Chapter 52
A Novel Approach to Managing the Dynamic Nature of Semantic Relatedness

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ABSTRACT

This research proposes a novel method of measuring the dynamics of semantic relatedness. Research on semantic relatedness has a long history in the fields of computational linguistics, psychology, computer science, as well as information systems. Computing semantic relatedness has played a critical role in various situations, such as data integration and keyword recommendation. Many researchers have tried to propose more sophisticated techniques to measure semantic relatedness. However, little research has considered the change of semantic relatedness with the flow of time and occurrence of events. The authors' proposed method is validated by actual corpus data collected from a particular context over a specific period of time. They test the feasibility of our proposed method by constructing semantic networks by using the corpus collected during a different period of time. The experiment results show that our method can detect and manage the changes in semantic relatedness between concepts. Based on the results, the authors discuss the need for a dynamic semantic relatedness paradigm.

INTRODUCTION

Studies on the measurement of semantic relatedness, or similarity between concepts, have a long history in the fields of computational linguistics, psychology and computer science. Resolutions to various issues regarding semantic ambiguity often boil down to methods of relatedness or similarity between concepts.

Humans are very intuitive in determining similarity or relatedness between concepts but designing a computer to perform such a task is very difficult (Sheth, Aleman-Meza, Arpinar, & Bertram, 2005). The most widely used method for calculating similarity is to employ a ready-made ontology or taxonomy. Specifically, various WordNet-based methods (Resnik, 1995; Jiang & Conrath, 1997) have produced a relatively high level of performance.

The method of using auxiliary information such as ontology or taxonomy is based on the premise that the semantic relatedness between concepts will not change as time goes by. We call it the *static semantic relatedness paradigm* (Resnik, 1995; Jarmasz & Szpakowicz, 2004). Based on the assumption of static semantic relatedness, semantic similarity is measured at a particular point in time with an ontology, taxonomy, or thesaurus. In this case, the ontology or taxonomy is directly written in advance by humans.

However, such a static semantic relatedness paradigm has been challenged by the dynamic nature of information due to the development of knowledge-sharing systems and the spread of information. As new events and the social contexts around them continue to influence how people think, the nature of relationships between concepts may change. At the same time, the events that make the nature of relatedness between concepts dynamic spread rapidly as shared knowledge via information-sharing services and technologies such as social network or news feed. In this regard, there is a need for a paradigm shift toward a *dynamic semantic relatedness paradigm*. In this paper, we use the term "*dynamic semantic relatedness paradigm*" to describe the research considering the dynamics of semantic relatedness. If a change in semantic relatedness occurs due to a particular event which can affect the human thinking process, the existing methods of the static semantic relatedness paradigm cannot fully reflect this dynamic for the following reasons: normally, the existing auxiliary information (i.e., an ontology, taxonomy, or thesaurus) is not updated frequently due to the fact that recognizing the occurrence of semantic changes and rewriting the ontology or making a new taxonomy requires considerable effort. As a result, it is difficult to maintain up-to-date auxiliary information. In addition, the existing auxiliary information refers only to the semantic relatedness relevant for general situations. For example, reaching the conclusion that "Apple" and "Music" are closely connected is difficult by using WordNet[1].

The dynamics of semantic relatedness have not received much attention that they deserve in the semantic relatedness research. Some related studies hint at the idea of incorporating dynamics of semantic relatedness and propose algorithms to address the issue but are insufficient in terms of their complexity and agility to cope with dynamics. So, we present a critical review of existing research following *static* and dynamic *semantic relatedness paradigms* and address how to deal with the dynamics in semantic relatedness better than previous works.

In this context, a new computational approach to the semantic relatedness that takes into consideration of dynamic nature of the postulated semantic relatedness is necessary. In this regard, contributions of this study can be summarized as follows:

- We propose a novel method to corpus-based semantic relatedness calculation by constructing semantic networks that reflect the time and context-dependency nature of the corpus.
- The rationality of the proposed method is validated by experimental evaluation using actual corpus data collected from a particular context over a specific period of time.
- This approach enables quantification of the change of semantic relatedness among specific concepts as well as the dynamics of a semantic network itself.
- Based on the above, the necessity of a dynamic semantic relatedness paradigm is demonstrated.

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