

Research internship proposal (M2)

Location : LSV (<http://www.lsv.ens-cachan.fr>)
L2S (<http://www.lss.supelec.fr>)

Title : Games of imperfect information over graphs

Supervisors :

Patricia Bouyer-Decitre (LSV), Samson Lasaulce (L2S), Nicolas Markey (LSV)
Tél : 01 47 40 75 41, 01 69 85 17 34, 01 47 40 75 37
Web : <http://www.lsv.ens-cachan.fr/~bouyer/>
<https://sites.google.com/site/lasaulce/>
<http://www.lsv.ens-cachan.fr/~markey/>
Emails : {bouyer, markey}@lsv.ens-cachan.fr
samson.lasaulce@lss.supelec.fr

Description :

The aim of this internship is to confront and gather models and technics arising from two (almost three) communities : the computer-science community, the game-theory community and the information-theory community. So the targetted student can come from any of these communities.

The general context of this internship is the development of formal methods for the analysis and the synthesis of reliable and efficient computerized or communication systems. The target is that of automatic methods based on models, which will allow to trust with confidence the correctness of a design or of a system. One such methods is the so-called *model-checking* approach, which, given a system \mathcal{S} and a property P , consists in constructing a mathematical model $\mathcal{M}_{\mathcal{S}}$ for the system and a mathematical model φ_P for the property, for which we will be able to automatically check that $\mathcal{M}_{\mathcal{S}}$ satisfies φ_P .

In this internship we will be particularly interested in systems involving several agents (or players), like communication protocols, and in analyzing information mechanisms that can be used to accurately achieve a property. We will study games on graphs involving several players, and, following [4], we will assume imperfect observation—or monitoring—of actions by the players (that is, one player only observes actions of his neighbouring players). Such games are interesting e.g. when modelling communication systems like power control games [3].

In computer science, imperfect observation is often modelled as a coloring function on nodes of the graph, two nodes with the same color being not distinguishable by the players [2, 1]. The mechanism of imperfect information studied in [4] has not been studied over graphs, and nothing is known about (un)decidability of the existence of a winning strategy for a given coalition. The first aim of this internship is to study such decidability issues, and to compare with standard models of games on graphs with a partial observation assumption [2, 1].

We then target investigating other mechanisms for partial observation, by studying mechanisms like public signals or signals obtained by encoding functions [3].

This internship will be part of ERC project EQualIS (<http://www.lsv.ens-cachan.fr/~bouyer/equalis/>), and can naturally be extended into PhD studies (a PhD grant is available). Targetted applications of the results are mobile networks and smart grids.

Références

- [1] D. Berwanger and L. Kaiser. Information tracking in games on graphs. *Journal of Logic, Language and Information*, 19(4) :395–412, 2010.
- [2] L. Doyen and J.-F. Raskin. *Lectures in Game Theory for Computer Scientists*, chapter Games with Imperfect Information : Theory and Algorithms, pages 185–212. Cambridge University Press, 2011.
- [3] M. Le Treust. *Théorie de l'information, jeux répétés avec observation imparfaite et réseaux de communication décentralisés*. PhD thesis, Université Paris-Sud, 2011.
- [4] J. Renault and T. Tomala. Repeated proximity games. *International Journal of Game Theory*, 27(4) :539–559, 1998.