



A linguistic consensus model for Web 2.0 communities

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ABSTRACT

Web 2.0 communities are a quite recent phenomenon which involve large numbers of users and where communication between members is carried out in real time. Despite of those good characteristics, there is still a necessity of developing tools to help users to reach decisions with a high level of consensus in those new virtual environments. In this contribution a new consensus reaching model is presented which uses linguistic preferences and is designed to minimize the main problems that this kind of organization presents (low and intermittent participation rates, difficulty of establishing trust relations and so on) while incorporating the benefits that a Web 2.0 community offers (rich and diverse knowledge due to a large number of users, real-time communication, etc.). The model includes some delegation and feedback mechanisms to improve the speed of the process and its convergence towards a solution of consensus. Its possible application to some of the decision making processes that are carried out in the Wikipedia is also shown.

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1. Introduction

Making decisions, that is, the cognitive process leading to the selection of a course of action among several alternatives according to a set of criteria, is a common activity that appears in almost any human endeavour [1]: from choosing what to eat, what to wear and what to buy to selecting a representative or voting in an election. Group decision making (GDM) is a particular case of decision making where the final selected choice has to be done by multiple persons. GDM presents several special characteristics that distinguishes from individual decision making. For example, on the one hand, the total knowledge about a particular decision problem of a complete group of persons is usually higher than the knowledge of a particular individual, and thus, the group final decision may be better justified. On the other hand, the heterogeneous nature of the persons involved in the decision may introduce additional difficulties like very different points of view, specially on topics where feelings or beliefs are present.

One of the fields where GDM is a fundamental matter is politics. As political decisions may influence lots of people, during all history it has been necessary to develop different forms of government to make decisions. One of those forms of government is democracy, where usually a set of elected officers undertake to

represent the interests and/or views of citizens within a framework of the rule of law. However, as this kind of system only requires a periodic involvement in the elections of the majority of the citizens, the electorate is almost excluded from the political decision making, which can derive into a lack of political interest, knowledge and responsibility among the non-participant population [2].

It is clear that involving a very large number of individuals in a decision process is a difficult task but, with the appearance of new electronic technologies, we are in the beginning of a new stage where traditional democratic models may leave some space to a more direct participation of the citizens. In the specialized literature some efforts about the use of these new technologies are found in what it is being called e-democracy [2], e-participation [3], e-Governance [4] and public deliberation [5,6].

In fact, new Web technologies have allowed the creation of many different services where users from all over the world can join, interact and produce new contents and resources. One of the most recent trends, the so-called *Web 2.0*, which comprises a set of different web development and design techniques, allows the easy communication, information sharing, interoperability and collaboration in this new virtual environment. Web 2.0 communities, that can take different forms as Internet forums, groups of blogs, social network services and so on, provide a platform in which users can collectively contribute to a Web presence and generate massive content behind their virtual collaboration [7]. In fact, Web 2.0 represents a paradigm shift in how people use the web as nowadays, everyone can actively contribute content online.

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It is thus clear that to develop more sophisticated GDM models and schemes that can be applied into the new Web 2.0 communities is a current necessity. In fact, there have been several efforts in the specialized literature to create different models to correctly address and solve GDM situations. Particularly, the fuzzy theory [8] introduced by Zadeh has been shown to be a good tool to model and deal with vague or imprecise opinions (which is a quite common situation in any GDM process) [9–11]. Many of those models are usually focused on solving GDM situations in which a particular issue or difficulty is present. For example, there have been models that allow to use linguistic assessments instead of numerical ones, thus making it easier for the experts to express their preferences about the alternatives [12]. Other models allow experts to use multiple preference structures (and even multi-granular linguistic information) [13–15] and other different approaches deal with incomplete information situations if experts are not able to provide all their preferences when solving a GDM problem [16] or when a consensus process is carried out [17].

Moreover, usual GDM models have been complemented with consensus schemes that allow users to interact until there is a certain degree of agreement on the selected solution [18–20]. This consensus models allow not only to provide better solutions to decision problems, but also to increase the users satisfaction with the decision process as all the opinions are reconsidered to achieve a high enough level of consensus.

