# Building a Gigaword Corpus

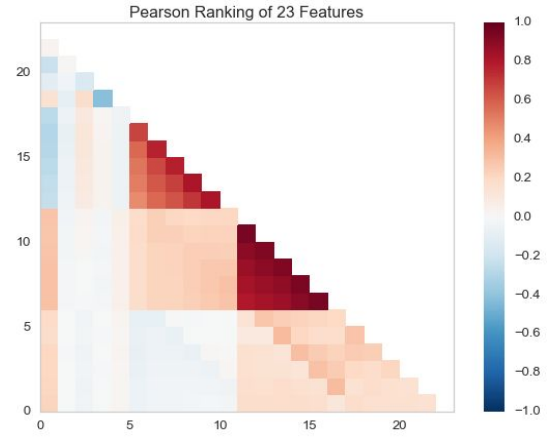
## Data Ingestion, Management, and Processing for NLP

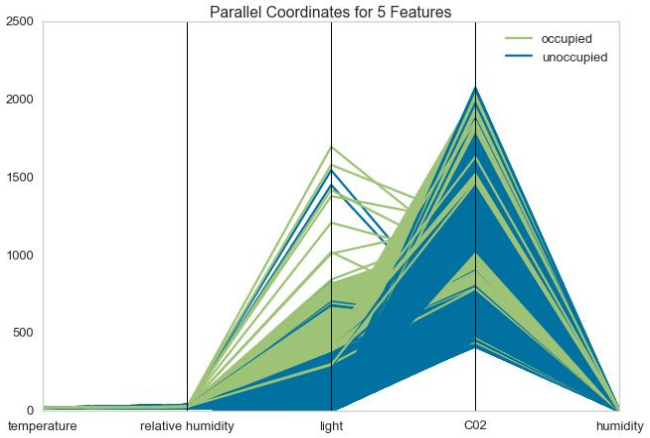
Rebecca Bilbro

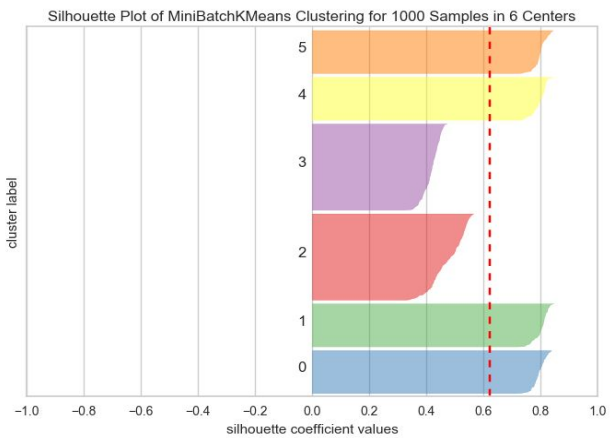
PyCon 2017

- Me and my motivation
- Why make a custom corpus?
- Things likely to go wrong
  - Ingestion
  - Management
  - Loading
  - Preprocessing
  - Analysis
- Lessons we learned
- Open source tools we made

