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NLP IN PYTHON

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NLP IN PYTHON

WEEK 0

MANIPULATING TEXT

COURSE INTRODUCTION

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WHO AM I?

- Nick Hathaway, BR ‘17
- CS major, former English major (*gasp*)
- Digital Humanities, Linguistics, Journalism
- Teeth Slam Poets

NATURAL LANGUAGE PROCESSING

- Programs that:
  - "Understand" human speech or text
  - Mainly statistical
- Natural vs. artificial languages
  - Programming languages are unambiguous
  - Human speech, not so much

YOU'LL LEARN

- Text processing
  - Tokenization, stemming, built-in text corpora
  - Brown, Reuters, WordNet, make your own!
- Text classification
  - Naive Bayes inference, n-gram language models, sentence parsing, etc.
  - Classify by topic (Reuters) or by sentiment (imdb)

YOU'LL LEARN

- Evaluating your models
  - F-scores, MaxEnt, selecting appropriate training and testing sets
- Applications, MOOCs, and books for further study

SOURCES

- Natural Language Processing with Python, by Steven Bird, Ewan Klein, and Edward Loper. O'Reilly Media, 978-0-596-51649-9.
- MOOC: Natural Language Processing with Dan Jurafsky and Christopher Manning (Stanford, Coursera)

APPLICATIONS

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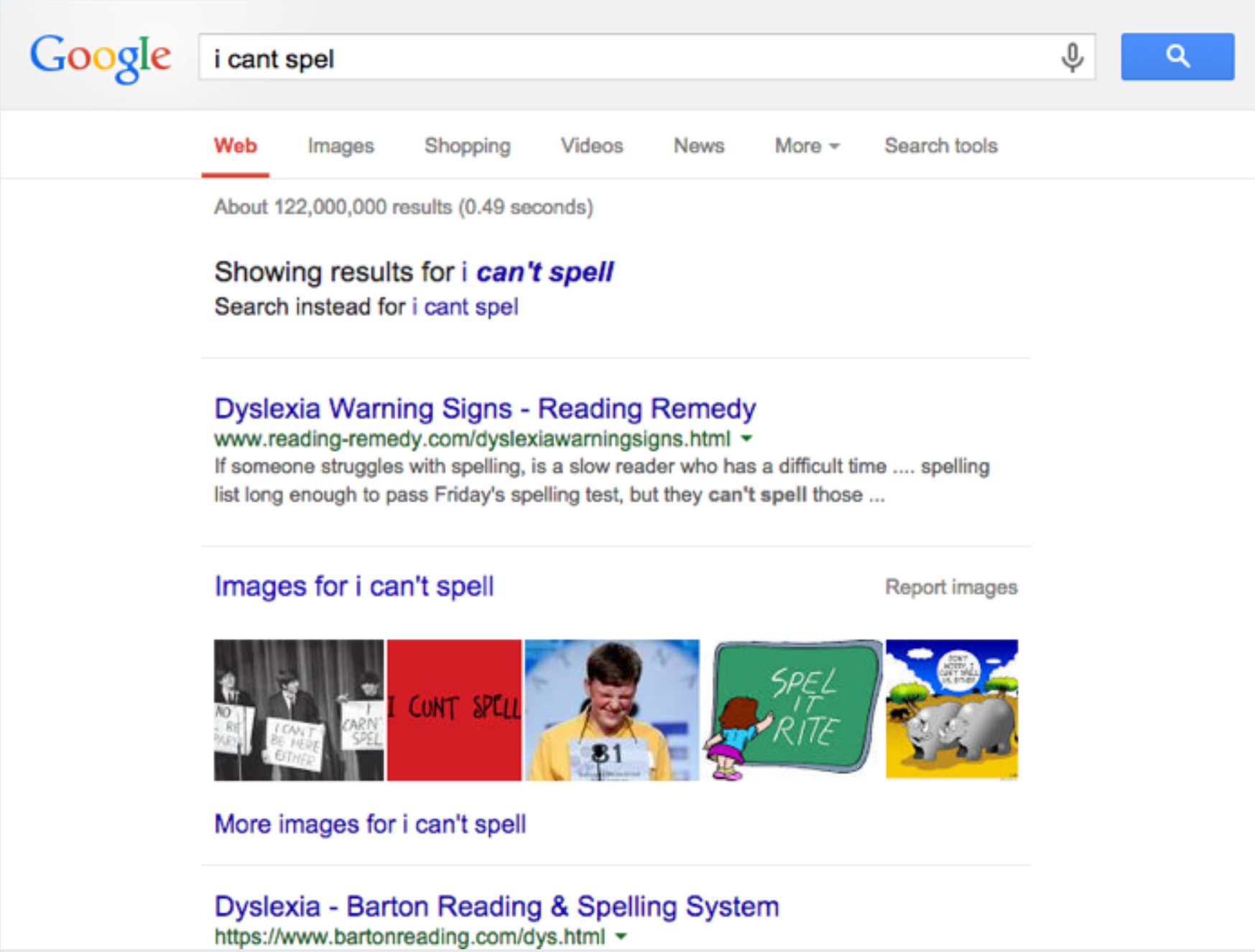
SPELL CHECKING



