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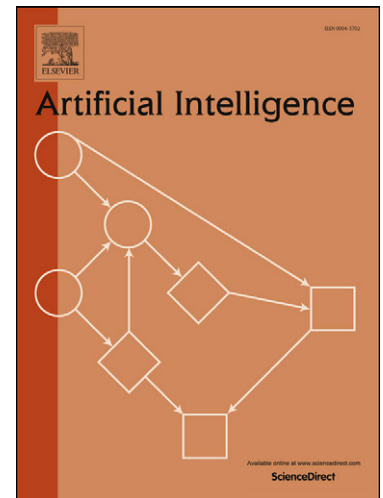
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Inducing semantic relations from conceptual spaces: a data-driven approach to plausible reasoning

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Abstract

Commonsense reasoning patterns such as interpolation and a fortiori inference have proven useful for dealing with gaps in structured knowledge bases. An important difficulty in applying these reasoning patterns in practice is that they rely on fine-grained knowledge of how different concepts and entities are semantically related. In this paper, we show how the required semantic relations can be learned from a large collection of text documents. To this end, we first induce a conceptual space from the text documents, using multi-dimensional scaling. We then rely on the key insight that the required semantic relations correspond to qualitative spatial relations in this conceptual space. Among others, in an entirely unsupervised way, we identify salient directions in the conceptual space which correspond to interpretable relative properties such as ‘more fruity than’ (in a space of wines), resulting in a symbolic and interpretable representation of the conceptual space. To evaluate the quality of our semantic relations, we show how they can be exploited by a number of commonsense reasoning based classifiers. We experimentally show that these classifiers can outperform standard approaches, while being able to provide intuitive explanations of classification decisions. A number of crowdsourcing experiments provide further insights into the nature of the extracted semantic relations.

Keywords: Conceptual spaces, Dimensionality reduction, Qualitative spatial relations, Commonsense reasoning

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