#39 Topic: Putting a Spin on Language

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Abstract:

One of the biggest challenges in Artificial Intelligence (AI) is to make a computer understand and formulate coherent and meaningful discourse in natural language. The main direction to codify the elusive notion of meaning involves representing words as vectors, that incorporate information such as their distribution. By construction, these vectors are agnostic to any grammatical structure, being used in specific tasks like word similarity. Therefore, the next step is to embed the vector representations in a grammar, allowing computers to use the meanings of individual words to compute the meanings of a strings of words, as in the meaning of "man bites dog" from the meanings of "man", "bites" and "dog".
To achieve this, words in a sentence can be seen to have a function-argument relationship, in which basic words, like nouns, are arguments and complex words, like verbs, are functions. Mirroring this, basic words can be described by rank-1 tensors and complex words by higher order tensors. The meaning of a grammatical string of words is then obtained via tensor contraction, behaving like a quantum process acting on vectors viewed as states. What we propose is an expansion to the use of density matrices instead, with the advantage of including ensembles of states too, and the attachment of an extra spin state to each word to deal with ambiguous readings, contributing to a promising line of research at the intersection of AI and Quantum Computing.