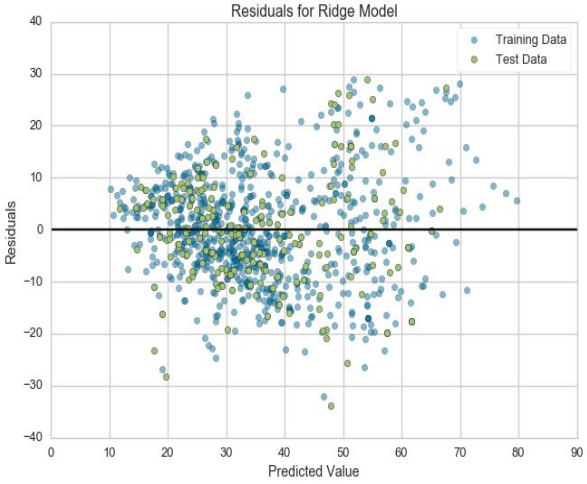

Rebecca Bilbro
Data Scientist

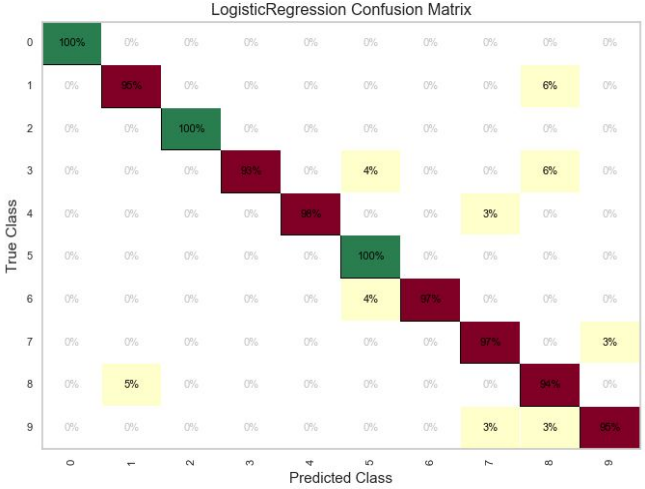


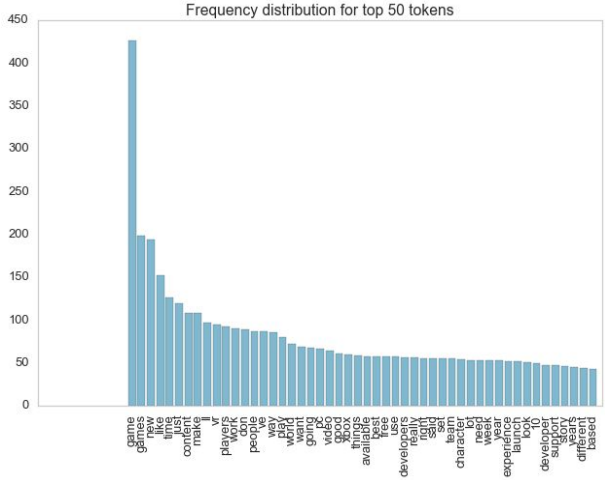



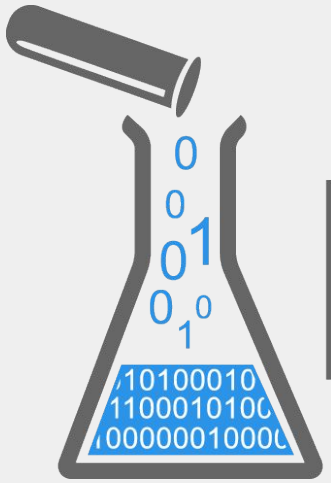




# Yellowbrick



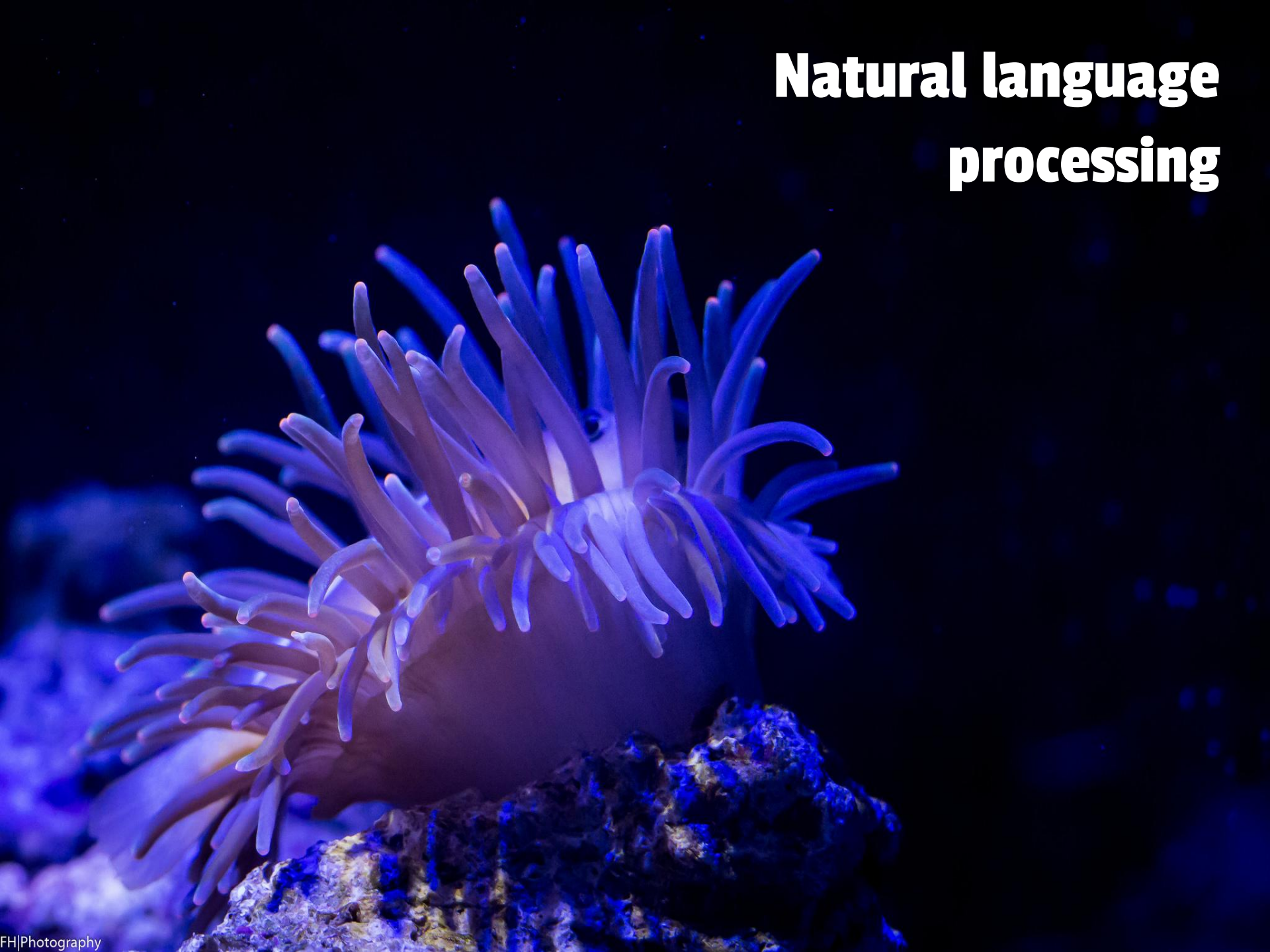



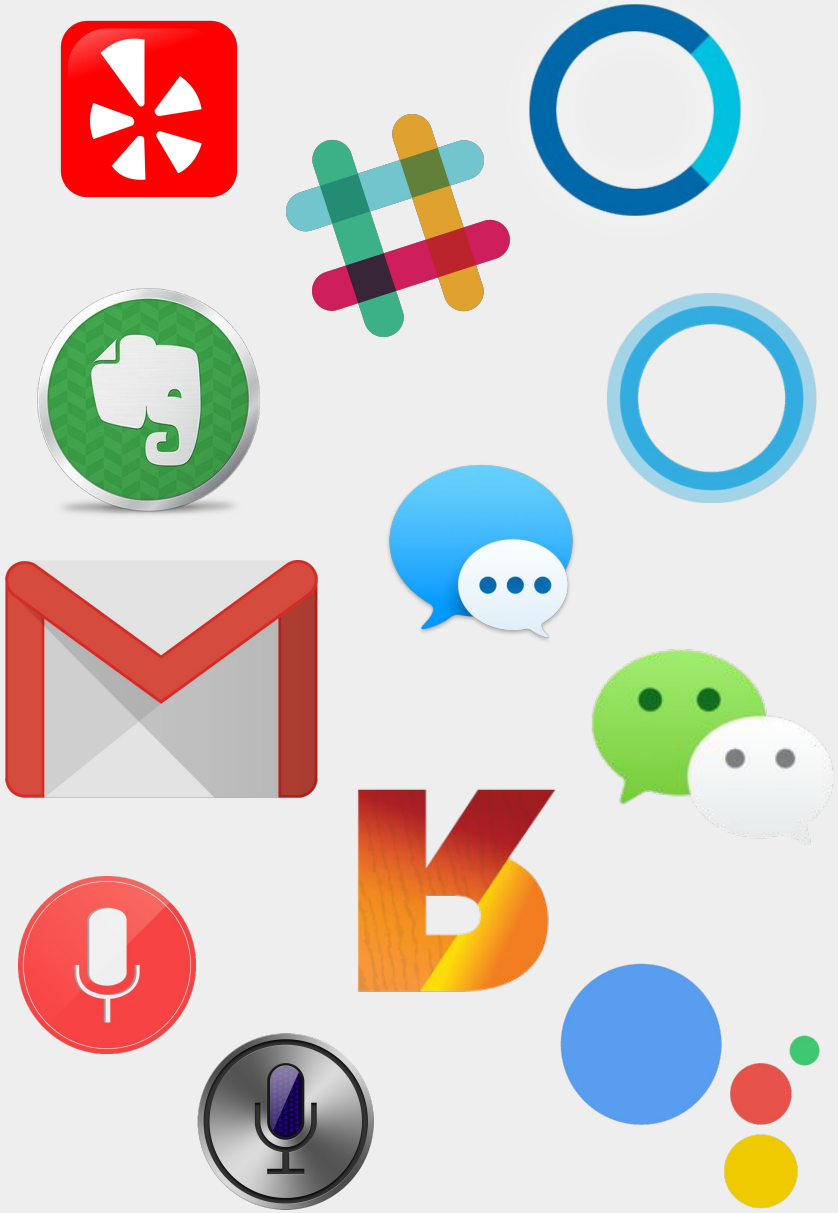



# DistrictDataLabs

# Natural language processing



# Everyone's doing it



theano

TensorFlow

spaCy

PyBrain

APACHE Spark