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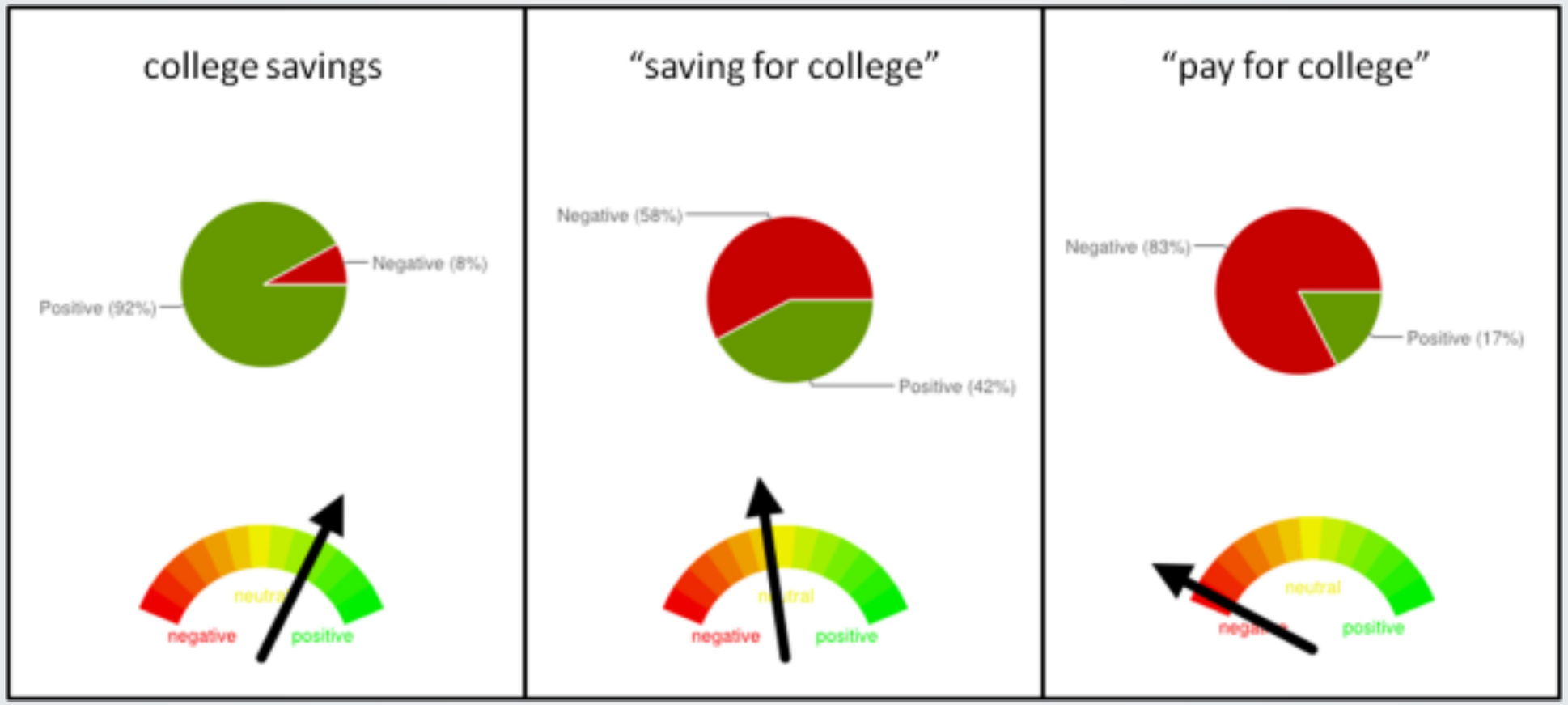
SPAM DETECTION

From	Subject
Adelaide Fatimah	a $12000 watch, we sell at $200, Quality watches at ...
antonino rodney	Goodiest c1alis
Irina Gidget	FDA Approved Medications: $1.12/pill forViagr...
tom@messagingtime...	tom@messagingtimes.com, Up to 20% OFF
Samantha Hickey	Enlarge, Widen and Strengthen
churchill ravi	MSG #:19846 The world's largest online presc...
abel yanjun	MSG #:84037 World's lowest prices on largest...
Maureen Orr	Recapture a bit of your youth again
nanako258@yahoo.c...	40□Î^È□ã,Å□S,à□g'Ì,à–ü,â,³,ê,½,¢•û,Í[–ü,â,...
Jerald Shook	a xmas gift to your wife is your bigger PE gs ft...
Blanca Petty	Mit und schaffen Sie das was Frauen wollern!
Lynne Mcneal	xp oem software
emerson forrest	from Stella Vargas
Revolution Jobs	Hundreds of digital careers on Revolution Jobs
Auto Loan Department	GET APPROVED!
jacquelyn	hi from jacquelyn
ParkRoyalCancun	Visit Cancun With A 3 Night Free Stay - No Pur...
Colon Cleanse Samples	View this LifeChanging Breakthrough
o05689ok97@tom.com	40□Î^È□ã,Å□S,à□g'Ì,à–ü,â,³,ê,½,¢•û,Í[–ü,â,...

