UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Probabilistic Models for Decision Making

2425-1-F1801Q127

Aims

The course will provide the main concepts and operative tools, based on computational methods, for representing the learning process and the reasoning techniques in uncertain domains. Students will gain the ability of using the concepts and methods learned for solving practical operational decision problems. In particular, they will acquire the following abilities: to identify relations between parameters by using probabilistic models, to build models for decision making, to evaluate and find the problem solutions.

Contents

Representing uncertainty in decision problems

Knowledge representation in uncertain domains

Bayesian Networks

Pseudo-number generation for sampling

Inference on BN

Probabilistic Reasoning over time

Markov Chains

Hidden Markov Models

Inference in dynamic models

Detailed program

1. "Representing uncertainty in decision problems Basic notions of probability theory Bayes rule and its application". Chapter 13.

   2.1 "Knowledge representation in an uncertain domain Bayesian network semantics; Efficient representation of conditional probabilities". Chapter 14 (14.1, 14.2, 14.3).

   2.2 D-separation (papers & slides)

   2.3 Pseudo-number generation for sampling (papers & slides)

   3. "Exact and approximate inference in Bayesian Networks". Chapter 14 (14.4, 14.5)

   4. "Markov Chains" (papers & slides)

   5. Hidden Markov Models; Forecasting, Filtering and Smoothing ". Chapter 15 (15.1, 15.2 15.3).

Prerequisites

Basic notions of: probability, statistics, linear algebra

The course is in Italian.

Teaching form

Lectures, classroom exercises, lab exercises

- 32 lectures of theory of 2 hours each in presence of erogative nature
- 20 excercise lectures of 2 hours each (of which a maximum of 3 hours of interactive lectures in presence and a maximum of 3 hours of interactive lectures on line)

Textbook and teaching resource

S. Russel, P. Norvig. “Artificial Intelligence: A Modern Approach", Prentice Hall, III Edizione

papers & slides

Semester

Second Semester

Assessment method

Written Exam + oral (optional)

There are 2 optional ongoing tests:

- first partial test, during which the skills acquired will be evaluated in relation to:

- Representing uncertainty in decision problems
- Knowledge representation in uncertain domains
- Bayesian Networks
- Pseudo-number generation for sampling
- Inference on BN

- second partial test, during which the skills acquired will be assessed in relation to:

- Probabilistic Reasoning over time
- Markov Chains
- Hidden Markov Models
- Inference in dynamic models

Office hours

By appointment

Sustainable Development Goals