

A Collaborative System Based on Reputation for Wide-Scale Public Participation

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Abstract. The aim of this paper is to use a reputation system to promote trust among participants of an online social network. By the use of past behaviour and ratings from other users, this paper presents a novel metric to compute the reputation of peers. Also a prototype and deployment results are included.

Keywords: Reputation system, public participation, e-democracy.

1 Introduction

This article proposes the use of a reputation system to promote trust among participants and the system construction over an online social network.

Although reputation systems are being used in several fields, it has not yet been implemented in politics and citizen participation. We have not found other attempts of reputation systems for the world of politics in order to promote participation and e-democracy between peers.

Reference [1] defines e-democracy as the sum of acts realized by individuals or groups in order to influence the way the political system operates. Due to the Internet, citizens can easily access political content and such an increased access to political information should extend governmental transparency and thus democracy.

In reference [2], a proposal over the Internet where players have to cope with uncertainty from quality of products and trustworthiness of participants is presented. The method to address this predicament is to use feedback ratings about past behaviour to make recommendations about who to trust.

In reference [3] a proposal for the use of reputation systems in Communities of Practice (CoPs) was presented in order to assist users in creating relationships for honest and useful participation, based on trust, for the benefit of the entire community. Indeed [3] presents a simple reputation calculation based only in the median of past reputations.

In [4] we have used reputation systems in a Mobile Ad hoc Network (MANET) which is a low complexity system. But in this paper we offer a generalisation of the use of reputation systems to a more complex framework represented by the world of politics with the aim to promote participation and e-democracy between peers.

The paper is organized as follows: section 2 presents reputation systems concepts and issues; section 3 presents the proposed reputation model with its respective reputation metric; section 4 presents the deployed system; and finally, section 5 discusses our conclusions.

2 Reputation Systems

Many interactions in real world are based on rumours or on friends' experiences. As a result of this, future interactions can be influenced by past interactions. We call this the reputation of a user. Keeping that in mind we can build a system that collects, processes and distributes information about the quality of interactions. Referring to [5], we call such system a "reputation system". Reputation systems are well suited for stimulating social control within online communities. The idea is to let parties rate each other and use those ratings to derive a reputation score, which can assist other parties in deciding whether or not to transact with that party in the future [6].

Reputation systems need models in order to calculate the reputation of its users, that is, a way to obtain a qualification for each individual, using information stored in the system. Many reputation models have been proposed for online environments systems throughout the past years, but there is not an accepted common model yet.

3 Proposed Reputation Model

In our model we identified several factors that influence on the reputation of a user in the system which will be described as follows.

Whenever a user participates in the system he should be rewarded. A good way to measure the participation is by the relative contribution factor which will be the amount of actions executed by a user over the amount of total actions. We will denote C_i^P as the relative contribution factor for participation which has been divided in m areas, where m represents the amount of participation dimensions measured by the system, and its values will satisfy $0 \leq C_i^P \leq 1$ for $i = \{1, \dots, m\}$. Each contribution should have different importance in the system, for such reason we will identify β_i as the importance weight of C_i^P which values will go between 0 and 1. We then define the participating reputation R_p of user a as:

$$R_p(a) = \sum_{i=1}^m \beta_i C_i^P(a) \quad (1)$$

Certain users have the ability to generate participation in others and such ability should be rewarded by the system. In a similar way to participating reputation, C_i^L represents the contribution factor for leadership which will be sorted out in n different areas, where n represents the amount of leadership dimensions and its

values will satisfy $0 \leq C_i^L \leq 1$ for $i = \{1, \dots, n\}$. We will define δ_i as the weight of C_i^L in the system which values will go between 0 and 1. The leadership reputation R_L of user a will then be defined as:

$$R_L(a) = \sum_{i=1}^n \delta_i C_i^L(a). \quad (2)$$

Users in the system can be qualified by others for a performed activity. Agent a will be rated and given a qualification $q \in Q$ where $Q = \{1, 0\}$ which represent a positive or negative qualification respectively. Q_a represents the time-sorted list of qualifications of user a assigned by other users where $Q_a[1]$ is the oldest rate and $Q_a[h]$ is the most recent. Each user in the system will have an ordered list used to store his last h qualifications. When a new qualification $h+1$ arrives, the oldest one comes out of the list like a FIFO array.

Agents will behave more probably like they did in their most recent transactions. Therefore we chose a metric called BlurredSquared [7] which computes a weighted sum of all ratings. The older a rating is, the less it influences the current reputation. In our particular case the reputation will only be calculated with the last h qualifications.

The peer reputation R_Q of user a will then be defined as:

$$R_Q(a) = \sum_{j=1}^h \frac{Q_a[j]}{(h-j+1)^2}. \quad (3)$$

The chosen model is based in the one described in [8]. The essential distinction between that metric and ours is that this novel metric considers qualifications from other nodes assigning more importance to the most recent ones.

We will define F as a function that determines the level of recent activity of a certain node. Let $T(a)$ be the residential time of user a in the system and let k be a discount factor between 0 and 1 that will be chosen in order to decrease the level of participation when the time spent in the system is higher and increase it when it is shorter. The level of recent activity for user a will be:

$$F(a) = R_p(a) \cdot R_L(a) \cdot k^{T(a)}. \quad (4)$$

Our model computes the global reputation or trust of a user based on two factors: past qualifications and level of recent activity. Trust for user a will be calculated as:

$$Trust(a) = \frac{R_Q(a)^{1+F(a)} - 1}{R_Q(a) - 1}. \quad (5)$$

4 Deployed System

The proposed system was implemented in the Alumni Center of the Faculty of Engineering of Universidad Católica de Chile using the well-known social network Facebook. Such implementation offers a participation platform for students as it permits them to express their concerns and ideas and allows others to vote or comment about them. The previously described model was applied in order to determine the improvement of trust among peers.

Figure 1 shows the evolution of trust for several users. Initially all users begin with the same trust value. Their behaviour in the system and the qualifications assigned by others determines the progress of their trust. User 1 has an increasing participation and leadership reputation as well as a good reputation among other peers; therefore his level of trust increases significantly over time. User 2 presents a decreasing participating reputation but an incremental leadership and a high reputation. Finally User 3 has a poor participation in the system and is not well qualified by others for that reason it presents a decreasing trust value as time passes by.

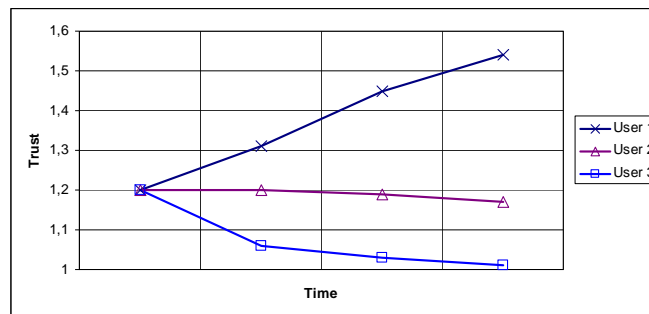


Fig. 1. Evolution of trust for different users.

5 Conclusions

This paper reflects the behaviour of a user in the system and the quality of his contribution in his trust value. As a direct consequence arises the fact that users with high level of trust are comparatively better users and therefore will eventually come with good ideas that could be used as part of future policies in the world of politics.

From simulation we can conclude that good behaviour in the past and the use of ratings from other participants is a high-quality metric in a social network.

A trust-based system built over a well-known social network brings a great opportunity to participate for all interested users as well as an opportunity to identify high-quality users whom may become in the leaders for tomorrow.

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