However, those approaches are not usually well suited to be used by Web communities due to some of their inherent properties. For example, due to the diversity of the users backgrounds, using numerical preferences might be not adequate (and thus, linguistic assessments should be used [21]) or dynamic situations in which some of the parameters of the problem, as the set of experts, the set of alternatives and even the set of criteria to select the solutions change, have not been modelled. This kind of situations are quite common in other environments: in [22] the problem of managing time-dependent preferences (that is preferences expressed at different periods) is presented; the problem of dealing with dynamic real-time information to choose the best routes is shown in [23], and a practical example about resource management where the criteria to make decisions (climate) changes over time can be found in [24]. Thus, it is important to develop new models that take into account this kinds of dynamical situations to solve realistic GDM problems [25].

For the particular case of Web Communities, dynamic situations in which the group of experts vary over time are quite common: a new expert could incorporate to the process, some experts could leave it or a large group of experts could be simplified in order to minimize communications and to ease the computation of solutions. This behaviour is usually found in democratic systems where the individuals delegate into a smaller group of experts to make decisions (it is usually not possible to involve everyone in each decision). There have been some efforts to model this kind of situations. For example, in [26] a recursive procedure to select a qualified subgroups of individuals taking into account their own opinions about the group is presented. However, there is still a big necessity of creating new consensus models that suit Web Communities characteristics appropriately.

In this paper a consensus model in which preferences are expressed in a linguistic way and that has been designed taking into account the characteristics of Web 2.0 communities is presented. In particular, it has been designed considering that the number of users of this kind of communities is usually large [27]. For example, online music communities usually gather hundreds or even thousands of individuals that share an interest about particular bands or music genres. To reach a consensual decision with such a large user base is not an easy task because, for example, not every member of the community is willing to participate and contribute

to solve the problem [28] or maybe because the topic being discussed is controversial and involves individual feelings or beliefs [29]. In addition, this model allows dynamic sets of users, that is, the users set to solve the decision problem may change in time. Moreover, by means of a delegation scheme (based on a particular kind of trust network [30]) an important simplification in the obtaining of a proper consensus level may be achieved. The model also incorporates a feedback mechanism that helps the users to change their preferences towards a higher consensus level solution. In addition, a trust checking procedure allows to avoid some of the problems that the delegation scheme could introduce in the consensus reaching model. Finally, a brief discussion about the applicability of the model to increase the consensus level in the decision making processes of the Wikipedia is also presented. It is important to remark that this model is one of the first efforts in introducing the fuzzy logic theory and the fuzzy linguistic modelling into the field of Web 2.0 communities.

To do so, the paper is set as follows: in Section 2 some preliminaries are presented, that is, some of the most important characteristics of Web 2.0 communities and the basic concepts that are used in the paper. In Section 3 the new consensus model with linguistic preferences that helps to obtain consensual decisions in Web 2.0 communities as well as its possible application to the Wikipedia is introduced. Finally, in Section 4 some conclusions are pointed out.

2. Preliminaries

In this section some preliminaries are presented: first some of the main characteristics of Web 2.0 communities that have to be taken into account when designing any tool for them are described; second, some groundwork about the use of linguistic preferences in consensus models is presented.

2.1. Web 2.0 communities

New Web 2.0 technologies have provided a new framework in which virtual communities can be created in order to collaborate, communicate, share information and resources and so on. This very recent kind of communities allows people from all over the globe to meet other individuals which share some of their interests. Particularly, some of the most common activities in which the different users in online communities participate are:

- *Generate online contents and documents*, which is greatly improved with the diversity and knowledge of the involved people. One of the clearest examples of this kind of collaboration success is Wikipedia [31], where millions of articles have been produced by its web community in dozens of different languages [32]. It is clear that in a massive service as Wikipedia many situations where it is necessary to make decisions about its inner workings and the contents that are being created arise [33].
- *Provide recommendations* about different products and services. Usual recommender systems are increasing their power and accuracy by exploiting their user bases and the explicit and implicit knowledge that they produce [34,35]. This kind of systems represent a quite powerful addition to Web 2.0 systems where decisions have to be made. A clear example of recommender systems success, which exploits its users community knowledge to provide personalized recommendations, is the Amazon online store [36].
- *Participate in discussions and forums*. Many online communities have grown around a web forum or some discussion boards where users share information or discuss about selected topics. In many of these communities some simple group decision

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