Knowledge-aware and Conversational Recommender Systems

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ABSTRACT

More and more precise and powerful recommendation algorithms and techniques have been proposed over the last years able to effectively assess users' tastes and predict information that would probably be of interest for them. Most of these approaches rely on the collaborative paradigm (often exploiting machine learning techniques) and do not take into account the huge amount of knowledge, both structured and non-structured ones, describing the domain of interest for the recommendation engine. The aim of knowledge-aware and conversational recommender systems is to go beyond the traditional accuracy goal and to start a new generation of algorithms and interactive approaches which exploit the knowledge encoded in ontological and logic-based knowledge bases, knowledge graphs as well as the semantics emerging from the analysis and exploitation of semi-structured textual sources.

CCS CONCEPTS

• **Information systems** → *Social recommendation*; **Recommender systems**; *Ontologies*; • **Computing methodologies** → **Knowledge representation and reasoning**; **Semantic networks**;

KEYWORDS

knowledge-aware; linked data; knowledge graph; knowledge base; natural language processing; conversational agents

1 BACKGROUND AND MOTIVATION

While recommender systems are becoming part of our daily life in many and diverse situations, they start showing their limits in a tight interaction with human users. During the last years, thanks also to the new wave of deep learning approaches, a plethora of data-driven algorithms have been proposed that try to find latent connections among users and items. Despite their excellent results in terms of accuracy in recommending new items, such approaches very often miss a fundamental actor in the loop: the end user. Exploitation of the knowledge about the domain of interest of a catalog via reasoning as well as critiquing approaches are very common in the normal behavior of a human user, but they are not well codified in recommendation engines behaviors. Knowledge-based approaches have been proposed in the past [1, 2, 6, 7] but they have never reached the attention of a broad audience in the recommender systems community. Things have slightly changed with the Linking Open Data[1] initiative when a huge number of knowledge-graphs have been released and made freely available as RDF triples. These include encyclopedic datasets such as DBpedia[2] or, more recently, Wikidata[3] where semantics-aware information is available on different knowledge domains. The exploitation of such datasets together with their ontologies is at the basis of many approaches to recommendation and challenges proposed in the last years [3–5].

Conversational approaches to recommendation followed an analogous path. Consider a recommender which engages with its user to help her to articulate her short- or longer-term preferences. Consider also a recommender which invites the user to express an opinion about tentative recommendations in order to guide the recommender in making further recommendations. In both cases, there is a cycle of interactions between the user and the recommender. We refer to these as conversational recommenders. Note

[1] http://linkeddata.org
[2] https://dbpedia.org
[3] https://wikidata.org

that the phrase "conversational" as defined here neither implies, nor excludes, recommenders that conduct dialogs in natural language. A conversational recommender might converse in natural language, but it may allow more constrained modes of user interaction too. Research into conversational recommenders was a prominent strand in the late 1990s and early 2000s [8]. Papers on preference elicitation through question-asking and on recommendation critiquing (*like this but cheaper*) were common. While research and development into conversational recommenders has never gone away, it has certainly been less prominent for a while.

2 OBJECTIVES

The *Knowledge-aware and Conversational Recommender Systems* (KaRS) Workshop focuses on all aspects related to the exploitation of external and explicit knowledge sources to feed and build a recommendation engine. The aim is to go beyond the traditional accuracy goal and to start a new generation of algorithms and approaches which exploit the knowledge encoded in ontological and logic-based knowledge bases,knowledge graphs as well as the semantics emerging from the analysis of semi-structured textual sources.The aim of the workshop is to bring together researchers and practitioners around the topics of designing and evaluating novel approaches for recommender systems in order to:

- share research and techniques, including new design technologies and evaluation methodologies,
- identify next key challenges in the area, and
- identify emerging topics.

This workshop aims at establishing an interdisciplinary community with a focus on the exploitation of (semi-)structured knowledge for recommender systems and promoting the collaboration opportunities between researchers and practitioners. We particularly encourage demos and mock-ups of systems to be used as a basis of a lively and interactive discussion in the workshop.

3 TOPICS OF INTEREST

The topics of interest include (but are not limited to):

- Knowledge-aware data models based on structured knowledge sources (e.g., Linked Open Data, BabelNet, Wikidata, etc.)
- Semantics-aware approaches exploiting the analysis of textual sources (e.g., Wikipedia, Social Web, etc.)
- Knowledge representation and Automated Reasoning for recommendation engines
- Knowledge-aware explanations to recommendations (compliant with the General Data Protection Regulation)
- Using knowledge sources for cross-lingual recommendations
- User studies (e.g., on the user's perception of knowledge-based recommendations), field studies, in-depth experimental offline evaluations
- Critiquing in conversational recommenders
- Question-asking in conversational recommenders
- Active learning in conversational recommenders
- User modelling for knowledge-aware and conversational recommenders
- Natural language processing and interaction with recommenders

- Speech interfaces and Dialogue management for conversational recommenders
- UX design for conversational recommenders
- Conversation analysis for conversational recommenders
- Conversational group recommenders
- Interaction methods in conversational recommenders

4 PROGRAM COMMITTEES

Each submitted paper has been reviewed by at least three members of the workshop PC:

- Toine Bogers, Aalborg University Copenhagen, Denmark
- Ludovico Boratto, Eurecat, Barcelona, Spain
- Alessandro Bozzon, TU Delft, The Netherlands
- John Breslin, National University of Ireland, Galway, Ireland
- Robin Burke, DePaul University, Chicago, USA
- Annalina Caputo, ADAPT centre, School of Computer Science and Statistics, Trinity College Dublin, Ireland
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