scikit learn

NLTK

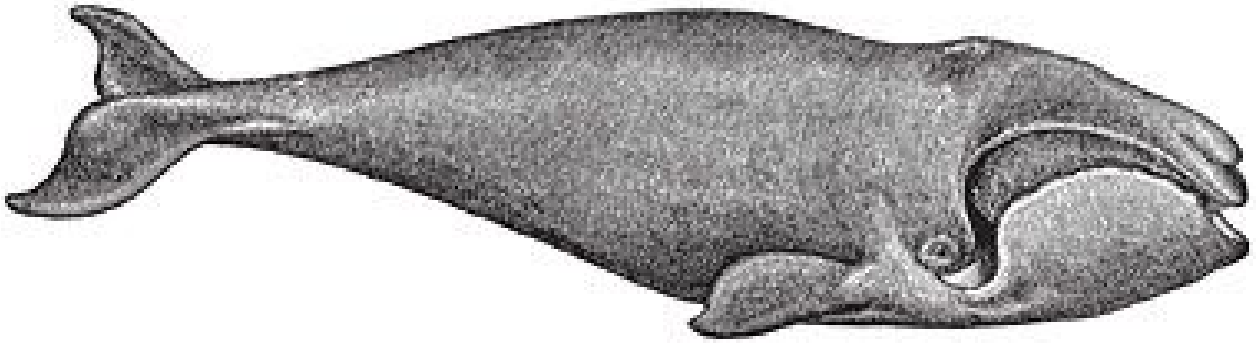
PYTORCH

gensim

K

Caffe

# So many great tools



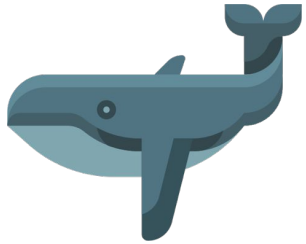
```
import nltk

moby = nltk.text.Text(nltk.corpus.gutenberg.words('melville-moby_dick.txt'))

print(moby.similar("ahab"))
print(moby.common_contexts(["ahab", "starbuck"]))
print(moby.concordance("monstrous", 55, lines=10))
```

# The Natural Language Toolkit


```
import bz2
import gensim

# Load id to word dictionary
id2word = gensim.corpora.Dictionary.load_from_text('wikipedia_wordids.txt')

# Instantiate iterator for corpus (which is ~24.14 GB on disk after compression!)
mm = gensim.corpora.MmCorpus(bz2.BZ2File('wikipedia_tfidf.mm.bz2'))

# Do latent Semantic Analysis and find 10 prominent topics
lsa = gensim.models.lsimodel.LsiModel(corpus=mm, id2word=id2word, num_topics=400)
lsa.print_topics(10)
```

