

# COMPSCI 760: Machine Learning and Data Mining, Semester 1 2019

## 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).

In Pat Riddle's part of the paper, we will provide an overview of the learning problem and the view of learning as search. We will study several techniques for learning such as Ensemble Learning, Reinforcement Learning, and Neural Networks. In addition, we will provide an overview of the experimental methods necessary for understanding machine learning research.

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 Joerg 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, Recommender Systems and Matrix Factorization, Privacy, Online Learning, and Time Series.

In Ian Waton's 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).

## 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 to some basic research question, such that they can show that the experiments actually support the question they are asking.

## 3 Teaching staff

Pat Riddle (Coordinator)

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Yun Sing Koh

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Ian Watson

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Joerg Wicker

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Phone: 373-7599, Ext 82184 Email: [j.wicker@auckland.ac.nz](mailto:j.wicker@auckland.ac.nz)

## 4 Lecture Times

Mon 11am, Room 104-G54

Mon 1pm, Room 423-348

Tues 1pm, Room MLT3/303-101

## 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 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 4 member teams, with 5 due dates.

Topic area agreement 0% Due: Monday March 25th

Literature Survey 12% Due: Friday April 5th

Proposal area agreement 0% Due: Friday Apr 12<sup>th</sup>

Proposal 4% Due: Wednesday May 8<sup>th</sup>

Presentation 2%

Final Report 20% Due: Friday June 7st

The two 0% agreements require you to get approval (in writing in email) from Pat, Yun Sing, Joerg, or Ian concerning your topic and proposal areas.

There is also 2 individual assignments, worth 1% each.

Mock Exam 1% Due: Monday Apr 29th

Exam Peer Review 1% Due: Monday May 6th

## 6 Proposed lecture schedules (subject to change)

Week 1 Ensembles, Neural Networks

Week 2 Experimental Design,

Week 3 Reinforcement Learning  
Week 4 Pattern Mining  
Week 5 Clustering, Data Streams  
Week 6 Explainable Artificial Intelligence (XAI)  
Week 7 Recommender Systems  
Week 8 Case Based Reasoning  
Week 9 Multi-Label  
Week 10 Multi-Target, Adversarial  
Week 11 Privacy  
Week 12 Presentations

## 7 Seeking assistance

The primary source of assistance is the teaching staff. Please contact Pat, Joerg, 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

Overhead 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. If you know in advance that you will miss a lecture, please let the course coordinator know.

### 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. For more detailed information, refer to pages 44–45 of the University of Auckland's 2012 Calendar.

## 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/uaa/home/about/teaching-learning/honesty>