Deep Lexical Semantics

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Abstract. In the project we describe, we have taken a basic core of about 5000 synsets in WordNet that are the most frequently used, and we have categorized these into sixteen broad categories, including, for example, time, space, scalar notions, composite entities, and event structure. We have sketched out the structure of some of the underlying abstract core theories of commonsense knowledge, including those for the mentioned areas. These theories explicate the basic predicates in terms of which the most common word senses need to be defined or characterized. We are now encoding axioms that link the word senses to the core theories. This may be thought of as a kind of "advanced lexical decomposition", where the "primitives" into which words are "decomposed" are elements in coherently worked-out theories. In this paper we focus on our work on the 450 of these synsets that are concerned with events and their structure.

1 Introduction

Words describe the world, so if we are going to draw the appropriate inferences in understanding a text, we must have underlying theories of aspects of the world and we must have axioms that link these to words. This includes domain-dependent knowledge, of course, but 70-80% of the words in most texts, even technical texts, are words in ordinary English used with their ordinary meanings. For example, so far in this paragraph, only the words "theories" and "axioms" and possibly "domain-dependent" have been domain-dependent.

Domain-independent words have such wide utility because their basic meanings tend to be very abstract, and they acquire more specific meanings in combination with their context. Therefore, the underlying theories required for explicating the meanings of these words are going to be very abstract.

For example, a core theory of scales will provide axioms involving predicates such as *scale*, $<$, *subscale*, *top*, *bottom*, and *at*. These are abstract notions that apply to partial orderings as diverse as heights, money, and degrees of happiness. Then, at the "lexical periphery" we will be able to define the rather complex word "range" by the following axiom:

$$\begin{aligned}
&(\forall\, x, y, z) range(x, y, z) \equiv \\
&\quad (\exists\, s, s_1, u_1, u_2) scale(s) \wedge subscale(s_1, s) \wedge bottom(y, s_1) \\
&\qquad \wedge\, top(z, s_1) \wedge u_1 \in x \wedge at(u_1, y) \wedge u_2 \in x \wedge at(u_2, z) \\
&\qquad \wedge\, (\forall\, u \in x)(\exists\, v \in s_1) at(u, v)
\end{aligned}$$