

Dynamics of interdependent multidimensional opinions

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Abstract

In opinion dynamics, individuals in a group can change their opinions on issues as a result of connections to other individuals. Motivated by the DeGroot model, we propose an extended DeGroot model which allows agents to revise their opinions on multiple interdependent topics. We introduce a coupling function which indicates couplings between opinions of multiple interdependent topics. This extended model allows us to choose a specific mathematical function to represent a specific situation. We present a model which describes the dynamics of the opinions of individuals in a group on one topic by pooling their neighbours' opinions and the influences of their own opinions on multiple topics. Different cases of coupling between agents opinions are investigated. Numerical results demonstrate how couplings between a number of issue specific opinions influence the convergence of opinions of agents in the network.

Background

One can model the dynamics of the opinions of a group of individuals by representing each individual as a node on a network. Each node takes a value (or set of values) between -1 and 1 . The value indicates the strength of opinion on an issue with 1 meaning strongly in favour of the issue and -1 meaning strongly against it. The individuals that affect the opinion of each particular individual are called neighbours. The opinion of each individual on an issue changes with time as a result of the influence of the opinions of its neighbours. In the DeGroot model, time increases from 0 in unit steps and if $x_i(t)$ is the opinion of individual i on an issue at time t (where $i = 1, \dots, N$) then $x_i(t+1) = \sum_{j=1}^N W_{ij}x_j(t)$. If individual j has a positive influence on the opinion of i on the issue then $0 < W_{ij} \leq 1$. If individual j has a negative influence on the opinion of i on the issue then $-1 \leq W_{ij} < 0$. If individual i has no influence on the opinion of i on the issue then $W_{ij} = 0$. A consensus is reached if $x_i(t)$ for all i tends to a particular value as $t \rightarrow \infty$.

It is possible to generalize the DeGroot model to what is referred to as the multidimensional case where each individual has opinions on a set of issues. The possibility then arises of how opinions on one issue can affect opinions on another issue. This is what we examine in this paper but we model the influence in a more general way than has been done previously.

Related resources

- [1] DeGroot MH (1974) Reaching a consensus. *J Am Stat Assoc* **69**, 118–121.
- [2] Parsegov SE, Proskurnikov AV, Tempo R, Friedkin NE (2017) Novel multidimensional models of opinion dynamics in social networks. *IEEE Trans Automat Contr* **62**, 2270–2285.