This course first introduces fundamentals of machine learning with a large size of samples, including basic principles (maximum likelihood vs least redundancy) and typical structures (linear systems of hidden factors, mixture of local structures, and Markov temporal models). The second part of the course covers learning theories towards small sample size challenge, including major topics (model selection, learning regularization, two stage implementation, sparse learning, and automatic model selection) and three streams of efforts, namely generalization error estimation (CV, AIC, VC theory), shortest coding length (MML vs MDL) or similarly various Bayes (BIC, MAP, Laplace, marginal, and variational), and BYY learning (BYY system, best harmony theory, Ying-Yang alternation updating, and five action circling implementation).

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.

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.

C

有關等級說明的資料，請參閱英文版本。
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.

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.

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.

EquivalentOffering:
Units: 3 (Min) / 3 (Max) / 3 (Acad Progress)
Grading Basis: Graded
Repeat for Credit: N
Multiple Enroll: N
CourseAttributes: MSc Computer Science
MPhil-PhD Computer Sci & Erg

Topics:

COURSE OUTCOMES
Learning Outcomes:

Students will be able to understand fundamental concepts and develop critical thinking on:
1. ingredients, challenges, basic principles and a unified perspective of machine learning;
2. fundamentals of machine learning with a large size of samples;
3. efforts on learning theories and methods towards small sample size challenge;
4. a unified statistical learning framework: BYY learning and best harmony theory.

Course Syllabus:

This course first introduces fundamentals of machine learning with a large size of samples, including basic principles (maximum likelihood vs least redundancy) and typical structures (linear systems of hidden factors, mixture of local structures, and Markov temporal models). The second part of the course covers learning theories towards small sample size challenge, including major topics (model selection, learning regularization, two stage implementation, sparse learning, and automatic model selection) and three streams of efforts, namely generalization error estimation (CV, AIC, VC theory), shortest coding length (MML vs MDL) or similarly various Bays (BIC, MAP, Laplace, marginal, and variational), and BYY learning (BYY system, best harmony theory, Ying-Yang alternation updating, and five action circling implementation).

Assessment Type:

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<td>Short answer test or exam</td>
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<tr>
<td>Selected response test or exam</td>
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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:

To be provided by course teacher.

Recommended Readings:

- Emerging themes on information theory and Bayesian approach, Xu, L, Li, Y D. eds, special issue, Frontiers of Electrical and Electronic Engineering in China, 2010, 5(3).
1. **CSCI5030**

   Acad Organization=CSEGV; Acad Career=RPG

**COMPONENTS**

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<tr>
<th>Component</th>
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**ENROLMENT REQUIREMENTS**

1. **CSCI5030**

   **Enrollment Requirement Group:**
   - For students in MSc Computer Science; or
   - For students in MPhil-PhD Computer Science & Engineering; or
   - For undergraduate students in Computer Science (CSCIU & CSCIN) or Computer Engineering (CENGU & CENGN)

CAF

<END OF REPORT>