



# FORA – A fuzzy set based framework for online reputation management

Edy Portmann <sup>a,b,\*</sup>, Andreas Meier <sup>c</sup>, Philippe Cudré-Mauroux <sup>c</sup>, Witold Pedrycz <sup>d,e,f</sup>

<sup>a</sup> University of Bern, Engehaldenstrasse 8, 3012 Bern, Switzerland

<sup>b</sup> University of California, Berkeley, 443 Soda Hall, Berkeley, CA 94720, USA

<sup>c</sup> University of Fribourg, Boulevard de Pérolles 90, 1700 Fribourg, Switzerland

<sup>d</sup> Department of Electrical & Computer Engineering, University of Alberta, Edmonton, T6R 2V4 AB, Canada

<sup>e</sup> Department of Electrical and Computer Engineering, Faculty of Engineering, King Abdulaziz University, Jeddah 21589, Saudi Arabia

<sup>f</sup> Systems Research Institute, Polish Academy of Sciences, Warsaw, Poland

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## Abstract

The Social Web offers increasingly simple ways to publish and disseminate personal or opinionated information, which can rapidly exhibit a disastrous influence on the online reputation of organizations. Based on social Web data, this study describes the building of an ontology based on fuzzy sets. At the end of a recurring harvesting of folksonomies by Web agents, the aggregated tags are purified, linked, and transformed to a so-called fuzzy grassroots ontology by means of a fuzzy clustering algorithm. This self-updating ontology is used for online reputation analysis, a crucial task of reputation management, with the goal to follow the online conversation going on around an organization to discover and monitor its reputation. In addition, an application of the Fuzzy Online Reputation Analysis (FORA) framework, lessons learned, and potential extensions are discussed in this article.

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## 1. Motivation

An online reputation is the publicly kept social evaluation of an entity based on the entities previous behavior, what was posted by the entity, and what third parties share about the entity on the Internet. The Internet thereby constitutes a worldwide database, where information is archived and not easily deleted. People, organizations, and governments are increasingly drawing on today's social Web to create and share on the Internet. In large parts, this Web is comprised of media that are simultaneously hugely scalable and easy-to-use. It provides prosumers (combination of producer and consumer of Web data) publishing techniques to spread information through social interaction. One of its key

\* Corresponding author.

E-mail addresses: [edy.portmann@iwi.unibe.ch](mailto:edy.portmann@iwi.unibe.ch) (E. Portmann), [andreas.meier@unifr.ch](mailto:andreas.meier@unifr.ch) (A. Meier), [philippe.cudre-mauroux@unifr.ch](mailto:philippe.cudre-mauroux@unifr.ch) (P. Cudré-Mauroux), [wpedrycz@ualberta.ca](mailto:wpedrycz@ualberta.ca) (W. Pedrycz).

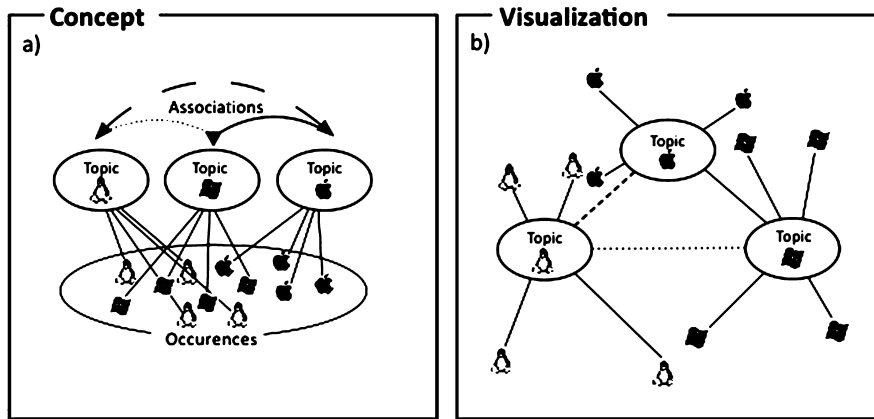


Fig. 1. Concept of knowledge map and its visualization.

characteristics is that it can stimulate to echo information; as a consequence opinions are easily shared through the proliferation of blogs, microblogs, social networks and other social media sites [44]. Nothing can ever again avoid an organization's danger from being the focus of a negative entry [10]. By this means social media can severely affect the public perception of an organization. Online buzz may be good or bad, and consequently a Web strategy for a first-hand interaction with stakeholders to respond to their concerns, is absolutely invaluable [34]. It is vital for an organization to listen to what is being said about it, even (or not until then) if it is negative. Listening bears the opportunity to take action and resolve problems or deal with virulent information, both of which can negatively affect an organization's brand image and reputation.

To not degenerate into an organization that is indeed social Web data rich but knowledge poor [1,31], for online reputation management a straightforward graphical user interaction is strived for, which helps organizations to uncover contexts. Through an interactive visualization of an automatically generated knowledge base as associative nets, a responsible communication operative can easily grasp semantic context and straightforwardly communicate with potential attackers of the organizations reputation. Accordingly, this article presents an ontology-based knowledge map system to properly organize Web data into Topic Maps [32], from which a communication operative can obtain in-depth concepts to facilitate addressing critics and eventually go into an appropriate online conversation. A Topic Map thereby characterizes a standard for representing knowledge structures and associating information and resources to those structures. It represents the topics, associations (i.e., the relationships between the topics), and occurrences (i.e., information that is considered relevant to the topic). Since Topic Maps are not as suitable for general axiomatic specifications as the description logic based ontologies (i.e., a formal, explicit specification of a shared conceptualization [14,15]), in this article, they are used as visualization technique. Yet, in the Semantic Web ontologies are built on Boolean (two-valued) logic that is insufficient to reflect social Web's reality. Fig. 1 illustrates the concept of knowledge maps and its visualization as Topic Maps a communication operative can interact.

Fig. 1a illustrates the knowledge base that besides the topics and associations also includes occurrences (i.e., terms with associated Web data). The incidental terms are Web data specific and relevant to a particular topic. A good combination of map validity, novelty, usefulness, simplicity, understandability, and generality thereby is a main objective during the creation of the framework [14,31]. Hence, the visualization of the map (see Fig. 1b) can help users to locate required information and also offers subject-related information easily and rapidly [1].

In this study, we present the fuzzy-based framework FORA for online reputation analysis and management. Using this framework, an organization can independently follow the online conversation going on around its brand, competitor's brand or discover and monitor real-time reputation of a given business sector. Conversations in the social Web rely on the use of natural language that convey a complex structure, which is substantive not only to the human communication, but also to the way human beings think and perceive the world. The main idea and the underlying model of our approach is to capture the imprecision of human language used in Web content, and to express it with appropriate mathematical tools for the realization of the framework. By fuzzy set theory human vagueness is captured and expressed in a formal fashion [29,42,47]. Accordingly, fuzzy set theory provides a basis for an emulation of higher order cognitive functions, thoughts and perceptions inherent in social Web data. For this very reason the

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