Cooperative game theory seminar

18. května 2022

Abstrakt

We are interested in cooperative games where each player has partial knowledge of the game.

1 Problem

Setting: For a set of n players, we have n incomplete games $(N, \mathcal{K}_1, v_1), \ldots, (N, \mathcal{K}_n, v_n)$ representing each player's knowledge about a common underlying game.

Goal: We assume that N forms. How to distribute $v(N)$?

2 Assumptions

- *consistency*: for $S \in \mathcal{K}_i \cap \mathcal{K}_j$, it holds $v_i(S) = v_j(S)$
- *knowledge assumptions*
  - $N \in \mathcal{K}_i$ for every i ... all players know the *budget*
  - $\{i\} \in \mathcal{K}_i$ for every i ... everyone knows his worth
- *honesty* ... players do not ***lie***
- *secrecy* ... no player ***shares*** anything about his knowledge

3 Model

- iterative vs. "one-time"process

3.1 Dynamic (iterative) model

Idea: The computation of payoffs is represented by an interative process. In each step, requests and information sharing (with possible payments for shares) take place. Based on these, each player re-evaluates his set of feasible payoff vectors. The process continues until a stable situation or ending condition is met.

3.2 One-time information sharing model

A simple model which might be viewed as a special case of the previous one with only one iteration.

- The process:
  1. Send requests to other players
  2. Share information
  3. Compute payoffs

3.2.1 Payoff distribution

We might assume that we choose $\mathcal{I}^*(v) = \{x \in \mathbb{R}^n \mid x_1 + \cdots + x_n = v(N)\}$.

- X_i ... *feasible* set of a player
- Questions
  - Do we agree on payoff distribution method before or after information sharing?
  - What are feasible vectors for every player i?

4 Questions

- How to define ***information sharing***?
  - graphs?
  - portion of $(N, \mathcal{K}_i, v_i)$?
  - ...
- Is *honesty* the right way to go?

5 Further ideas

5.1 God (arbiter)

Idea: Each player shares a *portion of his information* with the god, he then computes the solution and returns it to all the players.

- we decided to rule out this entity, because it leads in many scenarios to the standard model
  - *honesty* $\implies$ i shares $(N, \mathcal{K}_i, v_i)$ $\implies$ God concerns $(N, \mathcal{K}_1 \cup \cdots \cup \mathcal{K}_n, v)$ $\implies$ reduces to theory of incomplete games
  - Without arbiter, what do we share with the others?
    - payoff vectors vs. portion of information $(N, \mathcal{K}_i, v_i)$?