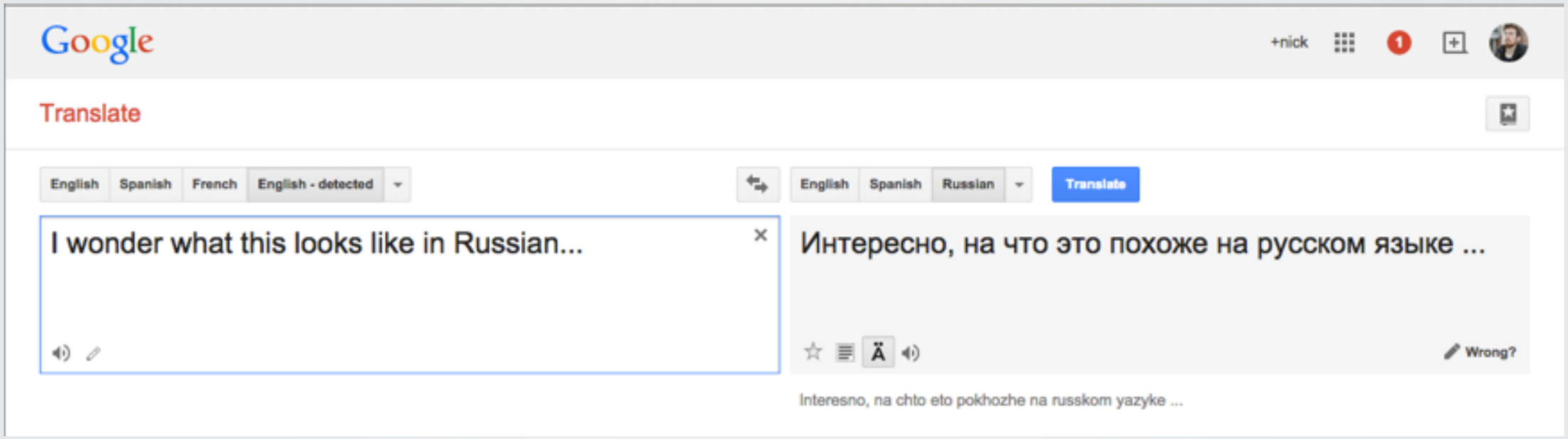
CREDIT: GROUPMAIL

SENTIMENT ANALYSIS

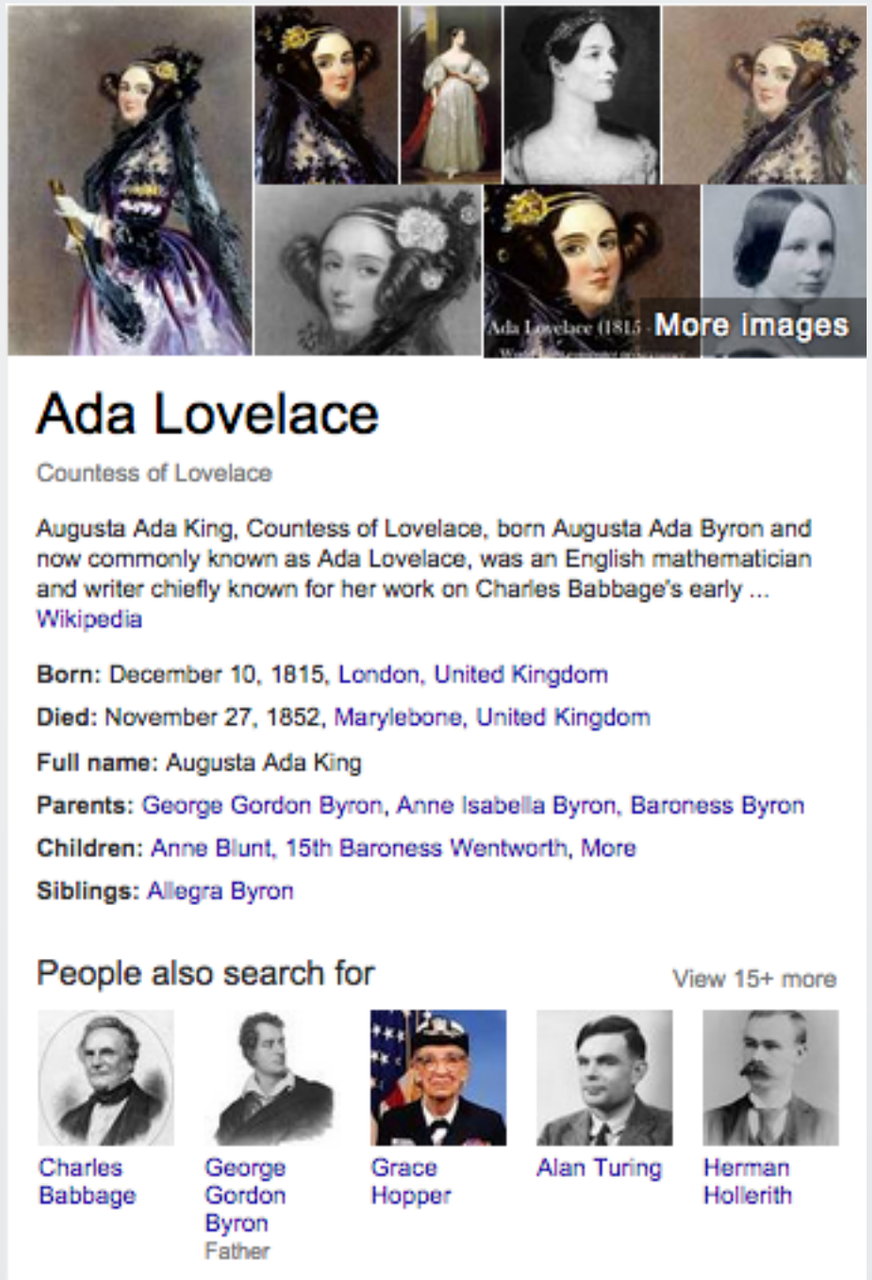


CREDIT: HUTCH CARPENTER, I'M NOT ACTUALLY A GEEK BLOG
VIA SENTIMENT140 & SENTIMENT ANALYZER

MACHINE TRANSLATION



INFORMATION EXTRACTION



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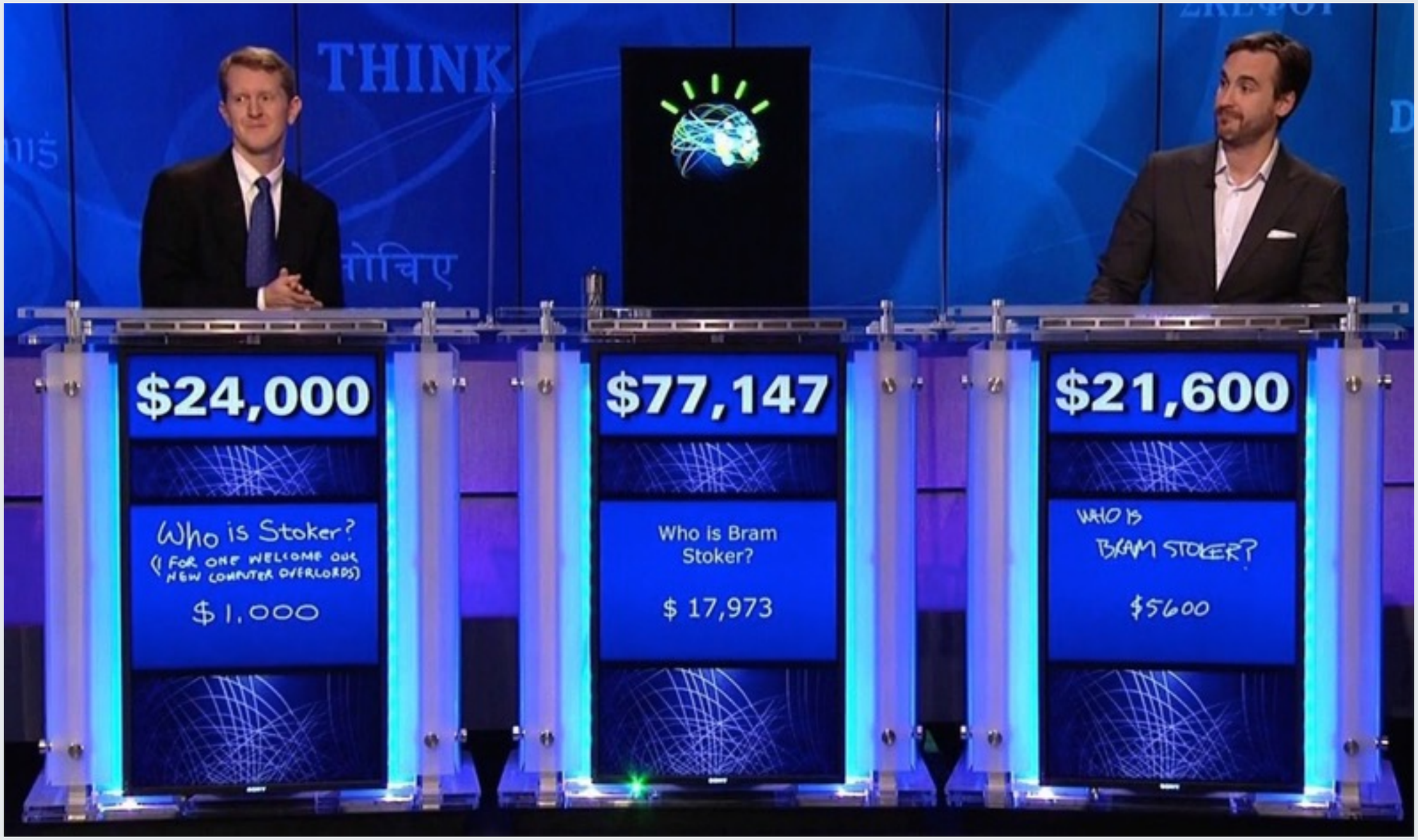
IBM WATSON