# Gensim + Wikipedia

# A custom corpus



```
import os
import requests
import feedparser

feed = "http://feeds.washingtonpost.com/rss/national"

for entry in feedparser.parse(feed)['entries']:
    r = requests.get(entry['link'])
    path = entry['title'].lower().replace(" ", "-") + ".html"

    with open(path, 'wb') as f:
        f.write(r.content)
```

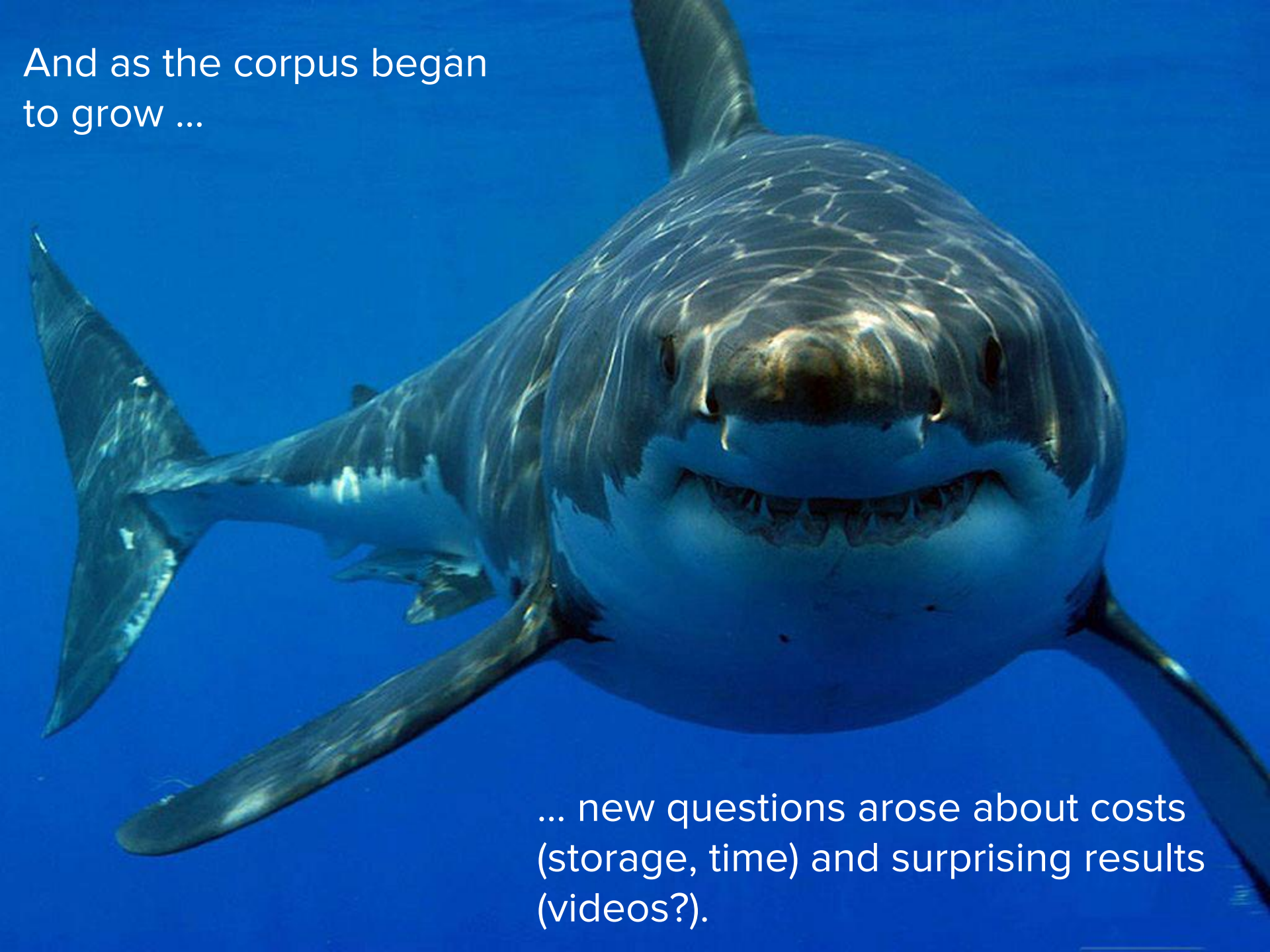
# RSS

Ingestion

