

Typed Graphs and Linked Data

Modelling and Analyzing Social-semantic Web Data

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Abstract: This extended abstract summarizes the subject of an invited talk at WebIST 2014 that introduces methods, models and algorithms studied by the Wimmics research lab to bridge formal semantics and social semantics on the Web.

1 HYBRID WEB COMMUNITIES

The Web is now a virtual place where users and software interact in hybrid communities. These large scale interactions create many problems in particular the one of reconciling formal semantics of computer science (e.g. logics, ontologies, typing systems, etc.) on which the Web architecture is built, with soft semantics of people (e.g. posts, tags, status, etc.) on which the Web content is built.

The Wimmics research lab studies methods, models and algorithms to bridge formal semantics and social semantics on the Web. The name of the lab stands for “web-instrumented man-machine interactions, communities, and semantics” and we address this problem focusing on the characterization of typed graphs formalisms to model and capture these different pieces of knowledge and hybrid operators to process them jointly.

The approaches we introduce rely on graph-oriented knowledge representation, reasoning and operationalization to model and support actors, actions and interactions in web-based epistemic communities. The research results are applied to support and foster interactions in online communities and manage their resources.

This extended abstract introduces: the need to combine different kinds of graph-based representations (section 2), the importance of having a multidisciplinary approach (section 3); and the interest of relying on typed-graph knowledge representations. The last section provides a number of references.

2 FORMAL-SOCIAL SEMANTICS

The initial graph of linked pages of the Web has been joined by a growing number of other graphs: social networks, workflows, navigation trails, automatas of distributed services, linked open data clouds, etc. And these graphs interact in all sorts of ways influencing the life-cycle of each other.

Not only do we need means to represent and analyse each kind of graphs, we also need the means to combine them and to perform multi-criteria analysis on their combination.

We propose to address this problem by focusing on the characterization of (a) typed graphs formalisms to model and capture these different pieces of knowledge with their links and (b) hybrid operators to process them jointly. We especially consider the problems that occur in such structures when we blend formal stable semantic models and socially emergent and evolving semantics.

3 MULTIDISCIPLINARY MODEL

Our research follows two main directions combining two complementary types of contributions:

- First research direction: to propose multidisciplinary approach to analyse and model the many aspects of these intertwined information systems, their communities of users and their interactions;
- Second research direction: to propose formalizations of the previous models and reasoning algorithms on these models

providing new analysis tools and indicators, and supporting new functionalities and better management.

In a nutshell, the first research direction looks at models of systems, users, communities and interactions while the second research direction considers formalisms and algorithms to represent them and reason on their representations.

In the short term we intend to survey, extend, formalize and provide reasoning means over models representing systems, resources, users and social links in the context of social semantic web applications.

In the longer term we intend to extend these models (e.g. dynamic aspects), unify their formalisms (dynamic typed graphs) and propose mixed operations (e.g. metrical and logical reasoning) and algorithms to scale them (e.g. random walks) to support the analysis of epistemic communities' structures, resources and dynamics.

Ultimately our goal is to provide better collective applications on the web of data and the semantic web with two sides to the problem: (1) improve access and use of the linked data for epistemic communities and at the same time (2) use typed graph formalisms to represent the web resources, users and communities and reason on them to support their management.

4 TYPED GRAPHS

The work presented in this invited talk reports on models and algorithms to bridge formal semantics and social semantics by formalizing and reasoning heterogeneous semantic graphs.

The models we design include: users, their profiles, their requirements, their activities and their contexts; social links, social structures, social exchanges and processes; conceptual models including ontologies, thesauri, and folksonomies. Whenever possible these models are formalized and published according to standardized web formalisms and may motivate research and suggestions on extending these standards. The main goal here is to improve the understanding the systems have of the communities, resources and activities of their users. We focus on formalizing the models as unified typed graphs in order for software to exploit them jointly in their processing while still being able to use the specificities of each one of them. The schemas and datasets are published as linked data following the web architecture principles and W3C standards.

The algorithms we designed include: typed graphs indexing, reasoning and searching; hybrid processing merging logical inferences, rules and metrical inferences; approximation and propagation algorithms; distributed querying and reasoning. We propose algorithms (in particular graph-based reasoning) and approaches (in particular knowledge-based approaches) to process the mixed representations we obtain. We are especially interested in allowing cross-enrichment between them and in exploiting the life cycle and specificities of each one to foster the life-cycles of the others. These algorithms are published, implemented and distributed as part of a generic open source platform and library called Corese/KGram.

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BRIEF BIOGRAPHY

Fabien Gandon is Senior Research Scientist and HDR in Informatics and Computer Science at INRIA and he is the Leader of the Wimmics team at the Sophia-Antipolis Research Center. He is also a member of the World-Wide Web Consortium (W3C) where he participates in several standardization groups. His professional interests include: Web, Semantic Web, Social Web, Ontologies, Knowledge Engineering and Modelling, Mobility, Privacy, Context-Awareness, Semantic Social Network/ Semantic Analysis of Social Network, IntraWeb. He previously worked for the Mobile Commerce Laboratory of Carnegie Mellon in Pittsburgh.