

Academic Org: Dept of Computer Sci & Engg – Subject: Computer Science

**Course:** CSCI3320      **Course ID:** 010174      **Eff Date:** 2022-07-01      **Crse Status:** Active      **Apprv. Status:** Approved      **【Course Rev】**  
Fundamentals of Machine Learning 機器學習之基礎課程

The first part introduces basic methods, including minimum error versus maximum likelihood, parametric versus nonparametric estimation, linear regression, factor analysis, Fisher analysis, singular value decomposition, clustering analysis, Gaussian Mixture, EM algorithm, spectral clustering, nonnegative matrix factorization. The second part provides an introduction on small sample size learning, consisting of model selection criteria, RPCL learning, automatic model selection during learning, regularization and sparse learning.

第一部分介紹基本方法，包括最小誤差與最大似然、參數與非參數估計、線性回歸分析、因數分析、費歇判別分析、奇異值分解、聚類分析、高斯混合、EM 演算法、譜聚類、非負矩陣分解。第二部分簡介有限樣本學習，包括模型選擇準則、RPCL 學習、學習過程中自動模型選擇、規則化與稀疏學習。

**Grade Descriptor:**

A

EXCELLENT – exceptionally good performance and far exceeding expectation in all or most of the course learning outcomes; demonstration of superior understanding of the subject matter, the ability to analyze problems and apply extensive knowledge, and skillful use of concepts and materials to derive proper solutions.

有關等級說明的資料，請參閱英文版本。

B

GOOD – good performance in all course learning outcomes and exceeding expectation in some of them; demonstration of good understanding of the subject matter and the ability to use proper concepts and materials to solve most of the problems encountered.

有關等級說明的資料，請參閱英文版本。

C

FAIR – adequate performance and meeting expectation in all course learning outcomes; demonstration of adequate understanding of the subject matter and the ability to solve simple problems.

有關等級說明的資料，請參閱英文版本。

D

MARGINAL – performance barely meets the expectation in the essential course learning outcomes; demonstration of partial understanding of the subject matter and the ability to solve simple problems.

有關等級說明的資料，請參閱英文版本。

F

FAILURE – performance does not meet the expectation in the essential course learning outcomes; demonstration of serious deficiencies and the need to retake the course.

有關等級說明的資料，請參閱英文版本。

**Equivalent Offering:**

**Units:** 3 (Min) / 3 (Max) / 3 (Acad Progress)

**Grading Basis:** Graded

**Repeat for Credit:** N

**Multiple Enroll:** N

**Course Attributes:**

**Topics:**

## COURSE OUTCOMES

**Learning Outcomes:**

1. understand basic concepts of statistical learning;
2. develop analytical skills on typical linear model based supervised and unsupervised learning;
3. develop analytical skills on typical approaches for clustering analysis;
4. become knowledgeable on fundamentals on a small sample size learning.

**Course Syllabus:**

The first part introduces basic methods, including minimum error versus maximum likelihood, parametric versus nonparametric estimation, linear regression, factor analysis, Fisher analysis, singular value decomposition, clustering analysis, Gaussian Mixture, EM algorithm, spectral clustering, nonnegative matrix factorization. The second part provides an introduction on small sample size learning, consisting of model selection criteria, RPCL learning, automatic model selection during learning, regularization and sparse learning.

**Assessment Type:** Others : 35%

Short answer test or exam : 55%  
Selected response test or exam : 10%

**Feedback for Evaluation:**

1. Mid-term course evaluation
2. Term-end course evaluation
3. Students' performance in their homework, the midterm exam and final exam

**Required Readings:**

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**Recommended Readings:**

1. Mitchell, T. (1997). Machine Learning, McGraw Hill. ISBN 0-07-042807-7
2. Richard O. Duda, Peter E. Hart, David G. Stork (2001) Pattern classification (2nd edition), Wiley, New York, ISBN 0-471-05669-3
3. Trevor Hastie, Robert Tibshirani and Jerome Friedman (2001). The Elements of Statistical Learning, Springer. ISBN 0-387-95284-5

**OFFERINGS**

1. CSCI3320 Acad Organization=CSD; Acad Career=UG

**COMPONENTS**

LEC : Size=30; Final Exam=Y; Contact=3  
TUT : Size=30; Final Exam=N; Contact=1

**ENROLLMENT REQUIREMENTS**

1. CSCI3320 **Enrollment Requirement Group:**  
Prerequisite: ENGG2430 or 2450 or 2760 or 2780 or ESTR2002 or 2005 or 2018 or 2020 or 2308 or 2362 or IERG2470 or MIEG2440 or STAT2001.

**New Enrollment Requirement(s):**  
Pre-requisite = no change

**CAF**

eLearning hrs for blended cls 0  
No. of micro-modules 0  
Research components (UG) 1% - 49%

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