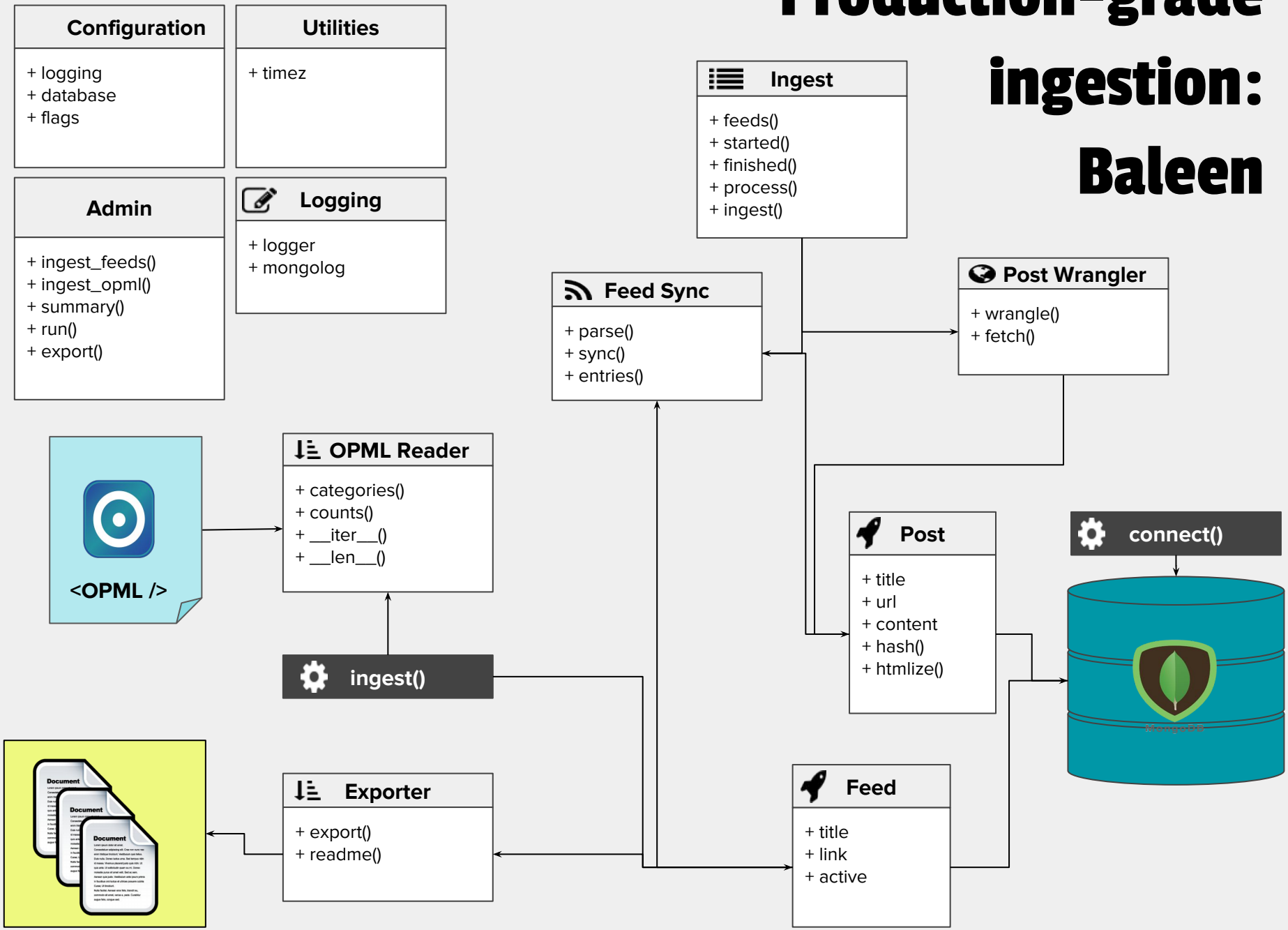
- Scheduling
- Adding new feeds
- Synchronizing feeds, finding duplicates
- Parsing different feeds/entries into a standard form
- Monitoring

Storage

- Database choice
- Data representation, indexing, fetching
- Connection and configuration
- Error tracking and handling
- Exporting


And as the corpus began to grow ...
... new questions arose about costs (storage, time) and surprising results (videos?).

