

Introduction to Machine Learning and Deep Learning, 2021

「咱們時候大為充裕，須得從頭學起，紮好根基。」於是將獨孤九劍第一劍的「總訣式」依著口訣次序，一句句的解釋，再傳以種種附於口訣的變化。

令狐冲先前硬記口訣，全然未能明白其中含意，這時得風清揚從容指點，每一刻都領悟到若干上乘武學的道理，每一刻都學到幾項奇巧奧妙的變化，不由得歡喜讚嘆，情難自己。

摘錄自：金庸，笑傲江湖，傳劍。

This is an introductory course to machine learning and deep learning (short for ML) offered by the Department of Civil Engineering, National Taiwan University. Artificial intelligence, in particular the ML subfield, is now ubiquitous. Using data as its core, the rapid surge and democratization on ML accelerates innovation in many domains. It is thus essential for students with engineering background to acquire basic understanding and ability on the subject.

This course is designed to help you to view problems and applications from a ML perspective and to understand principles of ML. There is a fundamental structure to ML thinking and basic principles that should be understood. There are also particular areas where intuition, creativity, common sense, and domain knowledge must be brought to bear. A ML perspective aims to provide students with structure and principles, and this will give you a framework to systematically analyze problems and to develop applications in various domains.

Course Objective

The objective of this course is to provide you with fundamental understanding of ML and with ability to apply ML theories and techniques. To comprehend the contents, you will need working knowledge on elementary Engineering Mathematics. *

This course will also emphasize on hand-on experience of doing ML via Python. You need to be familiar with the basic of Python and are willing to learn more. You are advised to take at least one solid introductory course on Python (for example, my freshman Python course) before taking this course. We will provide a self-evaluation to help you examine your ability and readiness. *

After taking this course, you should be able to: (1) approach problems and applications with ML in mind, (2) understand fundamental principles of ML and (3) use Python to process data and do ML.

Teaching and Learning Rationale

Three-hour weekly lectures will be given to facilitate your learning of basic theory and

formulation for ML. In-class videos will be released to facilitate your understanding.

Homework assignments will be given in a regular basis to deepen your understanding. Project competition on Kaggle will be conducted to facilitate your skills on ML.

Hours

Lecture: 0910 – 1210, Wednesday

- Given the current pandemic situation, our course will be taken place online. Please use the link below for the course:

<https://us02web.zoom.us/j/81807420957> 8:50

- If the pandemic situation improves later in the semester, we will move to 博雅 102.

* TA Office Hours: **1200** – 1400, Tuesday or By Appointment (黃政維)

前兩週線上 (<https://discord.gg/TxKwy9EamQ>), 後續於土研大樓 612 或依照疫情動態調整

Instructor and Teaching Assistants (TAs)

Instructor

Prof. Chuin-Shan David Chen (陳俊杉)

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FaceBook: 陳俊杉 <https://www.facebook.com/profile.php?id=1758067291>

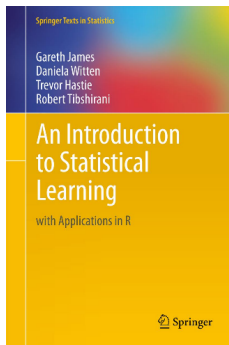
TAs: 黃政維 (Harry Huang)	harry@caece.net	611, CE Research Building
張鈞程	ccc14023748@caece.net	611, CE Research Building
簡子堯	kylechien0@gmail.com	610, CE Research Building
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Textbook

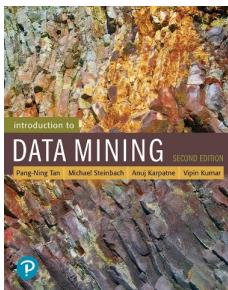
No required textbook. Course materials can be accessed from the NTU COOL system <https://cool.ntu.edu.tw/>.

References

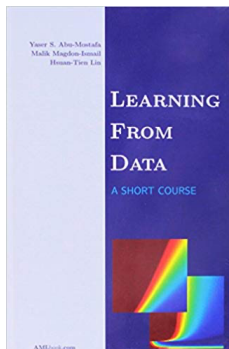
1. James, G., Witten, D., Hastie, T., Tibshirani, R. (2013), *An Introduction to Statistical Learning*. (e-access available from NTU subscription)



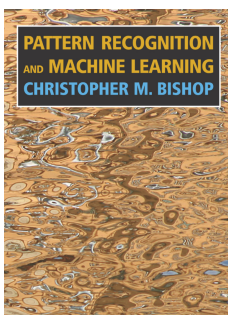
2. Tan, P. N., Steinbach M., Karpatne A., Kumar V. (2018), *Introduction to Data Mining*, Second Edition.