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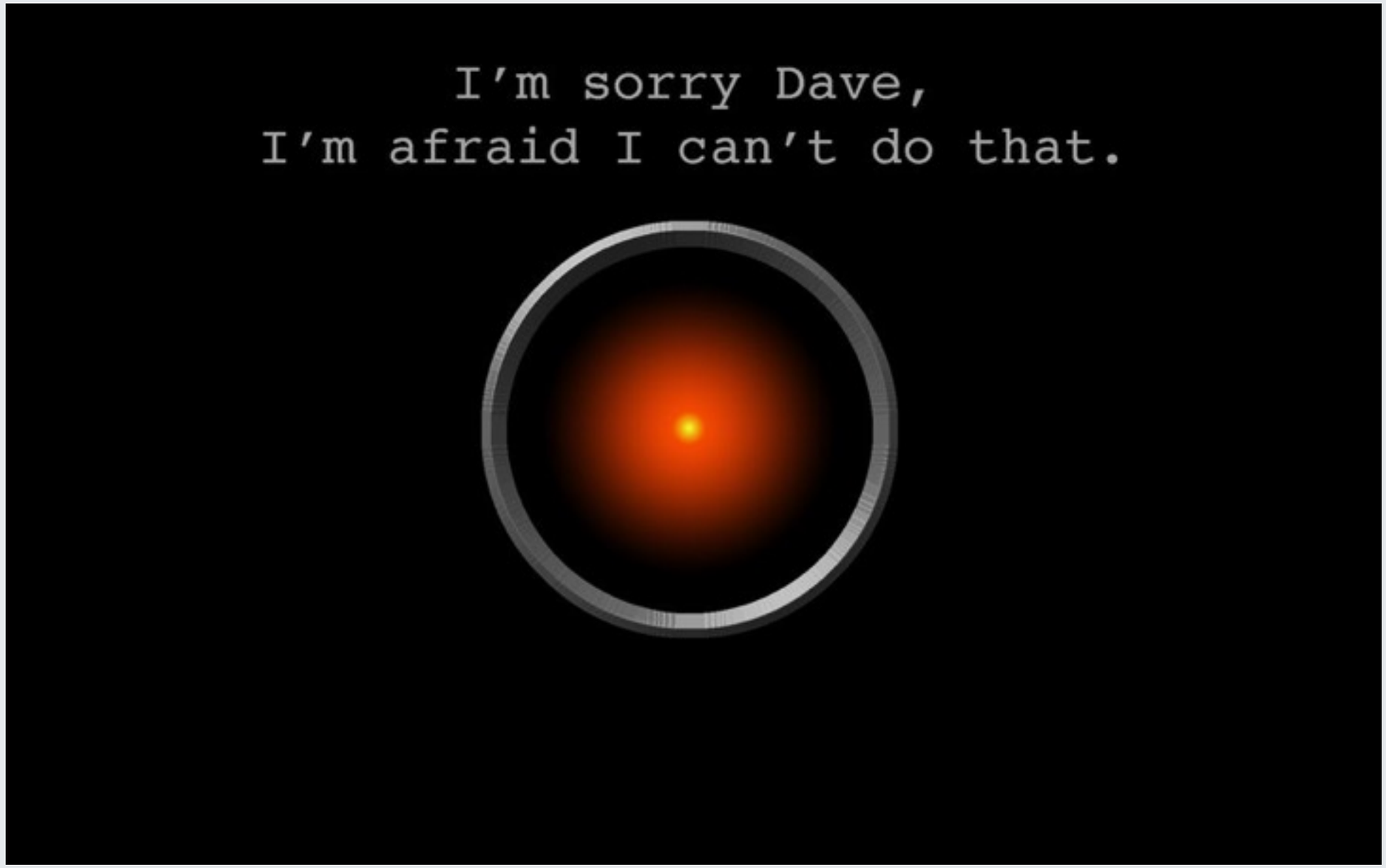
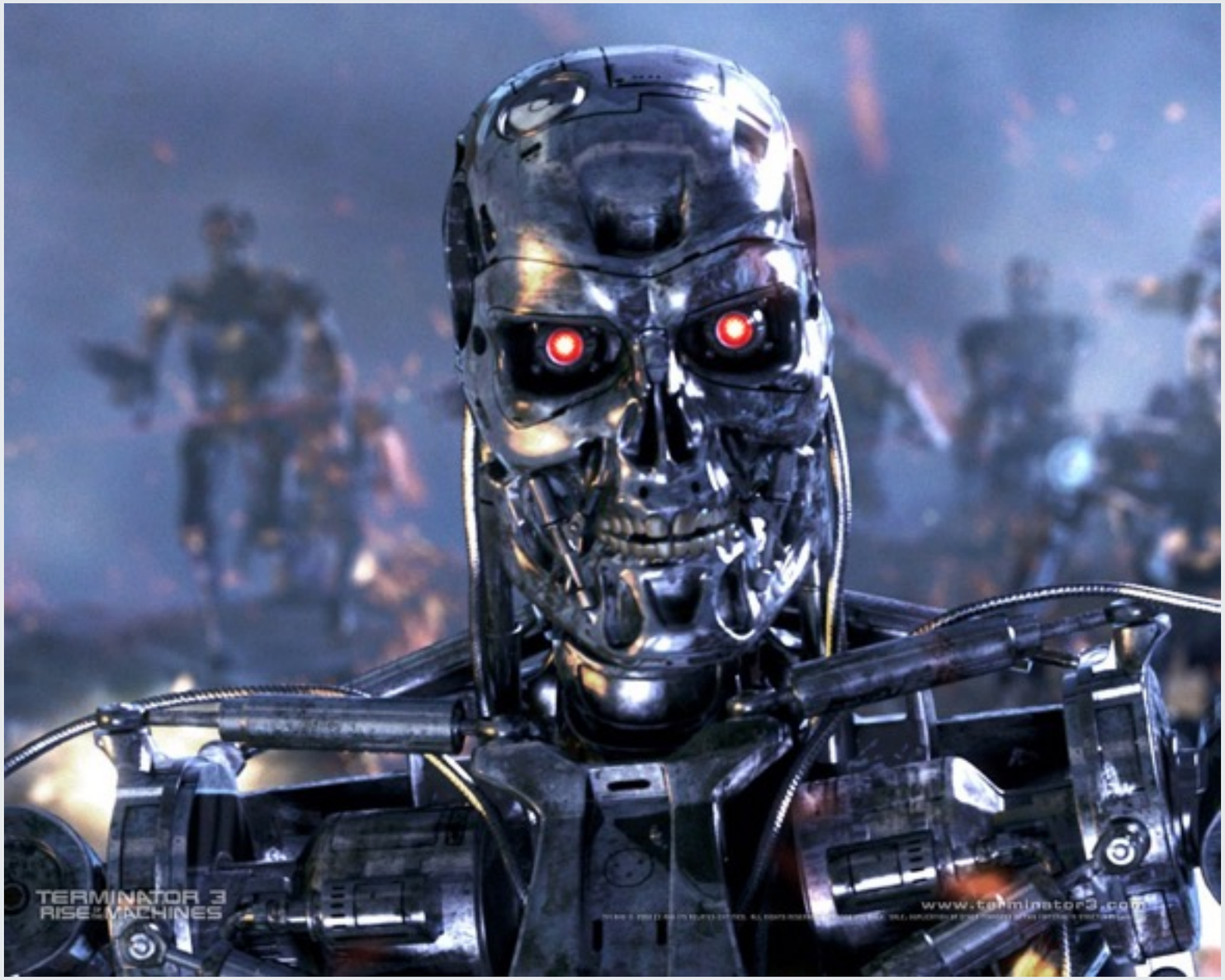
DIALOG SYSTEMS

