



UNIVERSITÀ  
DEGLI STUDI DI MILANO-BICOCCA

## SYLLABUS DEL CORSO

### Computational Modelling

2021-1-F5105P022

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#### Learning area

Research methods in experimental psychological sciences

#### Learning objectives

##### *Knowledge and understanding*

- Methodological and epistemological foundations in cognitive modelling
- Development of computational models: techniques and approaches
- Methods for the validation and assessment of the models

##### *Applying knowledge and understanding*

- Development of simple models in different domains of human cognition
- Application of toolkits to large-scale data
- Validation of computational models through behavioral data
- Critical analysis and interpretation of the model and its predictions

#### Contents

The course aims to provide an introduction to the use of computational modeling in cognitive sciences. The theoretical and epistemological bases of the approach will be described, as well as the main methods of developing

and validating a model, with examples from different domains of human cognition. The lectures will be accompanied by hands-on practice with the techniques and methodologies introduced.

## **Detailed program**

Introduction to computational modelling and Artificial Intelligence

Epistemological foundations of cognitive modeling

Levels of description and representation

Methods for developing models in different domains of cognition

Tuning, setting, and interpreting parameters

Training and validation of learning models

Simulation of behavioral data

Model evaluation: quantitative performance and theoretical criteria

Example: implementing an exemplar-based model for categorization

Example: implementing a model for the phonological loop

Example: training models based on the Rescorla-Wagner equations

Example: training and testing neural networks

## **Prerequisites**

Familiarity with R. General knowledge in the field of cognitive psychology

## **Teaching methods**

Lectures.

Discussions about the role of computational methods in psychology.

Hands-on experience with specific toolkits, implementation of simple models, and setup of simulations in the R environment.

Attendance is required.

\*\*\* Lessons will be held in presence or through online video lessons, according to the University's regulations regarding the COVID-19 emergency situation. In both cases, all lessons will be video recorded and made available to the students. \*\*\*

## **Assessment methods**

In order to evaluate their understanding of the general principles at the basis of cognitive modelling, students will be asked to prepare group talks dedicated to the critical analysis of a given computational model from the psychology literature. The talks will be followed by in-class debates.

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## **Textbooks and Reading Materials**

Lewandowsky, S., & Farrell, S. (2010). Computational modeling in cognition: Principles and practice. Sage Publications. Chapters 1, 2, 3, 8

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