Quantal Correlated Equilibrium in Normal Form Games

“Coordinating subrational players using a signaling device”

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Game model
Normal Form Games

Quantal Correlated Equilibrium (QCE)
All players quantil-respond after receiving their private signals
\[ u_i(s_i, s_{-i}) = \sum_{a_i, a_{-i}} \lambda_i(a_i, a_{-i}) s_i(a_i, a_{-i}) u_i(s_i, a_{-i}) \]

Quantal response equilibria

Optimization with criterion function \( f(\lambda, \sigma) \) \( \max_{\lambda, \sigma \in \text{QCE}(\lambda)} \)

Properties of Quantal Correlated Equilibrium

Relations:
1. QCE is an agent quantal response equilibrium in the extended game.
2. Any quantal response equilibrium may be extended into a QCE.
3. Let \( Q \) be a sequence of quantal response functions that approach the best response in the infinity. Then the limit quantal correlated equilibrium is a correlated equilibrium.

Advantage:
Let \( q_i \) be exponential for each player and \( u_i(\cdot, \cdot) \) Assume the signaler's utility is of signaling: negatively correlated with other players’ utilities. Then \( u_i(\text{QCE}) > u_i(\text{QREG}) \).

Topology:
Let \( C = \{ Q(\text{QCE}) \} \). Then \( C \) is compact and the correspondence \( \lambda \rightarrow \text{QCE}(\lambda) \) is upper hemi-continuous. If \( \text{QCE}(\lambda) \) are unique then \( C \) is connected.

Computation
Homotopy Formulation of Quantal Correlated Equilibrium

Tracing the path from uniform strategies to QCE using the system:

In each step of tracing we shift the homotopy towards the maximum of criterion \( \lambda^{0.1} \rightarrow P_0(\lambda + \eta f(\lambda, 0))/(\eta(\lambda)) \)

Comparison to BARON - Algorithm for General Optimization

Homotopy algorithm is faster

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See his other work at j-cerny.github.io

Jakub is looking for a postdoc position!
15 publications - EC, AAA, IJCAI, etc.

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