DIALOG SYSTEMS



CREDIT: ABOIET COUNSELING & THERAPY GROUP

ELIMINATE ALL HUMANS



CREDIT: TERMINATOR FRANCHISE &
OUR FUTURE ROBOT OVERLORDS

GETTING STARTED

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WHY PYTHON?

- String processing methods
- Excellent statistical libraries
  - Pandas, numpy, etc.
- Natural Language Toolkit
  - Created in 2002
  - > 50 text resources

ALTERNATIVES

- Java
  - StanfordNLP, mallet, OpenNLP
- Ruby
  - Treat, open-nlp

STRING MANIPULATION

```
string = “This is a great sentence.”
string = string.split()

string[:4]
=> [“This”, “is”, “a”, “great”]
string[-1:]
=> “sentence.”
string[::-1]
=> [“sentence.”, “great”, “a”, “is”, “This”]
```

FILE I/O

```
f = open(‘sample.txt’, ‘r’)

for line in f:
   line = line.split()
   for word in line:
      if word [-2:] == ‘ly’:
         print word
```

SET-UP

NLTK: http://www.nltk.org/install.html

NLTK DATA:

```
import nltk
nltk.download()
```

Matplotlib:

```
$ pip install matplotlib
```

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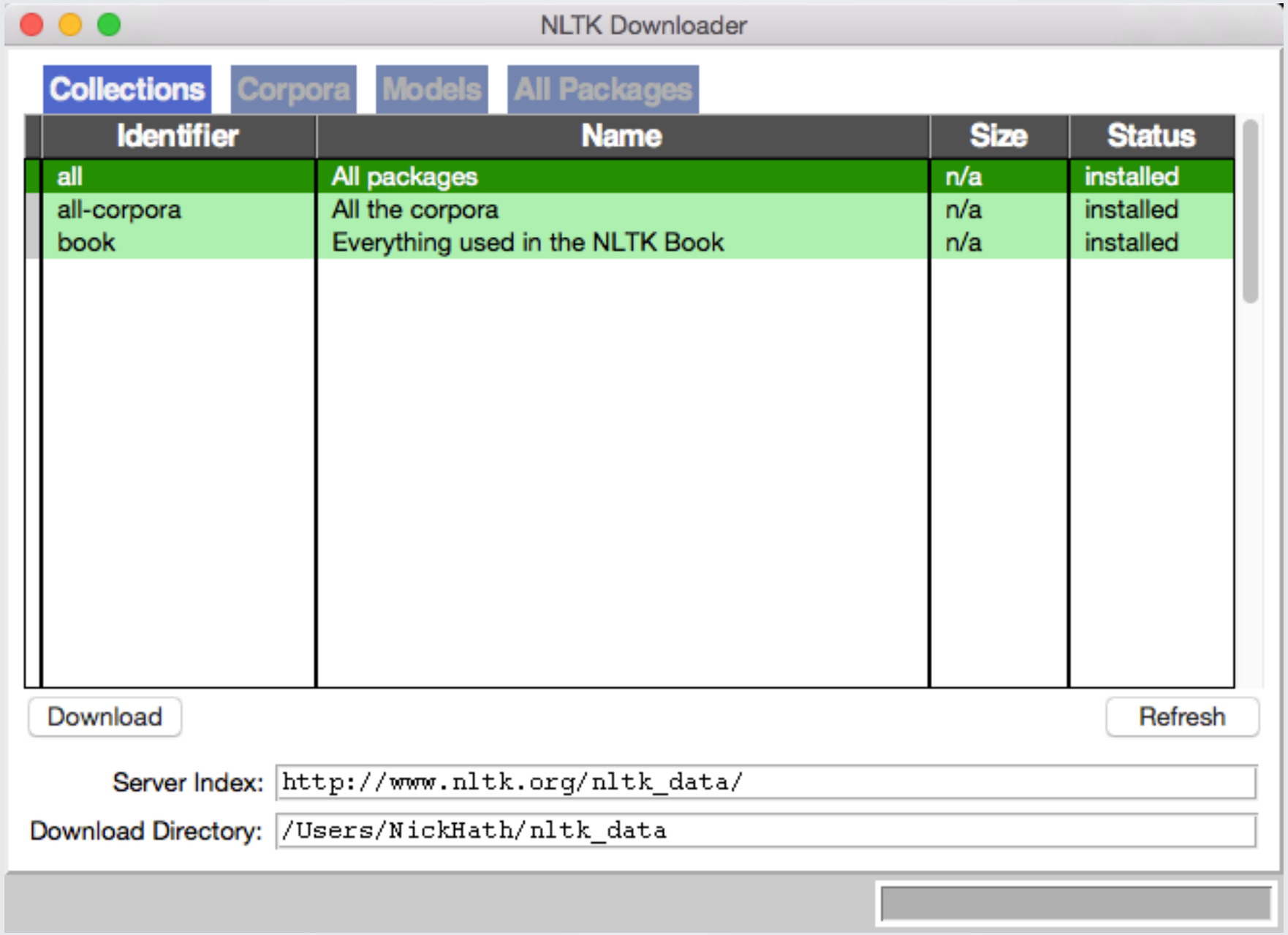
NLTK.DOWNLOAD()



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WEEK 0

- nltk.corpus
- nltk.tokenize
- nltk.chat

WHAT IS A CORPUS?

