used in data mining and machine learning, beginning with topics such as simple unsupervised learning and ending up with more recent topics such as data stream mining. The objective is not only to present the modern machine learning methods but also to analyse and evaluate the basic intuitions behind the methods as well as, a more formal understanding of how and why they work.

In Pat Riddles part of the paper, we will study several techniques for learning such as Ensemble Learning and Neural Networks. In addition, we will provide an overview of the experimental methods necessary for understanding machine learning research.

In Ian Watons part of the paper, we will cover case-based reasoning, recommender systems, explainable artificial intelligence (XAI), and recent case-studies of applied ML (time permitting).

In Jörg Wicker's part of the paper, we will cover further recent research topics in machine learning and data mining. Specifically, we will address Multi-Label and Multi-Target Learning, Matrix Factorization, and Privacy.

2 Learning Outcomes

The students will be able to:

- Discuss the idea that all machine learning algorithms have a basis and will be able to describe the basis of several algorithms
- Discuss the theory that for a particular dataset one algorithm will perform well and for another dataset a different algorithm will perform well. There is no one algorithm that performs well on all datasets.
- Describe a machine learning algorithm as a search algorithm through a space of hypotheses.
- Design a good set of experiments for determining the answer do some basic research question, such that they can show that the experiments actually support the question they are asking.

3 Teaching staff

Jörg Wicker (Coordinator)

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Yun Sing Koh

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Pat Riddle

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Ian Watson

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4 Lecture Times

- Mon 1pm, Room 206-209
- Wed 2pm, Room 206-209
- Fri 2pm, Room 206-209

5 Assessments

Your final grade will consist of a number of internal marks worth 40% combined and an exam worth 60%. This is set up as a research based course. So the internal marks will be based on a research project, done in 3 member teams. There is a practical and a theoretical pass on this paper. So make sure you spend enough time on the internal assessments.

5.1 Internal Marks

You will have a research project, done in 3 member teams, with 6 due dates.

- Form a group 0% Due: Friday, July 20th
- Topic area agreement 0% Due: Monday August 6th
- Literature Survey 12% Due: Friday August 17th
- Proposal area agreement 0% Due: Friday August 24th
- Proposal 4% Due: Friday September 14th
- Final Report 24% Due: Friday October 19th

Two 0% agreements (topic and proposal are agreement) require you to get approval (in writing in email) from Jörg, Pat, Yun Sing, or Ian concerning your topic and proposal areas.

6 Proposed lecture schedules (subject to change)

- Week 1 Pattern Mining
- Week 2 Multi-Target / Label Learning / Recommender Systems
- Week 3 Recommender Systems / Ensembles
- Week 4 Neural Networks / Case-Based Reasoning
- Week 5 Case-Based Reasoning
- Week 6 Neural Networks / Deep Learning
- Week 7 Statistics / Deep Learning
- Week 8 Clustering / Streams
- Week 9 Streams / Multi-Target / Label Streams
- Week 10 Boolean Matrix Decomposition / Privacy
- Week 11 Peer Review
- Week 12 Project Interviews

7 Seeking assistance

The primary source of assistance is the teaching staff. Please contact Jörg, Pat, Yun Sing, or Ian with any questions or concerns about the course. Both are available via email.

For help with more generic study skills or literacy, the Student Learning Centre and Library both offer many courses designed to help students become more efficient at study.

7.1 Missed lectures

Slides and recommended reading will be provided for the lectures on the CS Department website. Please review the material prior to seeing the teaching staff.

7.2 Exam

The final exam is worth 60% of your final mark. Please check Student Services Online for the exam time and date. The exam is closed book, calculators are not permitted. Provisional exam results can be obtained from Student Services Online.

7.3 Missed exam

If you miss the exam for any valid reason, or you sit the exam but believe that your performance was impaired for some reason, then you may be able to apply for an aegrotat, compassionate or special pass consideration.

7.4 Policy on Cheating and Plagiarism

Cheating is viewed as a serious offence by the University of Auckland. Penalties are administered by the Discipline Committee of the Senate, and may include suspension or expulsion from the university. Do not copy anyone else's work, or allow anyone else to copy from you.

For more information on the University's policy on cheating, please refer to the web page: <http://www.auckland.ac.nz/uoa/home/about/teaching-learning/honesty>