

# Reaching Consensus in Digital Libraries: A Linguistic Approach

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# Outline

## 1 Introduction

- Digital Libraries
- Group Decision Making
- Web 2.0
- Goal

## 2 Preliminares

- Fuzzy Linguistic Modelling
- Consensus

## 3 A Linguistic Consensus Tool for DLs

## 4 Conclusions

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# Digital Libraries

- A DL is a collection of information that has associated services delivered to user communities using a variety of technologies
- DLs are the logical extension of physical libraries in an electronic information society
- DLs offer new levels of access to broader audiences of users

The final aim of a DL is to enable people to access human knowledge  
at anytime and anywhere



The decisions about important issues in DLs have to be made by their  
own users



GDM problem

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# Group Decision Making

- It is a situation faced when individuals collectively make a choice from a suitable set of alternatives
- Involving a very large number of individuals in a decision process is a difficult task
- With the appearance of new electronic technologies, we are in the beginning of a new stage where traditional decision models may leave some space to a more direct participation of the “webizens”



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- ❑ Web 2.0 represents a paradigm shift in how people use the Web as nowadays; everyone can actively contribute content on-line
- ❑ The challenge is to develop more sophisticated Web 2.0 applications with better “participation architectures”
- ❑ They should be able to overcome the inherent problems of the Web 2.0 Communities as:
  - ❑ Large user base
  - ❑ Heterogeneity in the users, which present different backgrounds and use different expression domains
  - ❑ The low and intermittent participation rates
  - ❑ The dynamism of the Web 2.0 frameworks, e.g. the group of users could vary over time
  - ❑ Difficulties of establishing trust relations

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- A new consensus tool for Digital Libraries:
  - It assumes fuzzy linguistic preference relations to represent the user preferences
  - It implements an iterative process in which the members of the DL interact in order to reach a consensual solution on a particular problem
  - It implements some different modules that have been designed to tackle the difficulties that arise from the special characteristics of the DLs

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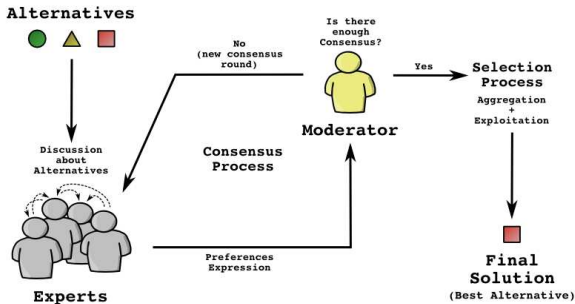
- There are situations in which the information cannot be assessed precisely in a quantitative form.
- The fuzzy linguistic modelling is a tool based on the concept of linguistic variable to deal with qualitative assessments.
- The ordinal fuzzy linguistic modelling is defined by considering a finite and totally ordered label set  $S = \{s_i\}$ ,  $i \in \{0, \dots, T\}$  with odd cardinality.
- Computational model:
  - Negation operator:  $NEG(s_i) = s_j \mid j = T - i$ .
  - Maximization operator:  $MAX(s_i, s_j) = s_i$  if  $s_i \geq s_j$ .
  - Minimization operator:  $MIN(s_i, s_j) = s_i$  if  $s_i \leq s_j$ .
  - Aggregation operators (LOWA).

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# Consensus



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# A Linguistic Consensus Tool