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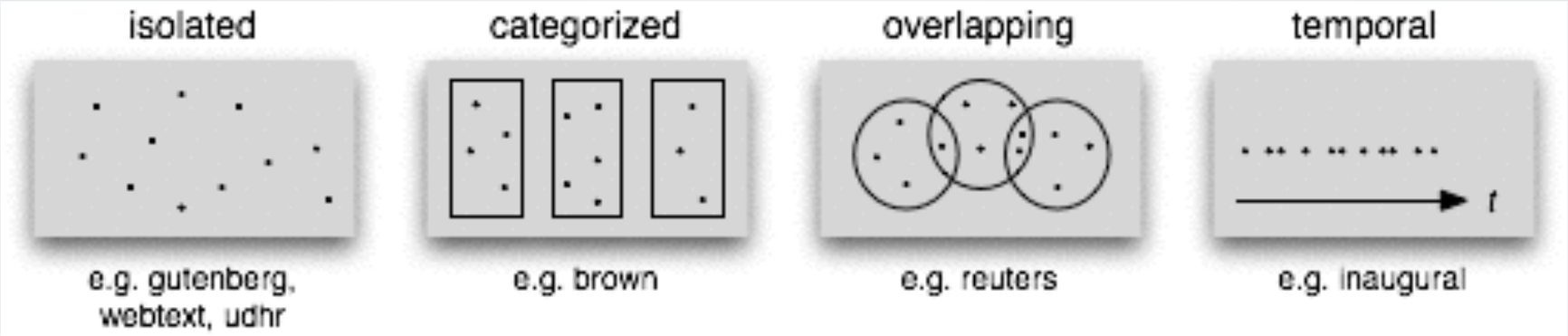
TEXT CORPORA

- Large body of text
  - Some are general (Brown), others are domain specific (nps_chat)
  - Some are tagged (Brown), others are raw
  - Some have very specific uses (movie_reviews - sentiment analysis)

NLTK BOOK: CORPUS CHART



CREDIT: NLTK BOOK

BUILT-IN CORPORA

- Sentences:
  [“I”, “hate”, “cats”, “.”]
- Paragraphs:
  [[“I”, “hate”, “cats”, “.”], [“Dogs”, “are”, “worse”, “.”]]
- Entire file:
  List of paragraphs, which are lists of sentences

MANIPULATING CORPORA

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BROWN CORPUS

- 1960's at Brown University
- > 1,000,000 words
- 15 categories
  - News, mystery, editorial, humor, etc.
- Part-of-speech tagged
- Widely cited

NAVIGATING CORPORA

```
from nltk.corpus import brown

brown.categories()
len(brown.categories()) # num categories
brown.words(categories=['news', 'editorial'])
brown.sents()
brown.paras()
brown.fileids()
brown.words(fileids=['cr01'])
```

TOKENS VS. TYPES

- Tokens
  - All of the words (or whatever you choose as your smallest particle of meaning)

    I really love this **song**. It's the best **song I** have ever heard.

    I: 2

    song: 2

    heard: 1

TOKENS VS. TYPES

- Types
  - The vocabulary of your text
  - Everything gets counted exactly once

    I really love this song. It's the best song I have ever heard.

    I: 1

    song: 1

    heard: 1

LEXICAL DIVERSITY

```
from nltk.corpus import brown
from __future__ import division

tokens = brown.words()
types = set(brown.words())

# lexical diversity
len(tokens)/len(types)
=> 20.714
```

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BY GENRE?

```
# pick categories to compare from:
brown.categories()

# calculate lexical diversity of news articles
news = brown.words(categories='news')
len(news) / len(set(news))

# versus fiction
fiction = brown.words(categories='fiction')
len(fiction) / len(set(fiction))
```

GUTENBERG CORPUS

- Curated by the NLTK team
- Just 18 books/poetry collections
- Also look at nltk.corpus.genesis

BY AUTHOR?

```
from nltk.corpus import gutenberg
gutenberg.fileids()
shakespeare = gutenberg.words(fileids='blah')

len(shakespeare) / len(set(shakespeare))

# versus

len(austen) / len(set(austen))
```

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WHAT ARE WE MISSING?

- What does the Brown corpus mean by “fiction”?
  - Is this representative of the question we want to ask?
  - Is 68,488 words enough?
- Can the different categories be compared?
  - Similarly sized data?
  - Same genres of writing?

INVESTIGATE YOUR CORPORA!

```
from nltk.corpus import brown

brown.fileids(categories='fiction')
brown.abspath('ck01')

# poke around the corpora in /…/nltk_data/corpora
# check out the README, category list, actual files
```

TEXT OBJECTS VS. CORPORA OBJECTS

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TEXT OBJECT VS. CORPUS OBJECT

- You have to convert some_corpus.words() to a text object using the Text method

  Ex:

  ```
  from nltk.text import Text

  text = Text(brown.words())
  ```

TEXT OBJECT VS. CORPUS OBJECT

```
# you have to convert a corpus object to a text
# object to access additional methods

from nltk.text import Text
text = Text(brown.words())
```

TEXT METHODS

```
from nltk.corpus import some_corpus
from nltk.text import Text
text = Text(some_corpus.words())

text.concordance(“word”)
text.similar(“word”)
text.common_contexts([“word1”, “word2”])
text.count(“word”)
text.collocations()
```

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WEBTEXT CORPUS

```
from nltk.corpus import webtext
from nltk.text import Text

dating = Text(webtext.words(fileids='singles.txt'))
dating.collocations()
```

NPS_CHAT CORPUS

- 10,567 forum posts by age
  - Out of 500,000 collected by the naval postgraduate school
- Can we identify online sexual predators?
  - Or categorize aspects of written communication that vary by age?

