ACE Network Subject Information Guide

Optimisation for Deep Learning

Semester 2, 2021

Administration and contact details

Host department	School of Information Technology
Host institution	Deakin University
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Subject details

Handbook entry URL	N/A.
Subject homepage URL	http://www.mocao.org/odl/
Honours student hand-out URL	http://www.mocao.org/odl/
Start date:	August
End date:	October
Contact hours per week:	2 hours of lectures + 2hrs Consultation
Census date:	29 August
Lecture day(s) and time(s):	TBA.
Description of electronic access arrangements for students (for example, WebCT)	Zoom

Subject content

1. **Subject content description**

The aim of this unit is to introduce classical optimisation techniques that are essential for deep learning models. The structure includes lectures, tutorials and computer labs. The final assessment task is a (group) project.

2. Week-by-week topic overview

Weeks 1-3: Introduction to optimisation, machine learning and deep learning: general terminology and convention. Overview of optimisation problems appearing in deep learning.
Week 4: Linear optimisation and elements of linear integer optimisation.
Weeks 5-6: Convex optimisation.
Weeks 7-8: Non-convex optimisation.
Weeks 9-12: Guided study and project submission.

3. Assumed prerequisite knowledge and capabilities

Linear Algebra and Calculus (one semester each).

4. Learning outcomes and objectives

After taking this unit, the students will be able to:

- Formulate mathematical programming models for modern real-world applications of deep learning and data analysis given in a non-specialised description.
- Explain the difference between various optimisation problems
- Analyse optimisation problems and identify advantages and disadvantages of various formulations (approximate solutions.
- Apply cutting edge numerical tools to solve large scale optimisation problems and integrate them into machine learning software.

AQF specific Program Learning Outcomes and Learning Outcome Descriptors (if available):

AQF Program Learning Outcomes addressed in this subject	Associated AQF Learning Outcome Descriptors for this subject
Formulate mathematical programming models for modern real-world applications	K1,S3,S4,A1
Analyse optimisation problems	K1,K2,S1-S5,A1
Apply cutting edge numerical tools to solve large scale optimisation problems and	K1,K2,S1-S3,A1

integrate them into machine learning software	

Learning Outcome Descriptors at AQF Level 8

Knowledge

K1: coherent and advanced knowledge of the underlying principles and concepts in one or more disciplines

K2: knowledge of research principles and methods

Skills

S1: cognitive skills to review, analyse, consolidate and synthesise knowledge to identify and provide solutions to complex problem with intellectual independence

S2: cognitive and technical skills to demonstrate a broad understanding of a body of knowledge and theoretical concepts with advanced understanding in some areas

S3: cognitive skills to exercise critical thinking and judgement in developing new understanding

S4: technical skills to design and use in a research project

S5: communication skills to present clear and coherent exposition of knowledge and ideas to a variety of audiences

Application of Knowledge and Skills

A1: with initiative and judgement in professional practice and/or scholarship

A2: to adapt knowledge and skills in diverse contexts

A3: with responsibility and accountability for own learning and practice and in collaboration with others within broad parameters

A4: to plan and execute project work and/or a piece of research and scholarship with some independence

5. Learning resources

Consult http://www.mocao.org/odl/ for lecture notes, recommended software and other resources.

6. Assessment

Exam/assignment/classwork breakdown					
Final Project	**60%**	**Assignment**	20 %	**Class work**	20 %
Assignment due dates		A1: September 2021	A2: October 2021	Click here to enter a date.	Click here to enter a date.
Approximate Project due date				October/November 2021	

Institution honours program details

Weight of subject in total honours assessment at host department	12.5%.
Thesis/subject split at host department	Thesis 62.5%, courses 37.5%
Honours grade ranges at host department	
H1	80-100 %

H2a	70-79 %
H2b	60-69 %
H3	50-59 %

Institution masters program details

Weight of subject in total masters assessment at host department	N/A.
Thesis/subject split at host department	100%
Masters grade ranges at host department	
H1	80-100 %
H2a	70-80 %
H2b	60-70 %
H3	50-60 %