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Self-Organizing Social Networks by Preference Similarity and the Networking Capacity of their Users

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Abstract

Consider the decision faced by the user of a social media site of whether or not to accept a friendship request from another user, given the limited amount of information available before deciding. We formalize the problem by defining the expected utility trade-offs derived from the request and simulate the resulting incentives numerically. These incentives provide the basis on which to build social networks determined by the different expectations and preferences of their users. Social networks are generated using a self-organizing map to cluster the decision makers (DMs) by their friendship acceptance behaviour. This behaviour is determined by the distribution of requesters relative to the preferences of the DMs.

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1. Motivation

The emergence of social media has led to a substantial increase in the amount of personal information available about their users¹, leading other media users and companies to use this information strategically². At the same time,

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social media research generally focuses on identifying the main factors determining the structure of already existing networks, while acknowledging the existence of different types of users in terms of their networking capacities and influence on other users^{3,4}. In this paper, we consider these characteristics of social media and their users but take a different research route from that of the existing literature.

We formalize the acceptance or rejection decision faced by a decision maker (DM) when receiving a friendship request and use the resulting framework as the base on which to build the corresponding network structures. In this regard, the friendship acceptance (or rejection) model defined in this paper relates to the basic postulates of expected-utility-based economic decision theory⁵, where a DM makes a decision considering the highest expected utility attainable at a given point in time^{6,7,8}.

The DM has to decide whether to accept a given friendship request and generate a link expanding his network, or reject it and either find a more suitable requester or remain with his current set of friends. When receiving a given friendship request, some basic but important information becomes available to the DM, indicating the main preferences (i.e. likes, pages followed) of the person requesting his friendship. Once accepted, additional secondary information becomes available, which can be used by the DM to complete his profile of the requester. Consequently, we will assume that the initial information provided to the DM is correlated with the secondary one and, therefore, conditions its expected realization. Finally, the capacity of the requester to increase the network of friends of the DM must also be considered. This capacity should be determined by the connections of the requester and his similarity in preferences with the DM. As a result, the initial (observed) and secondary (expected) characteristics observed can be used by the DM to determine the expected networking capacity of the requester.

We formalize the above decision problem by defining the expected utility tradeoffs derived from the request and simulate the resulting incentives of the DM numerically, which, at the same time, provide the basis on which to build social networks determined by the different expectations and preferences of its users. Social networks are generated using a self-organizing map to cluster the DMs by their friendship acceptance behavior, which, at the same time, is determined by the distribution of requesters' characteristics relative to the preferences of the DMs. We illustrate how the differences between the subjective beliefs used by the DM to define his expectations and the distribution of characteristics across requesters condition the formation of clusters in the resulting network.

2. Basic assumptions

The choice made by the DM regarding the friendship request depends on the following variables:

- $X_1 = [x_1^m, x_1^M]$: The characteristics/preferences of the requester directly observable when receiving a friendship request. It accounts for publicly available information that describes the main basic tastes of (likes displayed by) the requester. The realization observed is related to the remaining information, which is unavailable at the moment of the request together with the list of friends and, therefore, the networking capacity of the requester.
- $X_2 = [x_2^m, x_2^M]$: The characteristics/ preferences of the requester that become observable after accepting the friendship request. It allows the DM to obtain additional information regarding both the tastes on the requester as well as his potential networking capacity. Thus, the distribution of this variable is related to and influenced by the realization of X_1 , while both X_1 and X_2 affect and determine the potential networking capacity of the requester consistent with the preferences of the DM.
- $X_3 = [0,1]$: This characteristic reflects the networking capacity of the requester. The shape of its associated probability function is determined by the realizations of both X_1 and X_2 . It should be noted that the friends of a given social media user can be classified in different categories, with access to different levels of information. However, even if not allowed to access the whole network, the DM becomes part of the group of friends of the requester. That is, even though the DM may not have the same status as other friends, who may be used to expand his network but are classified in a different category by the requester, he may still benefit from the fact that those potential network friends can actually observe him.

The acceptance decision of the DM will therefore be determined by two incentive functions defining the expected utility derived from either accepting a given friendship request or rejecting it. If the DM rejects the request, he must consider the probability of improving upon the current request in the future and compute the corresponding expected

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