國立東華大學

教學計劃表 Syllabus

課程名稱(中文) Course Name in Chinese	統計機器學習			學年/學期 Academic Year/Semester	112/2
課程名稱(英文) Course Name in English	Statistical Machine Learning				
科目代碼 Course Code	AM__75150	系級 Department & Year	博士	開課單位 Course-Offering Department	應用數學系
修別 Type	選修 Elective	學分數/時間 Credit(s)/Hour(s)	3.0/3.0		
授課教師 Instructor	/曹振海				
先修課程 Prerequisite					

課程描述 Course Description

Statistical machine learning is one of the emerging unifying themes arising from statistics, information science. It is both theoretical intriguing and of important for practical applications. This course will provide a general overview of this exciting new branch of research. Using the textbook as our guideline along with hand-on computing exercises, we aim to pave a good ground for further application and theoretical exploration. Because most of the research results are relatively new and fast developing, we will familiar the students with the resources and portals such as related websites and literature databases.

Some possible topics/problems for group projects will be announced early in the class. These projects will be integrated with lectures, data analysis, class discussion and presentation. The statistical freeware R will be used for data analysis.

課程目標 Course Objectives

Statistical machine learning is one of the emerging unifying themes arising from statistics, information science. It is important in both theory and practice. This course will provide a general overview of this exciting new branch of research. Using the textbook as our guideline along with hand-on computing exercises, we aim to pave a good ground for further application and theoretical exploration. Because most of the research results are relatively new and fast developing, we will familiar the students with the resources and portals such as related websites, literature databases and benchmark data sites.

	系專業能力 Basic Learning Outcomes	課程目標與系專業能力相關性 Correlation between Course Objectives and Dept.'s Education Objectives
A	具備專業知識及邏輯推理能力。Have well-founded expertise and be capable of logical reasoning.	●
B	具備學習其它學科的能力，以期能邁向跨領域研究。 Be able to study other fields of science so as to conduct interdisciplinary research in the future.	●
C	具備獨立思考與解決問題的能力。 Be capable of independent thinking and have the problem-solving skills.	○

圖示說明Illustration ：● 高度相關 Highly correlated ○中度相關 Moderately correlated

授 課 進 度 表 Teaching Schedule & Content

週次Week	內容 Subject/Topics	備註Remarks
1	Motivation	

2	Overview I: Problem formulation	
3	Overview II: Methods (heuristics and implementation), criterion and concerns	
4	Linear Methods for Regression I : Old tools for new tasks	
5	Linear Methods for Regression II : good and bad, modification and computation	
6	Linear Methods for Classification I: Fisher Discriminant Analysis	
7	Linear Methods for Classification II: Logistic regression, separating hyperplanes	
8	Presentation I	
9	期中考試週 Midterm Exam/ Presentation I	
10	Recap and rethink: 1. Model-based methods vs "Non-model"-based methods 2. Optimization + Regularization	
11	Additive Models, Trees and Related Methods I: Overview, concept and theory	
12	Additive Models, Trees and Related Methods II: Trees vs. Classification and Regression Trees	
13	Boosting and Additive Trees: Concept and Theory	
14	Boosting and Additive Implementation	
15	Ensemble learning methods	
16	Recap and rethink: Regularization and shrinkage	
17	Presentation and Summary	
18	期末考試週 Final Exam/ Presentation and Summary	

教 學 策 略 Teaching Strategies

☑ 課堂講授 Lecture ☑ 分組討論Group Discussion ☐ 參觀實習 Field Trip

☐ 其他Miscellaneous:

教 學 創 新 自 評 Teaching Self-Evaluation

創新教學(Innovative Teaching)

☐ 問題導向學習(PBL) ☑ 團體合作學習(TBL) ☑ 解決導向學習(SBL)

☐ 翻轉教室 Flipped Classroom ☐ 磨課師 Moocs

社會責任(Social Responsibility)

☑ 在地實踐Community Practice ☐ 產學合作 Industy-Academia Cooperation

跨域合作(Transdisciplinary Projects)

☑ 跨界教學Transdisciplinary Teaching ☐ 跨院系教學Inter-collegiate Teaching

☐ 業師合授 Courses Co-taught with Industry Practitioners

其它 other: Gamification

學期成績計算及多元評量方式 Grading & Assessments									
配分項目 Items	配分比例 Percentage	多元評量方式 Assessments							
		測驗會考	實作觀察	口頭發表	專題研究	創作展演	卷宗評量	證照檢定	其他
平時成績(含出缺席) General Performance (Attendance Record)	30%			✓	✓				Project and presentation
期中考成績 Midterm Exam	20%								
期末考成績 Final Exam	35%								
作業成績 Homework and/or Assignments	15%								
其他 Miscellaneous (_____)									

評量方式補充說明
Grading & Assessments Supplemental instructions

將編成若干小組，並針對如 Kaggle 等資料分析競賽網站之資料進行分析報告。

教科書與參考書目（書名、作者、書局、代理商、說明）
Textbook & Other References (Title, Author, Publisher, Agents, Remarks, etc.)

Textbook: Hastie, Tibshirani and Friedman (2009). The Elements of Statistical Learning: Data Mining, Inference and Prediction. 2 Edition. Springer-Verlag.
http://statweb.stanford.edu/~tibs/ElemStatLearn/

References
1. Kutner, M.H., Nachtsheim, C.J., Neter, J. and Li, W. (2005). Applied Linear Statistical Models, 5th edition. McGraw-Hill.
2. Sen, A. and Srivastava, M. (1990). Regression Analysis: Theory, methods and applications. Springer.
3. Lehmann, E.L. (1986). Testing Statistical Hypotheses. 2 edition. Wiley.
4. Scheffe, H. (1959). The Analysis of Variance. Wiley.
5. R website: http://www.r-proje ct.org/

課程教材網址(含線上教學資訊,教師個人網址請列位於本校內之網址)
Teaching Aids & Teacher's Website(Including online teaching information. Personal website can be listed here.)

https://chtsao.gitlab.io/sml24/

其他補充說明 (Supplemental instructions)