INVESTIGATING CORPORA

```
from nltk.corpus import nps_chat
nps_chat.sents()
```

AHHH, DOESN’T WORK

```
# if you ever get stuck, use these techniques
# to find appropriate methods for a corpus

# gives you list of methods
dir(nps_chat)

# gives you documentation
help(nltk.corpus)
help(nltk.corpus.nps_chat)
```

FREQUENCY DISTRIBUTIONS

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FREQUENCY DISTRIBUTIONS

```
from nltk import FreqDist
from nltk.text import Text
import matplotlib

text = Text(some_corpus.words())
fdist = FreqDist(text)
=> dict of {‘token1’:count1, ‘token2’:count2,…}
fdist[‘the’]
=> returns the # of times ‘the’ appears in text
```

FREQUENCY DISTRIBUTIONS

```
# top 50 words
fdst.most_common(50)

# frequency plot
fdist.plot(25, cumulative=[True or False])

# list of all 1-count tokens
fdist.hapaxes()
```

FREQUENCY DISTRIBUTIONS

```
# most frequent token
fdist.max()

# decimal frequency of a given token
fdist.freq('token')

# total # of samples
fdist.N()
```

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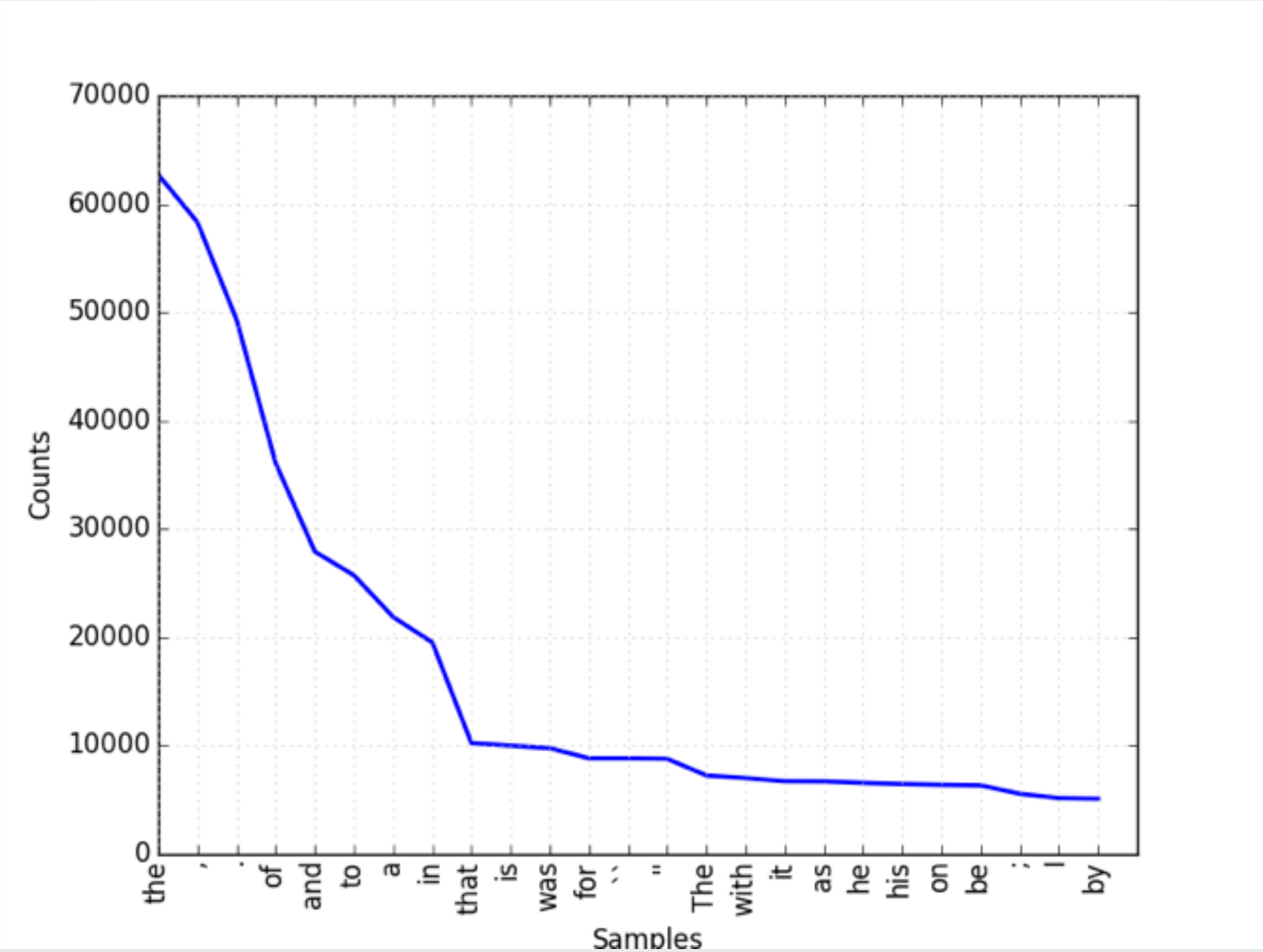
PROBLEM



FREQ. DIST. OF BROWN CORPUS

PROBLEM

- We're mostly counting words that don't tell us anything about the text
  - "The" is most frequent
  - Followed by ','
- We need stopwords
  - Commonly used words that you can remove from a corpus before processing

STOPWORDS

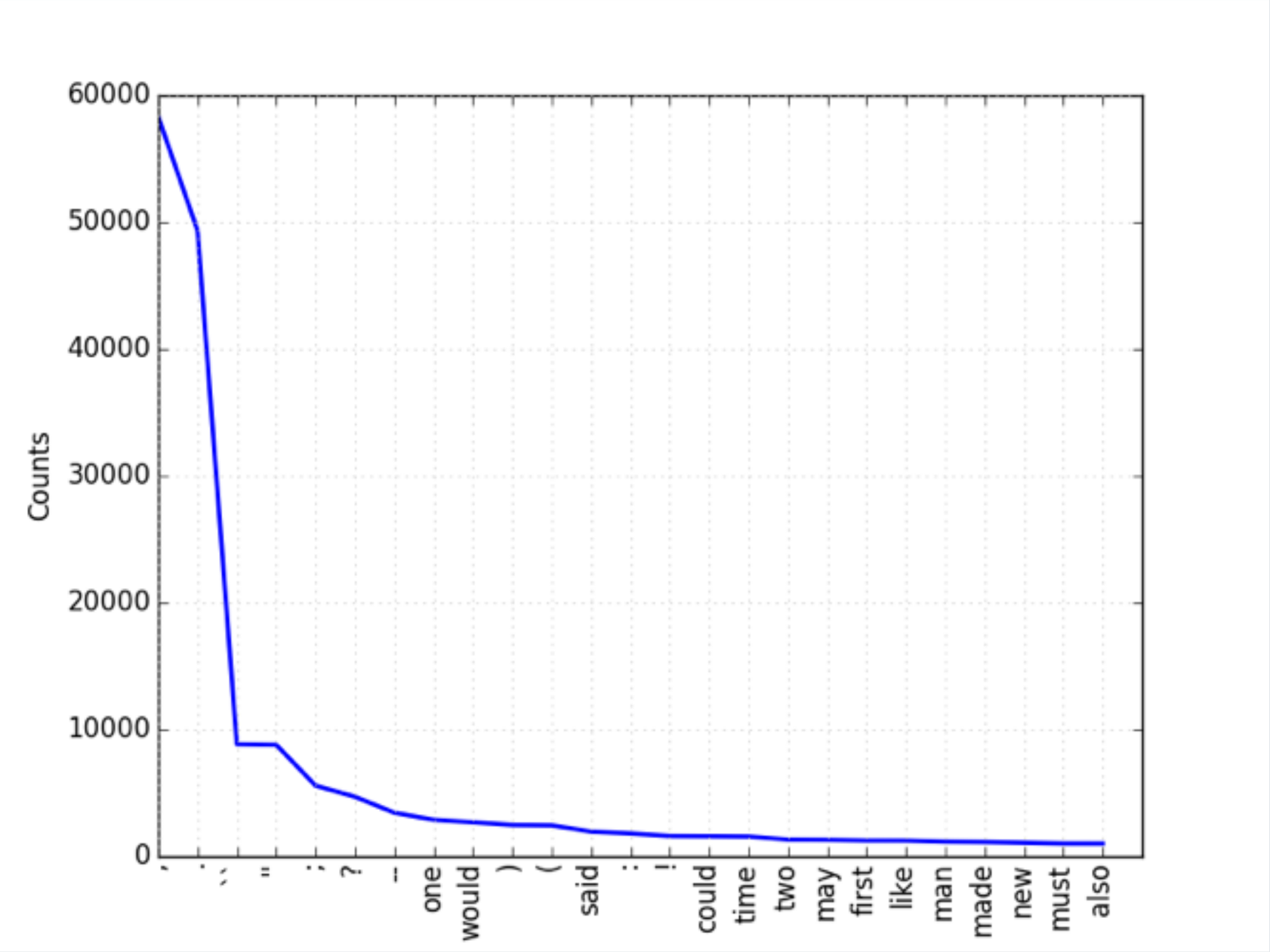
```
from nltk.corpus import stopwords

sw = stopwords.words(‘english’)
old_brown = brown.words()

new = [w for w in old_brown if w.lower() not in sw]

# better, but we’re still counting punctuation
# sample code - brown.py
```

