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Word Reordering and a Dynamic Programming Beam Search Algorithm for Statistical Machine Translation

Christoph Tillmann and Hermann Ney

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In this article, we describe an efficient beam search algorithm for statistical machine

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translation based on dynamic programming (DP). The search algorithm uses the translation model presented in Brown et al. (1993). Starting from a DP-based solution to the traveling-salesman problem, we present a novel technique to restrict the possible word reorderings between source and target language in order to achieve an efficient search algorithm. Word reordering restrictions especially useful for the translation direction German to English are presented. The restrictions are generalized, and a set of four parameters to control the word reordering is introduced, which then can easily be adopted to new translation directions. The beam search procedure has been successfully tested on the Verbmobil task (German to English, 8,000-word vocabulary) and on the Canadian Hansards task (French to English, 100,000-word vocabulary). For the medium-sized Verbmobil task, a sentence can be translated in a few seconds, only a small number of search errors occur, and there is no performance degradation as measured by the word error criterion used in this article.

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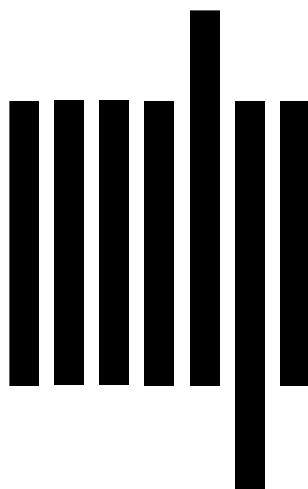
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