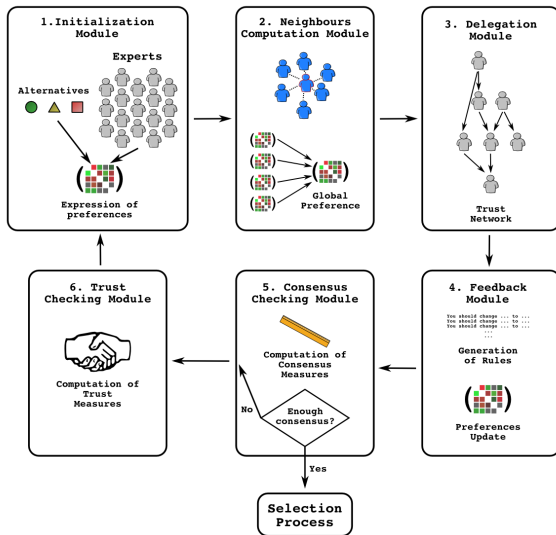
- It adapts the model presented by Alonso et al.<sup>1</sup> to deal with DL's features in order to increase the consensus level of the users when making a decision.
- Some of the properties of the presented tool are:
  - It does not require the existence of a moderator
  - It allows working in highly dynamical environments where participation and contribution rates change
  - It uses linguistic information to model user's preferences and trust relations
  - It allows weighting the contributions of each user according to some degree of expertise
  - It implements a feedback module to help experts to change their preferences about the alternatives
  - It provides a delegation scheme based on trust that allows minimizing communications and easing the computation of solutions
  - It implements a trust checking procedure to avoid some of the difficulties that the delegation scheme could introduce in the consensus reaching model

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<sup>1</sup>S. Alonso et al. *A linguistic consensus model for web 2.0 communities*. Applied Soft Computing 13:1 (2013) 149–157

# A Linguistic Consensus Tool

Its operation implies the implementation of different modules applied sequentially in each consensus round



## Initialization Module:

- It serves as an entry point for the experts that are going to participate in the consensus process
- It presents the different alternatives  $X = \{x_1, \dots, x_n\}$  in the problem to the experts
- Once they know the alternatives, each expert is asked to provide a fuzzy linguistic preference relation representing his/her opinions

## Neighbors Computation Module:

- For each participating expert a set of neighbors is computed along with a global current preference relation
- This information is presented to the experts
- To calculate the neighborhoods, the distance measure defined in Alonso et al. is used
- The global current preference relation is computed by aggregating all the individual FLPRs using the LOWA operator

## ■ Delegation Module:

- It allows each expert to delegate in other experts (presumably from his computed neighborhood, with similar opinions)
- It creates a kind of trust network that allows experts to leave (temporally or not) the decision process but maintaining part of his influence in the problem
- It is introduced to soften the intermittent contributions problem and to decrease the number of preference relations involved in the problem

## ■ Feedback Module:

- To ease the update of the preferences of the experts that have not delegated (in order to achieve a greater level of consensus) the system will provide several easy to follow feedback rules to the experts
- The users will then update their preferences

## ■ Consensus Checking Module:

- The system will check the consensus status by computing different consensus measures
- If the consensus degree is high enough the consensus phase ends and the selection one is applied

## ■ Trust Checking Module:

- It is carried out if the consensus measure is not high enough
- It is introduced to avoid some of the problems that can be derived of the characteristics of DL communities: the difficulties of establishing real trust relations
- It compares the last preference relation expressed by an expert with the last preference relations of the experts that delegated to him/her (direct or indirectly)
- The comparison is made by applying a distance operator

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# Conclusions

- We have presented a new consensus tool specially designed to be applied in DL communities
  - It has been designed to manage a large users base by means of a delegation scheme:
    - It is based in a particular kind of trust network created from linguistic trust evaluations given by the experts that simplifies the computations and the time needed to obtain the users preferences
    - It also solves the intermittent contribution problem, which is present in almost any on-line community
  - It also incorporates a feedback mechanism to help the experts in changing their preferences in order to quickly obtain a high level of consensus

# Conclusions

- It allows incorporating new experts to the consensus process: the tool is able to handle some of the dynamic properties that real DL communities have
  
- It incorporates a trust check mechanism that allows detecting some abnormal situations in which an expert may try to take advantage of others by drastically changing his opinion and benefiting from the trust that the other experts might have deposited in him in previous consensus rounds

Thank for your attention