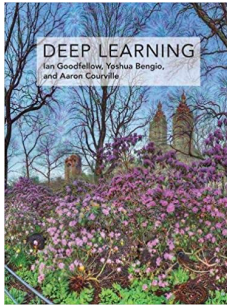
3. Abu-Mostafa, Y S, Magdon-Ismail, M., Lin, H-T (2012) *Learning from Data*, AMLbook.com.



4. Bishop, C (2006) *Pattern Recognition and Machine Learning*, Springer (e-access available from NTU subscription)



- Goodfellow, I., Bengio, Y., Courville, A., Bach, F. (2016) *Deep Learning*, MIT Press (e-access available from <https://www.deeplearningbook.org/>)

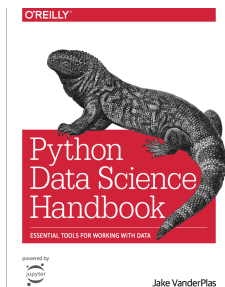


Python Programming

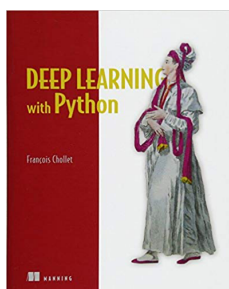
- Jake VanderPlas (2016), *A Whirlwind Tour of Python*, O'Reilly (freely available from <http://www.oreilly.com/programming/free/files/a-whirlwind-tour-of-python.pdf>)



- Jake VanderPlas (2016), *Python Data Science Handbook*, O'Reilly. (online version freely available from <https://jakevdp.github.io/PythonDataScienceHandbook>)



- Francois Chollet (2016), *Deep Learning with Python*, Manning Publications. (Second Edition is underway)



Course Website

本課程網站使用 NTU COOL 作為主要平台，請同學登入該平台方可使用繳交作業功能，課程講義與錄影也都會放在課程網站。NTU COOL 網址：<https://cool.ntu.edu.tw/>，若有想要旁聽的學生，請寄信給助教，助教會協助你加入本課程。

Course Facebook

修課與旁聽的同學請務必加入課程臉書，我們重要的公告、通知與討論都會在課程臉書進行 <https://www.facebook.com/groups/224199324773787/>。



Grading

30%	Homework ✓	$\frac{300}{250}$	$\frac{100}{30}$	$\frac{280}{300} \times 30\%$
✓ 30%	Midterm Project Competition	$\frac{\min(400, 300)}{300} \times 30\%$		
✓ 40%	Final Project Competition			

Handwritten notes: 同儕 2-3人, 4人

關於作業

作業繳交期限以實際公布日期為主。作業鼓勵與同學、助教、授課老師討論，方法、思考邏輯、相關程式技巧可多多討論，但不准直接拿別人的作業參考、抄襲或拷貝，一旦發現，抄襲與被抄襲者該次作業皆以零分計算。

關於競賽

競賽細節會於課堂說明，將在 Kaggle.com 進行。

關於寫程式

Discuss as much as you want but **DON'T SHARE CODES**.

Honor Code

We expect any work you submit **MUST** be your own work. When you get stuck at some points, it is perfectly normal. **DO ask me or TAs for help.**

- **DO NOT** consult any work from others.
- **DO NOT** consult any work from the past. You **MUST** do your own work.
- NTU policies on cheating will be enforced so **DO NOT** make the bad decision.

Course Schedule

(for reference only; you should consult the course website for update)

Week	Date	Content	Remark
1	09/22	Course Introduction Fundamentals and Landscape of Classical Machine Learning (I)	Python 自我測試
2	09/29	Fundamentals and Landscape of Classical Machine Learning (II)	HW1
3	10/06	Fundamentals and Landscape of Classical Machine Learning (III)	
4	10/13	Classification (I)	HW2
5	10/20	Classification (II)	
6	10/27	Classification (III) <u>期中競賽說明</u>	HW3
7	11/03	Classification (IV) Regression (I)	
8	11/10	Regression (II)	HW4
9	11/17	<u>期中競賽前三名分享</u> Fundamentals of Deep Learning (I)	
10	11/24	Fundamentals of Deep Learning (II)	HW5
11	12/01	Fundamentals of Deep Learning (III)	
12	12/08	Deep Learning for Computer Vision (I) <u>期末競賽說明</u>	HW6
13	12/15	Deep Learning for Computer Vision (II)	
14	12/22	Deep Learning for Computer Vision (III)	HW7
15	12/29	Deep Learning for Computer Vision (IV)	
16	01/05	<u>期末競賽前五名分享</u>	
17	01/12	AI Frontier and Happy Hours (Optional, By Registration)	