# Production-grade ingestion: Baleen



# Raw corpus != Usable data

Raw Corpus

HTML

Paras

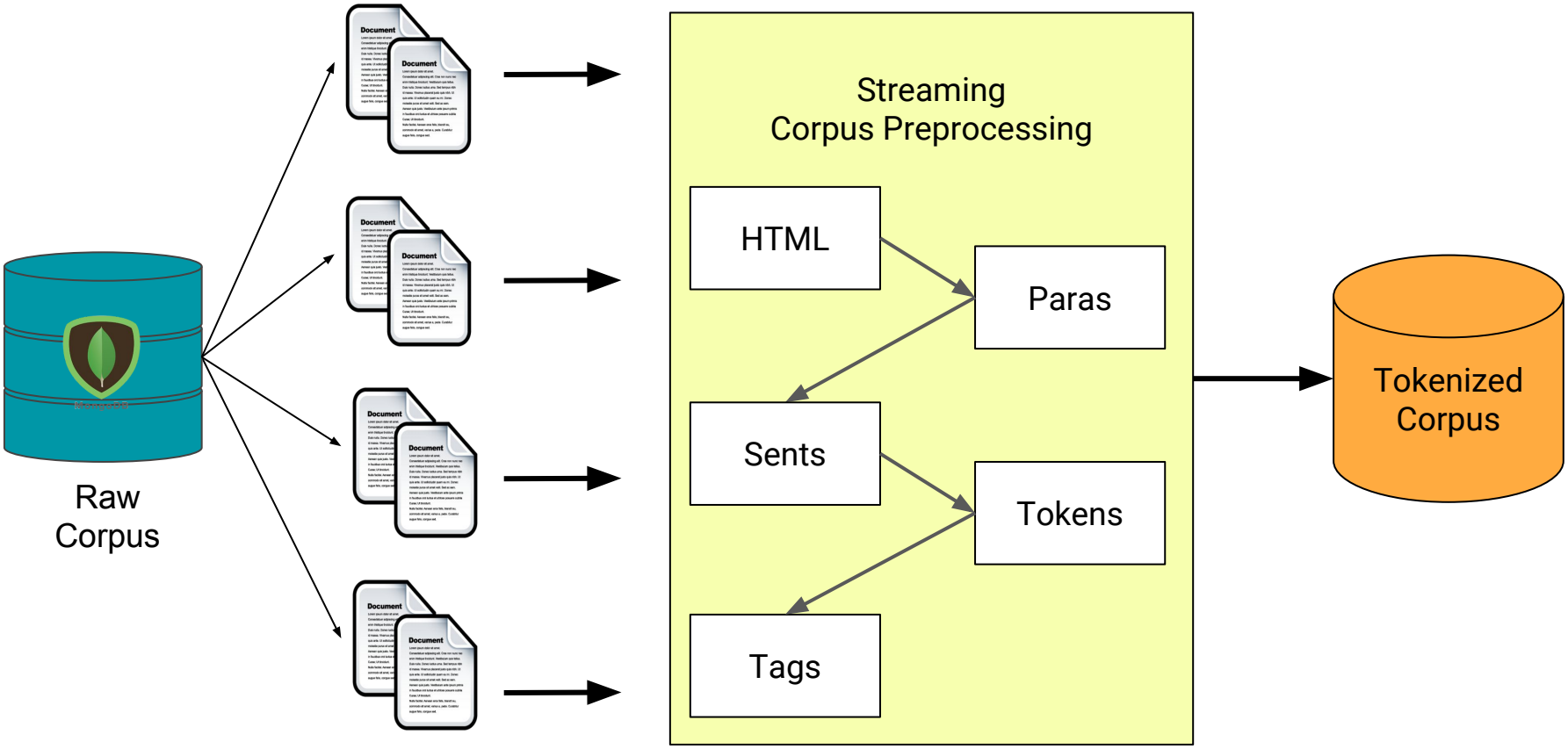
Sents

Tokens

Tags

```
corpus = [('How', 'WRB'),
          ('long', 'RB'),
          ('will', 'MD'),
          ('this', 'DT'),
          ('go', 'VB'),
          ('on', 'IN'),
          ('?', '.'),
          ...
        ]
```

