1SC2810 – Computational approach to games

Instructors: Pascale Le Gall
Department: DÉPARTEMENT INFORMATIQUE
Language of instruction: FRANCAIS
Campus: CAMPUS DE PARIS - SACLAY
Workload (HEE): 40
On-site hours (HPE): 22,50

Description

Game theory is the formal study of the interactions between rational agents defined by the objectives they seek to achieve and by their strategic options. Strategies can potentially be interdependent (i.e. situations in which the issue for each participant depends not only on the decisions they make, but also on the decisions made by other participants). In this course, we will deal more specifically with the computational approach to games, which is based on computer models of game situations (state and graph models, constraint models, etc.) and which aims to automate the search for strategies and analyze their performance (optimality). This course will cover the theory and practice of finding optimal and satisfying solutions for multi-player combinatorial games, such as popular games such as Soduku, Sokoban, Othello, Checkers,... It will include the following points..: the relevant representation of information, intelligent decision-making (i.e. satisfactory, quasi-optimal or optimal), modelling of action sequences, taking into account paiements and uncertainties and capitalizing on experience, aggregation of conflicting preferences, algorithms for routing combinatorial game spaces.

Quarter number
ST2

Prerequisites (in terms of CS courses)
None

Syllabus
Game theory

Terminology (game, payment, strategies, etc.), Modeling and different representations of a game (strategic form - extensive form), application domains: economics, pricing, auctioning, routing, etc.

Game in normal (or strategic) form: Dominated, cautious strategies, social welfare, Pareto Optimum. Representative examples: Prisoner's dilemma,

Battle of sexes, Beauty contest, Cooperative games. Pure and mixed strategies, Nash equilibria. Competitive games, repeated games. Bayesian games.

Games in extensive form: definition, modeling (game tree), with perfect or imperfect information, with hazard, strategy selection, backward induction, subgame perfect equilibrium, equivalent representation in strategic form

Sequential games for 2 players: theoretical study, practical resolution and search for a winning strategy. This part will be illustrated by typical examples of combinatorial games such as the Nim game. Algorithms for strategies by adversarial (minmax, alphabeta) or approximate method (Monte Carlo, Algorithm A*...)

Puzzle games (Soduku, Nongram, ...) : introduction, modeling using constraints - Algorithms for solving constraint satisfaction problems (propagation, arc consistency)

Class components (lecture, labs, etc.)
6 lectures of 1h30 each,

8 TD/TP of 1h30 (either as a TD or as a TP involving programming activities)

1 written exam of 1h30

Grading
Continuous assessment: 1 or 2 practical works (Programming exercices in Python)

1h30 written exam, with documents.

The written exam and the continuous assessment account for 60% and 40% of the final grade respectively

Course support, bibliography
Course slides - Handout - Handout - Topics and answers for tutorials

Resources
Personal labtop