# Exploration of Coalition forming in dynamic voting systems

Many real-world problems require group of agents to make choices on available alternatives. One of the most common and natural approach to address this problem is through voting. Over the years, researchers have studied several voting mechanisms such as Average voting, Positional voting and many of Condorcet method. Voting applications are most popular in electoral systems, especially in politics.

In multi-agent systems, voting plays a vital role in dynamic coalition formation. Automation of this process would save labor time of human negotiators as well as increase the efficiency of the computational agents [1]. Although, coalition formation has been a well-researched area, a little focus has been given to the dynamic (continuous) voting system. One of the key related area is Game theory. The main three stages involved in coalition formation are: Structure formation, Solving the optimization for coalitions, and Dividing the value among coalition member.

## Coalition Structure formation

Two class of activities associated with structure generation are, the structure generation activities performed by cooperating agents when proposed by a single designer, and activities performed by non-cooperating selfish-agent in order to maximise their own utility.

In a game G, a coalition structure CS is said to be optimal if

(1)

where v(*CS*) social welfare of coalition defined as

∑C∈CS v(C) (2)

In coalition structure forming, the goal is to find the set of elements for the eq. (1).

Another problem that arises is in economic model such as voting and multilateral bargaining is counter-intuitive several Nash or subgame perfect equilibria. In [2], Acemoglu *et al*. proposed an easier method to eliminated these non-intuitive equilibria. In their work, they showed that the methods can be applied to a dynamic voting model proposed in their previous work [3] under sequential voting, which can be interpreted as a game of dynamic coalition formation.

[220, 267] use dynamic programing approach to find optimal structure generation. Sandholm *et al.* uses coalition structure graph to find

Applications

Agent bargaining in Ecommerce

1 <https://www.cs.cmu.edu/~sandholm/coalstruct.aij.pdf>

[2] <https://economics.mit.edu/files/4669>

[3] Acemoglu, Daron, Georgy Egorov, and Konstantin Sonin (2008) Coalition Formation in NonDemocracies, Review of Economic Studies, 75(4): 987-1009