

Another application of knowledge bases and distributed representations for them is **word-sense disambiguation** (Navigli and Velardi, 2005; Bordes *et al.*, 2012), which is the task of deciding which of the senses of a word is the appropriate one, in some context.

Eventually, knowledge of relations combined with a reasoning process and understanding of natural language could allow us to build a general question answering system. A general question answering system must be able to process input information and remember important facts, organized in a way that enables it to retrieve and reason about them later. This remains a difficult open problem which can only be solved in restricted “toy” environments. Currently, the best approach to remembering and retrieving specific declarative facts is to use an explicit memory mechanism, as described in section 10.12. Memory networks were first proposed to solve a toy question answering task (Weston *et al.*, 2014). Kumar *et al.* (2015) have proposed an extension that uses GRU recurrent nets to read the input into the memory and to produce the answer given the contents of the memory.

Deep learning has been applied to many other applications besides the ones described here, and will surely be applied to even more after this writing. It would be impossible to describe anything remotely resembling a comprehensive coverage of such a topic. This survey provides a representative sample of what is possible as of this writing.

This concludes part II, which has described modern practices involving deep networks, comprising all of the most successful methods. Generally speaking, these methods involve using the gradient of a cost function to find the parameters of a model that approximates some desired function. With enough training data, this approach is extremely powerful. We now turn to part III, in which we step into the territory of research—methods that are designed to work with less training data or to perform a greater variety of tasks, where the challenges are more difficult and not as close to being solved as the situations we have described so far.