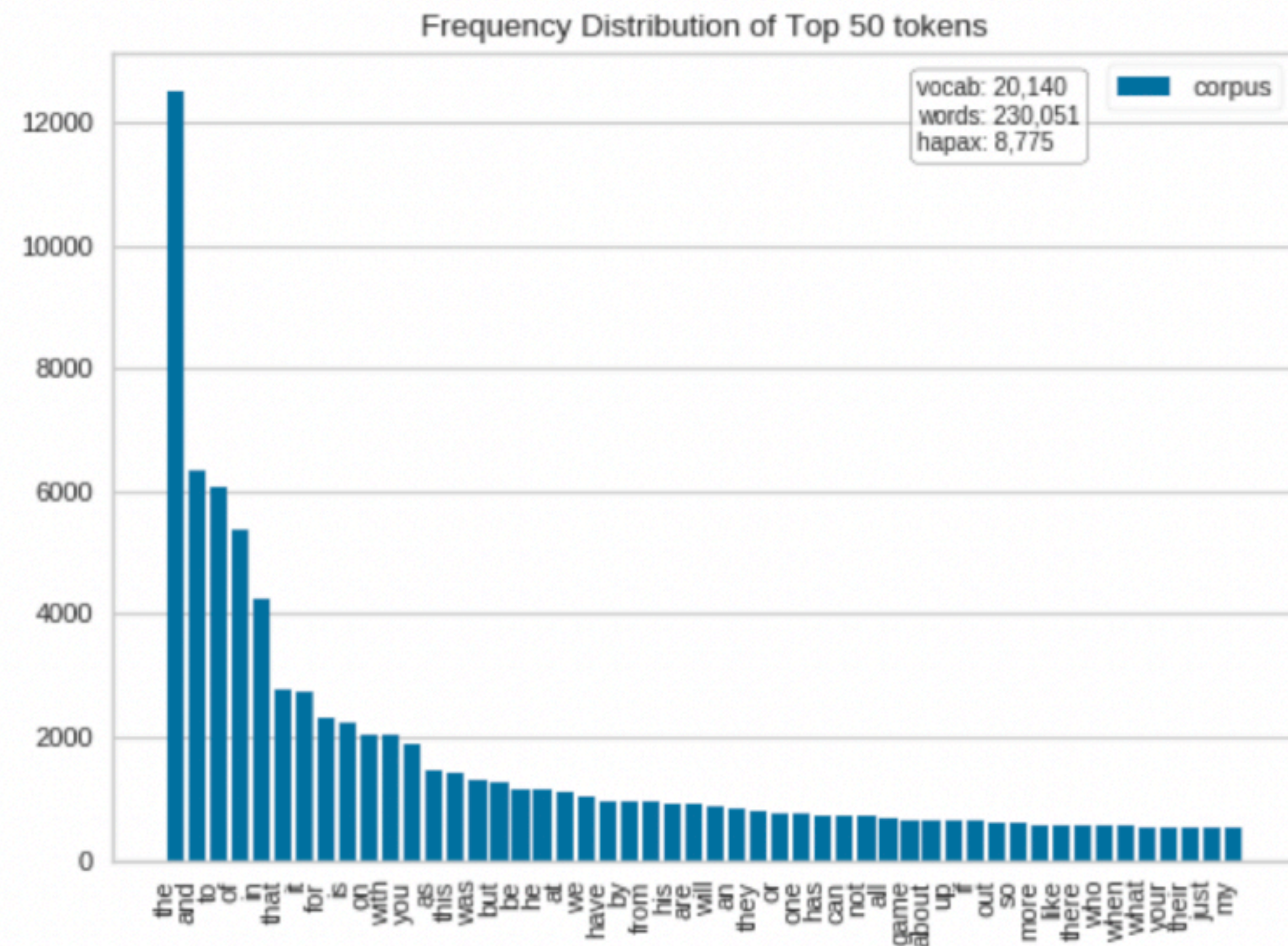


Why is modeling human language hard?

Non-uniform word distribution



The frequency of the k^{th} most frequent word is \sim proportional to $1/k$

- Zipf, 1949

Compositionality

Language is **compositional**: units such as words can combine to create phrases, which can combine by the very same principles to create larger phrases. For example, a **noun phrase** can be created by combining a smaller noun phrase with a **prepositional phrase**, as in *the whiteness of the whale*. The prepositional phrase is created by combining a preposition (in this case, *of*) with another noun phrase (*the whale*). In this way, it is possible to create arbitrarily long phrases, such as,

(1.1) ...huge globular pieces of the whale of the bigness of a human head.²

The meaning of such a phrase must be analyzed in accord with the underlying hierarchical structure. In this case, *huge globular pieces of the whale* acts as a single noun phrase, which is conjoined with the prepositional phrase *of the bigness of a human head*. The interpretation would be different if instead, *huge globular pieces* were conjoined with the prepositional phrase *of the whale of the bigness of a human head* — implying a disappointingly small whale. Even though text appears as a sequence, machine learning methods must account for its implicit recursive structure.

- Eisenstein, 2019, Chp 1

Why is conversation is hard?

World Knowledge

Domain knowledge

Discourse knowledge

