Course guide
270724 - SEL - Supervised and Experiential Learning

Last modified: 04/02/2025

Unit in charge: Barcelona School of Informatics
Teaching unit: 723 - CS - Department of Computer Science.

Degree: **Academic year:** 2024 **ECTS Credits:** 4.5
Languages: English

LECTURER

Coordinating lecturer: MIQUEL SANCHEZ MARRE

Others:

TEACHING METHODOLOGY

The teaching methodology will include both theoretical lecture sessions, sessions with practical examples of the concepts and algorithms explained in the course, and also some sessions devoted to support the practical work of the students.

LEARNING OBJECTIVES OF THE SUBJECT

STUDY LOAD

Type	Hours	Percentage
Hours large group	45,0	100.00

Total learning time: 45 h

CONTENTS

Machine Learning: Supervised and Unsupervised ML techniques

Description:
Basic principles and classification of Machine Learning techniques

Important Challenges in Supervised Learning

Description:
Quantity of data
Quality of data: representativity, imbalanced class distribution
Overfitting & Underfitting of models
Bias & Variance of models
Feature relevance
i. Reminder: Feature Selection vs Feature Weighting, Filters and wrappers
ii. Feature weighting techniques

Supervised Learning techniques

Description:
Rule-based Classifiers
i. Decision Tree Classifiers (ID3, C4.5, CART). Pruning techniques
ii. Classification Rules Classifiers (PRISM, RULES, CN2, RISE)
Probabilistic/Bayesian Classifiers
i. Bayes Optimal Classifier
ii. Gibbs algorithm
iii. Naïve Bayes Classifier
Linear Predictors
i. Linear Regression / Multiple Linear Regression
Statistical Classifiers
i. Linear Discriminant Analysis (LDA)
ii. Logistic/Multinomial Regression

Diversification / Ensemble of classifiers

Description:
a. Reminder: General scheme
b. Random Forests

Evaluation Techniques

Description:
a. Classification models
b. Regression models

Advanced Classification Challenges

Description:
a. Multi-label classification
b. Ordinal classification
c. Imbalanced Dataset classification
d. Using noise and diversification for improving classification
e. Meta-Learning of classifiers
f. Incremental Learning: Data stream/on-line learnin

Experiential Learning

Description:
Case-Based Reasoning
1. Reminder: Fundamentals of Case-based Reasoning
a. Cognitive Theories
b. Basic Cycle of Reasoning

CBR Academic Demonstrators/Examples

Description:
Some examples will be anañysed.

CBR System Components

Description:
a. Case Structure
b. Case Library Structure
c. Retrieval
d. Adaptation (Reuse)
e. Evaluation (Repair)
f. Learning (Retain)

CBR Application on a real domain

Description:
A real application will be described and analysed.

CBR Development Problems

Description:
a. Competence
b. Space Performance
c. Time Performance

Reflective Reasoning in CBR

Description:
a. Case Base Maintenance

CBR Applications and Development Tools [2h]

Description:
a. Industrial Applications
b. Software Tools

CBR Systems' Evaluation

Description:
How to evalaute CBR systems will be analysed.

Advanced Research Issues in CBR

Description:
a. Temporal CBR
b. Spatial CBR
c. Hybrid CBR Systems
d. Recommender Systems: CBR as a recommendation tool

GRADING SYSTEM

Evaluation of the knowledge and skills obtained by the students will be assessed through three project works. The first two works (PW1 and PW2) will be on an individual basis and the third one (PW3) will be on a team group basis.

The individual works will consist on the implementation, application and evaluation of some supervised machine learning algorithms. The teamgroup work will consist on the design, implementation, application and validation of a Case-Based Reasoning project to solve a synthesis problem.

The final grade will be computed as follows:

FinalGrade= 0.25 * PW1Gr + 0.25 * PW2Gr + 0.5 * PW3Gr * WFstud, where $0 \leq WFstud \leq 1.2$

WFstud is a Working Factor evaluating the work of a particular student within his/her teamwork in PW3. It will be obtained by observing and assessing the load of work and degree of participation of each student throughout the PW3. In normal conditions, the WFstud = 1.

The individual works (PW1 and PW2) will be evaluated according to the quality of the software developed (0.6), the evaluation done (0.2) and the documentation delivered (0.2).

The PW3Gr will be computed as follows:

PW3Gr = 0.5 * TeachAss + 0.5 * SelfAss

where TeachAss is the teacher assessment of the teamwork evaluated according to:

- The methodology of the work (0.5)
- The quality of the report written (0.2)
- The quality of the oral exposition (both presentation and content assessed, as well as the ability to answer questions) (0.2)
- Planning, coordination and management of the team (0.1)

and SelfAss is the individual assessment of each student by all the members of his/her team.

BIBLIOGRAPHY

Basic:

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- Murphy, K.P. Machine learning: a probabilistic perspective. Cambridge, Mass.: MIT Press, 2012. ISBN 9780262018029.
- Alpaydin, E. Introduction to machine learning. 4th ed. Cambridge, Massachusetts ; London: The MIT Press, 2020. ISBN 9780262043793.
- Hastie, T.; Tibshirani, R.; Friedman, J. The elements of statistical learning: data mining, inference, and prediction. 2nd ed. New York, NY: Springer, 2009. ISBN 9780387848570.
- Schank, R.C. Dynamic memory revisited. Cambridge: Cambridge University Press, 1999. ISBN 0521633982.
- Richter, M.M.; Weber, R.O. Case-based reasoning: a textbook. Berlin: Springer Berlin Heidelberg, 2013. ISBN 9783642401671.
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