

# Introduction to Text Modeling

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# Key concepts

- modeling document collections
- probabilistic models of text
- Zipf's law
- bag of words representations

# Modelling text documents

Here is an article from the Daily Kos (a US political blog) from Feb 16 2014:

GOP abortion foes are criminalizing the doctor-patient relationship

"The doctor-patient relationship." For more than 20 years, conservative propagandists and their Republican allies have used that four-word bludgeon to beat back universal health care reform. In 1994, GOP strategist Bill Kristol warned that "the Clinton Plan is damaging to the quality of American medicine and to the relationship between the patient and the doctor." Kristol's successful crusade to derail Bill Clinton's reform effort was greatly aided by future "death panels" fabulist Betsy McCaughey, who wrongly warned that Americans would even lose the right to see the doctor of their choice. Twelve years later, President George W. Bush proclaimed, "Ours is a party that understands the best health care system is when the doctor-patient relationship is central to decision-making."

With the victory of Barack Obama in 2008, GOP spinmeister Frank Luntz told Republicans obstructing the Affordable Care Act in Congress to once again "call for the 'protection of the personalized doctor-patient relationship.'" And during the 2012 campaign, the GOP platform declared the party would "ensure the doctor-patient relationship."

...

Why would we model text documents?

How could we model this document?

# Example: word counts in text

Consider describing a text document by the frequency of occurrence of every distinct word.

The UCI *Bag of Words* dataset from the University of California, Irvine.<sup>1</sup>  
For illustration consider two collections of documents from this dataset:

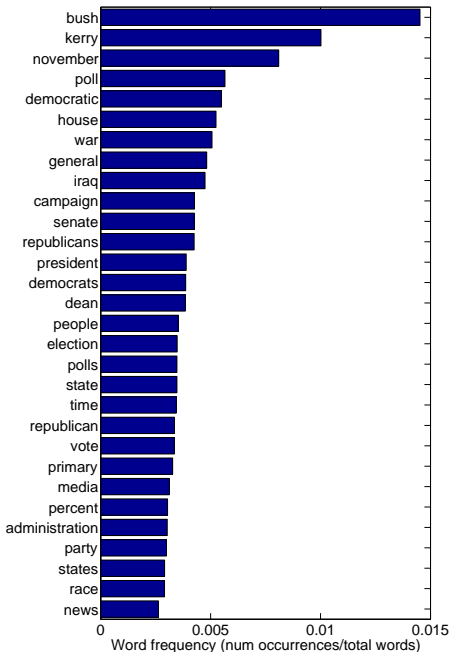
- KOS (political blog — <http://dailykos.com>):
  - $D = 3,430$  documents (blog posts)
  - $n = 353,160$  words
  - $m = 6,906$  *distinct* words
- NIPS (machine learning conference — <http://nips.cc>):
  - $D = 1,500$  documents (conference papers)
  - $n = 746,316$  words
  - $m = 12,375$  *distinct* words

no of (distinct) words per document is more than KOS, hence document is richer in content.

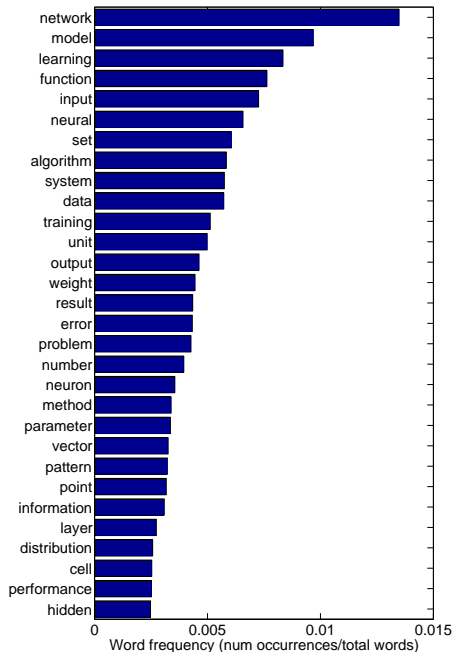
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<sup>1</sup><http://archive.ics.uci.edu/ml/machine-learning-databases/bag-of-words/>

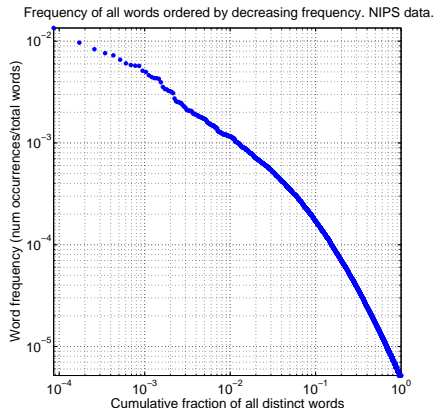
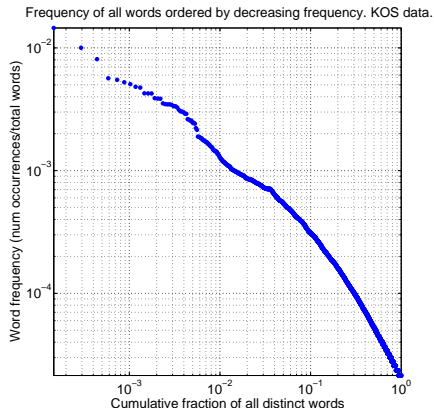
Frequency of the most frequent 30 words in the kos dataset



Frequency of the most frequent 30 words in the nips dataset



# Different text collections, similar behaviour



Zipf's law states that *the frequency of any word is inversely proportional to its rank in the frequency table.*

# Automatic Categorisation of Documents

Can we make use of the *statistical distribution* of words, to build an automatic document categorisation system?

- The learning system would have to be *unsupervised*
- We don't *a priori* know what categories of documents exist
- It must *automatically discover* the structure of the document collection
- What should it even mean, that a document belongs to a category, or has certain properties?

How can we design such a system?