Dynamics of Profit-Sharing Games

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Joint work with
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**Broad Classification of Games**

**Non-cooperative:** Emphasis on the individual
- Players can choose their own strategy.
- Individual payoff depends on choice of every player

**Cooperative Games:** Emphasis on the team
- Different members bring variety of skills.
- Some task is performed leading to a team payoff
- Standard framework is **static**.
- How to share the payoff?
IPL Teams and Players
Coalition Formation

Dynamics that govern coalition formation is important!

- Bargaining

- Assumption: agents are fully rational, but in reality...
  - agents have limited computational resources,
  - lack information about other players,
  - have to make “myopic” decision.

Our focus
Dynamics of coalition formation when agents are myopic.

Our Inspiration
Myopic dynamics of non-cooperative games! (Fabrikant et al. (2004), Awerbuch et al. (2008), Fanelli et al. (2008))
Our Contribution

- We introduce (i) Fair Value games, (ii) Labour Union Games, and (iii) Shapley Games.
- They are potential games, hence Nash equilibrium exists (Monderer and Shapley, 1996).
- All Nash equilibria are reasonably good.
  - More precisely, price of anarchy is at most 2.
- Fair Value and Labour Union games
  - have at least one Nash equilibrium with optimal total profit.
  - converge quickly to a total profit $\geq \frac{1}{2} \times$ optimal total profit.
- Labour Union games converge quickly to an approximate Nash equilibrium.

Chalkiadakis and Boutilier (2004). Extend Dieckmann & Schwalbe’s work to incomplete information.

Dynamics of Potential Games

- Complexity of computing Nash Equilibrium
  → If you cannot compute, then dynamics cannot reach Nash equilibrium.
  → Fabrikant et al., 2004; Skopalik and Vocking, 2008; Bhalgat et al., 2010; Caragiannis et al., 2011.

- How long does best response dynamics take to reach equilibrium? Typically exponential in number of players!
  → Chien and Sinclair, 2007; Ackermann et al., 2008.

- How optimal is the state of the game after polynomial steps?
  → Awerbuch et al., 2008; Fanelli et al., 2008.