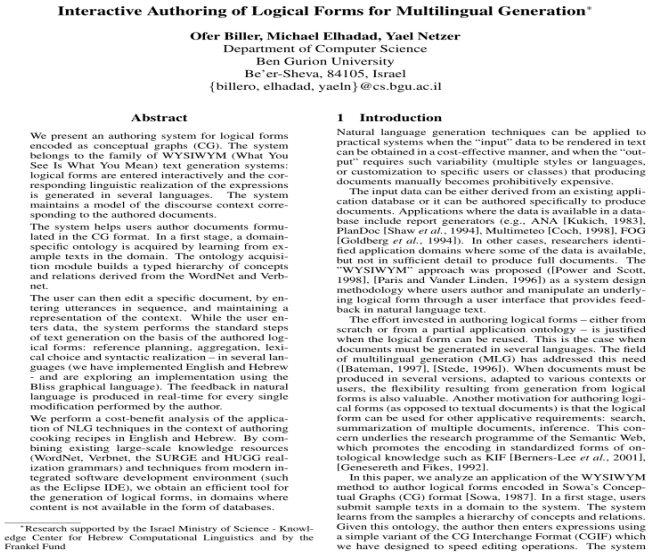
Lexical Semantics And Knowledge Representation In Multilingual Text Generation



Interactive Authoring of Logical Forms for Multilingual Generation*

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Abstract

We present an authoring system for logical forms encoded as conceptual graphs (CG). The system belongs to the family of WYSIWYM (What You See Is What You Mean) text generation systems: logical forms are entered interactively and the corresponding linguistic realization of the expressions is generated in several languages. The system maintains a model of the discourse context corresponding to the authored documents.

The system helps users author documents formulated in the CG format. In a first stage, a domain-specific ontology is acquired by learning from example texts in the domain. The ontology acquisition module builds a typed hierarchy of concepts and relations derived from the WordNet and Verbnet.

The user can then edit a specific document, by entering utterances in sequence, and maintaining a representation of the context. While the user enters data, the system performs the standard steps of text generation on the basis of the authored logical forms: reference planning, aggregation, lexical choice and syntactic realization – in several languages (we have implemented English and Hebrew – and are exploring an implementation using the Bliss graphical language). The feedback in natural language is produced in real-time for every single modification performed by the author.

We perform a cost-benefit analysis of the application of NLG techniques in the context of authoring cooking recipes in English and Hebrew. By combining existing large-scale knowledge resources (WordNet, Verbnet, the SURGE and HUGG realization grammars) and techniques from modern integrated software development environment (such as the Eclipse IDE), we obtain an efficient tool for the generation of logical forms, in domains where content is not available in the form of databases.

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1 Introduction

Natural language generation techniques can be applied to practical systems when the "input" data to be rendered in text can be obtained in a cost-effective manner, and when the "output" requires such variability (multiple styles or languages, or customization to specific users or classes) that producing documents manually becomes prohibitively expensive.

The input data can be either derived from an existing application database or it can be authored specifically to produce documents. Applications where the data is available in a database include report generators (e.g., ANA [Kukich, 1983], PlanDoc [Shaw *et al.*, 1994], Multimeteo [Coch, 1998], FOG [Goldberg *et al.*, 1994]). In other cases, researchers identified application domains where some of the data is available, but not in sufficient detail to produce full documents. The "WYSIWYM" approach was proposed ([Power and Scott, 1998], [Paris and Vander Linden, 1996]) as a system design methodology where users author and manipulate an underlying logical form through a user interface that provides feedback in natural language text.

The effort invested in authoring logical forms – either from scratch or from a partial application ontology – is justified when the logical form can be reused. This is the case when documents must be generated in several languages. The field of multilingual generation (MLG) has addressed this need ([Bateman, 1997], [Stede, 1996]). When documents must be produced in several versions, adapted to various contexts or users, the flexibility resulting from generation from logical forms is also valuable. Another motivation for authoring logical forms (as opposed to textual documents) is that the logical form can be used for other applicative requirements: search, summarization of multiple documents, inference. This concern underlies the research programme of the Semantic Web, which promotes the encoding in standardized forms of ontological knowledge such as KIF [Berners-Lee *et al.*, 2001], [Genesereth and Fikes, 1992].

In this paper, we analyze an application of the WYSIWYM method to author logical forms encoded in Sowa's Conceptual Graphs (CG) format [Sowa, 1987]. In a first stage, users submit sample texts in a domain to the system. The system learns from the samples a hierarchy of concepts and relations. Given this ontology, the author then enters expressions using a simple variant of the CG Interchange Format (CGIF) which we have designed to speed editing operations. The system

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