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Bridging Inference Based Sentence Linking Model for Semantic Coherence

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ABSTRACT

As the various social Medias emerge on the web, how to link the large scale of unordered short texts with semantic coherence is becoming a practical problem since these short texts have vast decentralized topics, weak associate relations, abundant noise and large redundancy. The challenging issues to solve the above problem includes what knowledge foundation supports sentence linking process and how to link these unordered short texts for pursuing well coherence. Herein, the authors develop bridging inference based sentence linking model by simulating human beings' discourse bridging process, which narrows semantic coherence gaps between short texts. Such model supports linking process by implicit and explicit knowledge and proposes different bridging inference schemas to guide the linking process. The bridging inference based linking process under different schemas generates different semantic coherence including central semantics, concise semantics and layered semantics etc. To validate the bridging inference based sentence linking model, the authors conduct some experiments. Experimental results confirm that the proposed bridging inference based sentence linking process increases semantic coherence. The model can be used in short-text origination, e-learning, e-science, web semantic search, and online question-answering system in the future works.

KEYWORDS

Bridging Inference, Cognitive Informatics, Cognitive Semantics, Linking Process, Semantic Coherence

1. INTRODUCTION

As various novel web social media appears, a large volume of short messages are transmitted by sentences such as Twitter, Facebook, micro-blogs, etc. In the volume short messages, two associated short texts belonging to one topic may be far away from each other and thus have weak associate relations between them since the weak association relations between short texts are being diluted by short text ocean on web, resulting in mass decentralized topics, large redundancy, and abundant noises. Therefore, it is a significant and practical problem to study how to link some unordered short texts in a semantic coherence way in large scale web data environment. However, direct research on sentence links is a difficult problem because of no well-round mathematic methods and no already standards dataset of short text. For simplicity, we use sentences to refer short texts in the follow parts since the short texts and sentences are alike in length.

Coherence is defined as a "continuity of senses" and "the mutual access and relevance within a configuration of concepts and relations" [Beaugrande and Dressler 1981]. In the human discourse process, semantic coherence is a key problem and thus readers routinely attempt to construct coherent

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meanings by inference [Graesser, et al. 1994; Ferstl and Cramon 2001;Kintsch 1988; Singer 1994]. Among the inferences, bridging inference is particularly central to the textual semantic coherence, which adds bridges between sentences to narrow semantic gaps between sentences [Kim 1999; Mckoon and Ratcliff 1992; Graesser et al. 1994; Singer 1990].

Figure 1 shows the bridging inference process when human beings face unordered sentence. The reader first acquires the meaning at terms/sentence level as the explicit knowledge (shown as steps 1-2). Then, he/she makes bridging inference to narrow the semantic gaps between the sentences by the explicit knowledge (shown as step 3). If the linked sentences are semantic incoherence, the human bridging inference process activates implicit bridges from domain knowledge to link sentences (shown as loop in steps 3-6) [McKoon and Ratcliff, 1992; O'Brien et al., 1988; Singer and Ferreira, 1983]. Less semantic coherence of the sentences are, more bridging inference are added to link sentences [Johnson et al., 1973] (shown as steps 7-8).

Obviously the above manually process is too time-consuming to link the large scale unordered sentence on web. To solve the above issue, inspired by cognitive Informatics and cognitive computation [Wang et al., 2012, 2013], we propose bridging inference based linking model which simulates bridging inference in discourse process for linking unordered sentences on web.

The rest of the paper is organized as follows: the next section discusses how the bridge inference works in human discourse bridge coherence and proposes a framework of bridging inference based sentence linking model. Section 3 proposes knowledge representation as knowledge foundation to supports bridging inference based linking process; Section 4 discusses semantic coherence measurement for detecting coherence change caused by semantic gap between unordered sentences; Section 5 proposes three bridging inference schema for guiding the linking process. Section 6 develops sentence linking process for linking unordered sentences on web. Section 7 carries out plenty experiments to verify the effectiveness of the linking process. Conclusion is given in section 8.

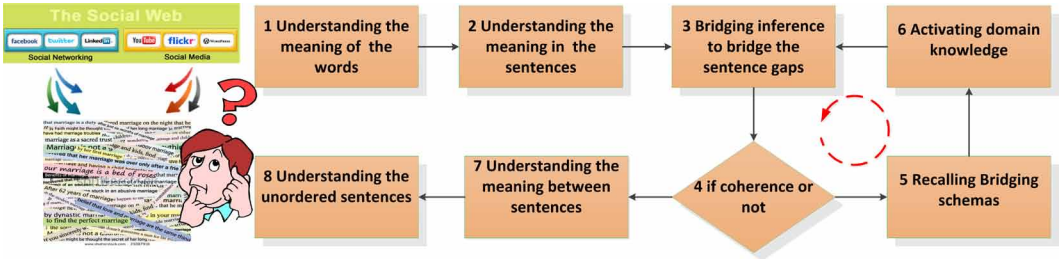
2. HOW BRIDGING INFERENCE TO LINK UNORDERED SENTENCES

This section gives how the bridging inference works in human discourse coherence and proposes a framework of bridging inference based sentence linking model.

2.1. Bridge Inference Process for Discourse Coherence

Bridging inference is one type of inferences by which objects or events in sentences are connected in a meaningful way so as to create coherence discourse [Levinson 2000; Matsui 2001]. Bridging inference includes explicit bridging inference and implicit bridging inference. Explicit bridging inference links discourse by the explicit meaning in discourse context; implicit bridging inference links discourse by implicit meaning in domain knowledge [Grice, 1975; Bach, 1994; Recanati, 1989; 1993; Levinson, 2000; Moeshler, 2012]. After bridging inference, the discourse sentences are linked in semantic coherence way and the whole discourse is understood [Clark and Haviland, 1977].

Figure 1. Human beings' bridging inference process to link unordered sentences



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