PROBLEM



FREQ. DIST. OF BROWN CORPUS

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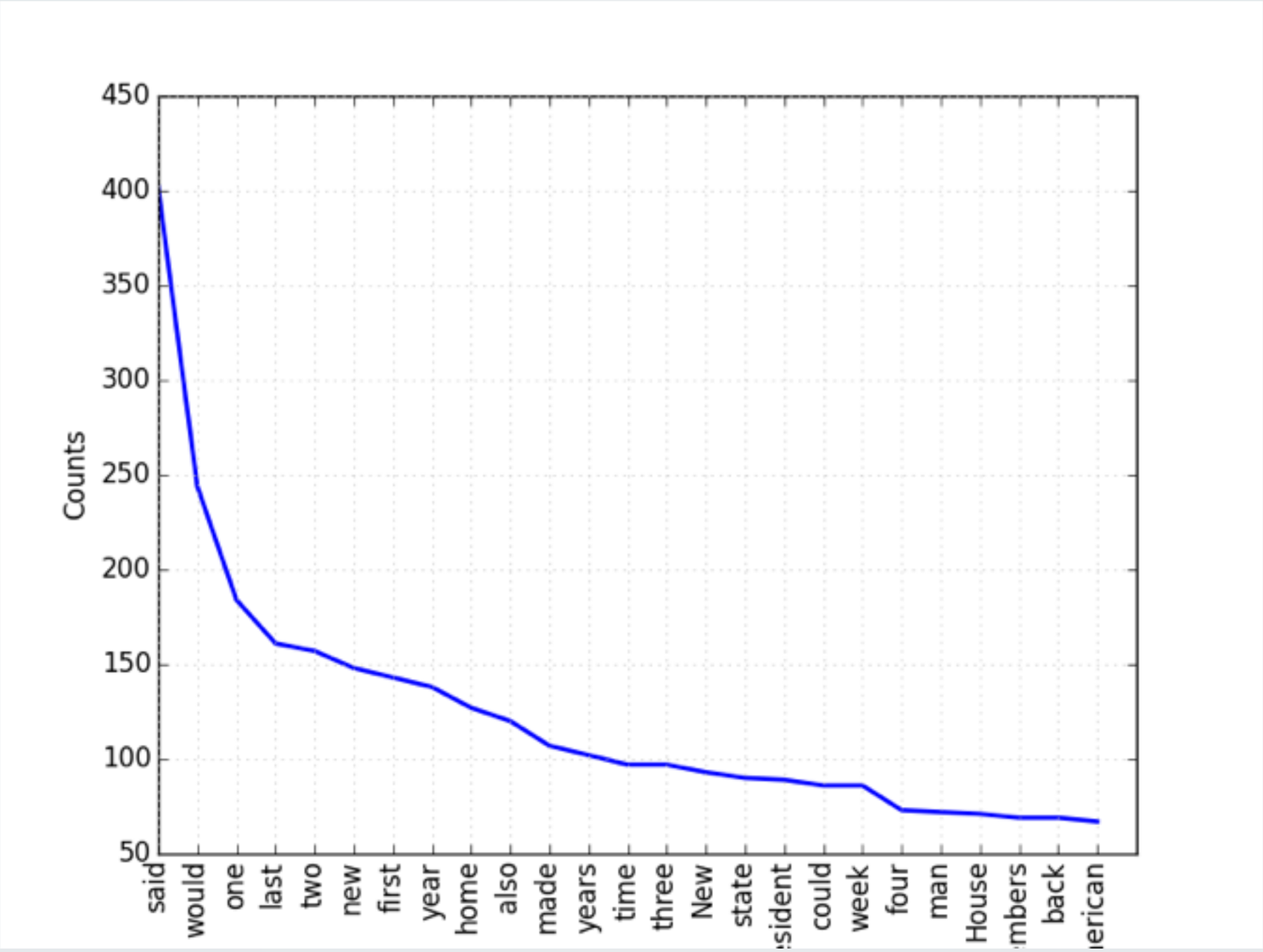
STOPWORDS & PUNCTUATION

```
from nltk.corpus import stopwords

sw = stopwords.words('english')
old_brown = brown.words()

new = [w for w in old_brown if w.lower() not in sw
                                and w.isalnum()]
```

STILL PROBLEMS



FREQ. DIST. OF BROWN'S NEWS CORPUS

HOMEWORK

- Play around with new corpora
  - What are the frequent words of diff. genres?
  - Look at webtext.fileids() for a diversity of text files
  - Find one in your area of interest
    - movie_reviews, udhr, wordnet, etc.
    - dir(some_corpus) => how do the methods differ?
    - some_corpus.abspath() => what's actually in the corpus?