Deep Learning - COSC2779/2972

Introduction to Deep Learning

Dr. Ruwan Tennakoon

RMIT UNIVERSITY

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Outline

Dr Ruwan Tennakoon (Senior Lecturer - Artificial Intelligence)

Ruwans research interests:

- Computer Vision & Machine Learning
- Medical Image Analysis
- Statistical Signal Processing

If you are interested in my research: HomePage

Official consultation hours: Tuesday's 11:30 am - 12.30pm (Building 14 level 11 room 3 - online on request).

Pubudu Sanjeewani (Tutor/Lab Demonstrator)

Pubudu's research interests:

- Computer Vision & Machine Learning
- Currently a Machine Learning Engineer at Smart AI Connect.

Objectives of Our Course

Learn about Deep learning (DL) conceptually and practically.

- Different problem types of DL and sample of approaches.
- Learn about the typical process of developing deep Neural Networks.
- Apply these to solving real world prediction and exploratory tasks.

Focus on:

- *Analysis* of what the algorithms are doing.
- *Analysis* of the data set and results
- Learning an initial set of tools, the *key DL techniques*.
- *Terminology and concepts* so can learn other DL approaches not covered in course.

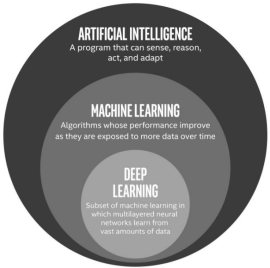
The complete set of learning objectives are in the Course guide

Official Prerequisite:

- (Computational) Machine Learning - COSC2793/2673

Desirable:

- Knowledge of Python
- Calculus (gradients)
- Linear Algebra
- Optimisation
- Probability and Statistics
- Algorithms



Machine Learning: Statistics, Algorithm & complexity theory, Optimization.

See Canvas Week 1 Optional readings for some reversion materials.

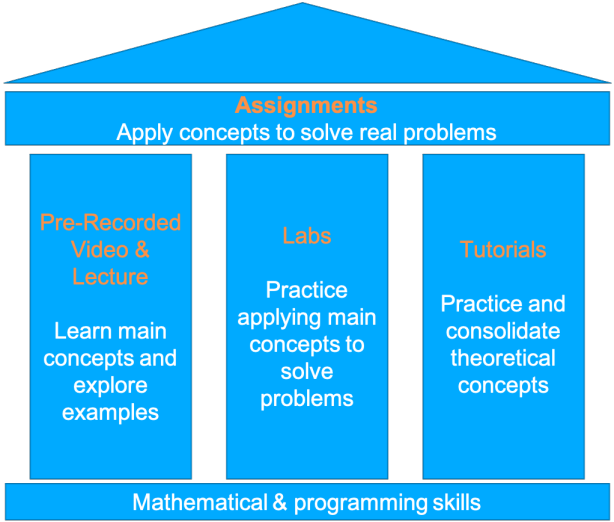
Course Structure

Week 1	Introduction Deep Learning	
Week 2	Deep Feed Forward Networks	Basics
Week 3	Neural Network Optimization	
Week 4	Convolutional Neural Networks	
Week 5	Vision Application & CNN Architectures	CNN
Week 6	Practical methodology/Hyper parameter tuning	
Week 7	Modelling Sequential (Time Series) Data	
Week 8	Time Series Applications	Time Series
Week 9	Unsupervised Learning/Generative Models	
Week 10	Representation Learning/Self Supervised Learning	Advanced Topics
Week 11	Neural Network Model Interpretation/Explainable AI (XAI)	
Week 12	Review	

Course Information

- **Delivery mode:** On-campus)
- **Classroom and Hours:**
  - Pre-Recorded Content: Recording will get you ready for the lectorial.
  - Lectures (Lectorial): Monday 2:30 – 4:30pm. Will also contain information that is not covered in the pre-recorded videos.
  - Lab/Tute: Tuesday/Wednesday (On-Campus)
- **Canvas:** Everything (slides/homeworks/projects/discussion board etc.)

Course Structure



Online Delivery

- **Lectures:**
  - Each week a set of pre-recorded videos will be a available prior to the lecture (Monday). Please make sure that you go through them before joining the lecture.
  - There will be a Lectorial session during the timetable slot.
  - Lectorial will cover summary of pre-recorded videos, **additional materiel**, examples and Q&A.
- **Lab/Tutorials:** On-Campus
  - Each week lab exercises and tutorial questions will be made available prior to class. Please make sure that you go through them before joining and be prepared to discuss the ideas.
  - *Labs will be a good place to ask questions on assignments.*
- **Self Study** You are also expected to spend a significant amount of time in private study, working through the course as presented in classes and learning materials and gaining practice at solving conceptual and technical problems.
- **Office hours (consultation):** See canvas for details.

Course Workload and Assignments

Workload (every week): $>$ 10**hrs:**

- Four Contact hours: Lecture 2hrs, Lab/Tutorial 2hr
- At least six Self study hours (include pre recorded videos)

Assignments:

- Introduction to DL (30%) - Due Friday Week 6
- DL Project (50%) - Due Friday Week 11
- Virtual Presentation & Interview (20%) Will be scheduled in week 14.

Late penalty for assignments

- Standard CS, -10% each day.
- Set last day for submission.
- Special Consideration may result in equivalent assessment, **not extensions**.

Text and Reference Books

Primary reference:

- Ian Goodfellow, Yoshua Bengio, Aaron Courville, *Deep Learning*, MIT Press, 2016, http://www.deeplearningbook.org.

Other references:

- TensorFlow Tutorials
- Oswald Campesato, *TensorFlow 2.0 pocket primer*, 2020. Library Link.
- Tom Mitchell, *Machine Learning*, McGraw Hill, 1997.
- Neural Networks and Deep Learning by Michael Nielsen Link

Additional Reading material (references) specific to each week will be made available via the relevant canvas module.

Expectations

Us → You

- This is an elective (for most of you). Hence we do expect you to work hard and be highly motivated.
- Please attend classes.
- Interact while in class! Be curious, ask questions.
- We try to be fair as possible and allow you opportunities to ask us about assessment marks, but please do not haggle about them.
- Please don't cheat!

You → Us

- We will strive to be prompt in replying to your requests.
- We provide support and help for you to achieve the best learning outcomes as you can.

Us → You

- Announcements are made regularly on Canvas.
- Emails will be sent out on a need basis.
- Lecture announcements.

You → Us

- Consultation hours, email, before/after class, during labs.
- Official consultation hours: see canvas.

Many → Many

- Discussion Board on Canvas. Please don't hesitate to reply to queries on discussion boards.

The programming language used for the course will be **Python**. Deep learning models will be implemented with **Tensorflow 2.0 + Keras**.

Infrastructure:

- Google Colab

More details on the above platforms and information to get started is provided in week 1 lab exercises (self-study).
Tensorflow tutorials https://www.tensorflow.org/tutorials

Academic Integrity

- Please see:
  https://www.rmit.edu.au/students/student-essentials/rights-and-responsibilities/academic-integrity
- You are encouraged to form groups to solve problems; however, *when writing or programming, write in your own words or code, and provide your own solutions.*
- This is not about penalising or yielding the stick, but you've made a conscious act to enroll in this course (thank-you), and we want you to:
  - Learn by trying things, making mistakes
  - Fair for everyone
  - Quality control of your degree