# **2018:**

# **1. Stable Outcomes in Modified Fractional Hedonic Games:**

In coalition formation games self-organized coalitions are created as a result of the strategic interactions of independent agents. For each couple of agents(i, j), weight wi, j = wj, i reflects how much agents i and j benefit from belonging to the same coalition. We consider the modified fractional hedonic game, that is a coalition formation game in which agents’ utilities are such that the total benefit of agent i belonging to a coalition (given by the sum of wi,j overall other agents j belonging to the same coalition) is averaged overall the other members of that coalition, i.e., excluding herself.

We consider common stability notions, leading to strong Nash stable outcomes, Nash stable outcomes or core stable outcomes: we study their existence, complexity and performance, both in the case of general weight sand in the case of 0-1 weights. In particular, we completely characterize the existence of the considered stable outcomes and show many tight or asymptotically tight results on the performance of these natural stable outcomes for modified fractional hedonic games, also highlighting the differences with respect to the model of fractional hedonic games, in which the total benefit of an agent in a coalition is averaged over all members of that coalition, i.e., including herself.

Acronyms and Definitions:

* MFHG: Modified Fractional Hedonic Games
* SW: Social Welfare
* SN: Strong Nash
* PoA: Price of Anarchy
* PoS: Price of Stability
* SPoA: Strong Price of Anarchy
* SPoS: Strong Price of Stability
* CPoA: Core Price of Anarchy
* CPoS: Core Price of Stability

Results:

* There exists a star graph G containing only nonnegative edge-weights such that MFHG admits no 2-strong Nash stable outcome.
* For any coalition structure C, there exists a coalition structure C′ containing only basic coalitions and such that SW(C′) ≥ SW(C).
* Given an unweighted graph G, there exists a polynomial time algorithm for computing a coalition structure C\*­ maximizing the social welfare.
* Given an unweighted graph G, it is possible to compute in polynomial time an outcome C ∈ n−SN and such that SW(C) = SW(C∗).
* The strong price of anarchy for unweighted graphs is 2.
* There exists a graph G containing edges with negative weights such that its MFHG admits no Nash stable outcome.
* For any weighted graph with non-negative edge weights G, PoA(MFHG(G)) ≤ n−1.
* There exists a weighted star G with non-negative edge weights such that PoS(MFHG(G)) = Ω(n).
* Given any graph G = (N, E, w), there exists a polynomial time algorithm for computing a core stable coalition structure C such that SW(C) ≥ ½\*SW(C\*(MFHG(G))) and all coalitions in C are of cardinality at most 2.
* For any graph G, CPoS(MFHG(G)) ≤ 2.
* For any ϵ > 0,there exists a weighted graph G such that CPoS(MFHG(G)) ≥ 2−ϵ.
* For any unweighted graph G, CPoS(MFHG(G)) = 1.
* For any graph G, CPoA(G(G)) ≤ 4.
* For any unweighted graph G, CPoA(MFHG(G)) = 2.

Open Problems:

* Reduce the gap between the lower bound of 2 for the core price of stability and the upper bound of 4 for the core price of anarchy.
* Complexity of computing an optimal outcome when the graph is weighted.
* Designing truthful mechanisms for MFHGs that perform well with respect to the sum of the agents’ utility.
* Adopting different social welfare functions like maximizing the minimum utility among the agents.