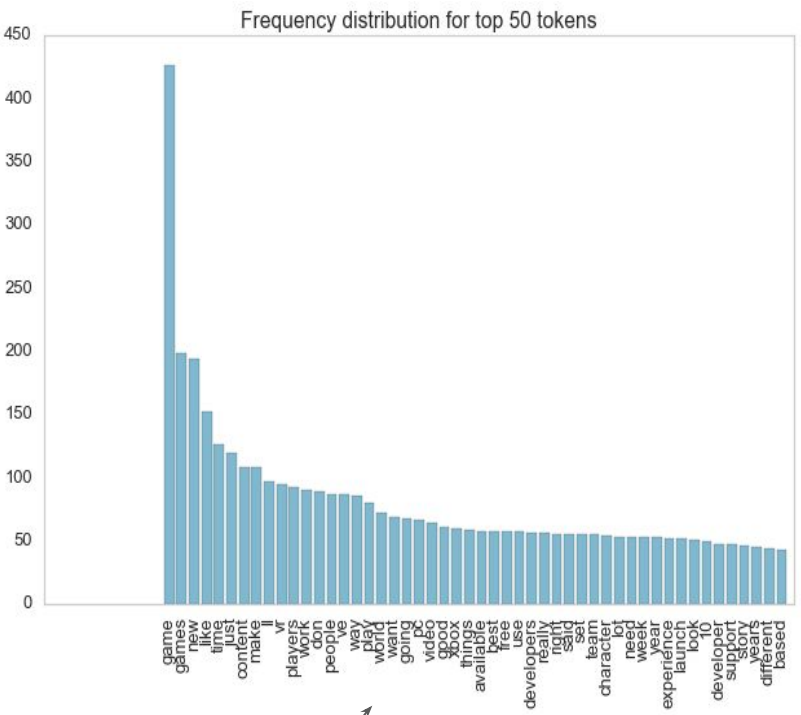
From each doc, extract html, identify paras/sents/words, tag with part-of-speech

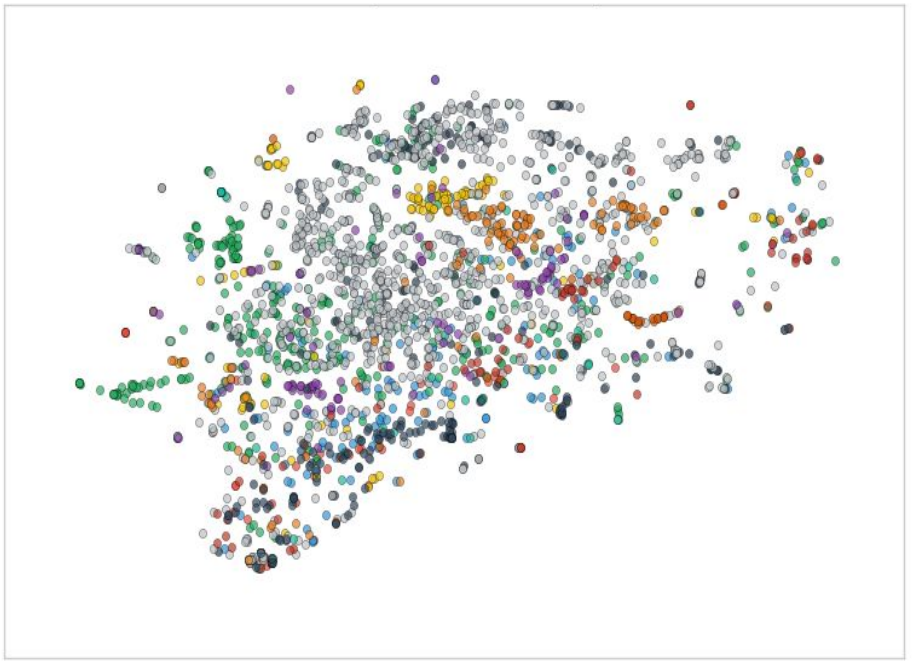



CorpusReader for streaming access, preprocessing, and saving the tokenized version


Vectorization
...so many features

# Yellowbrick

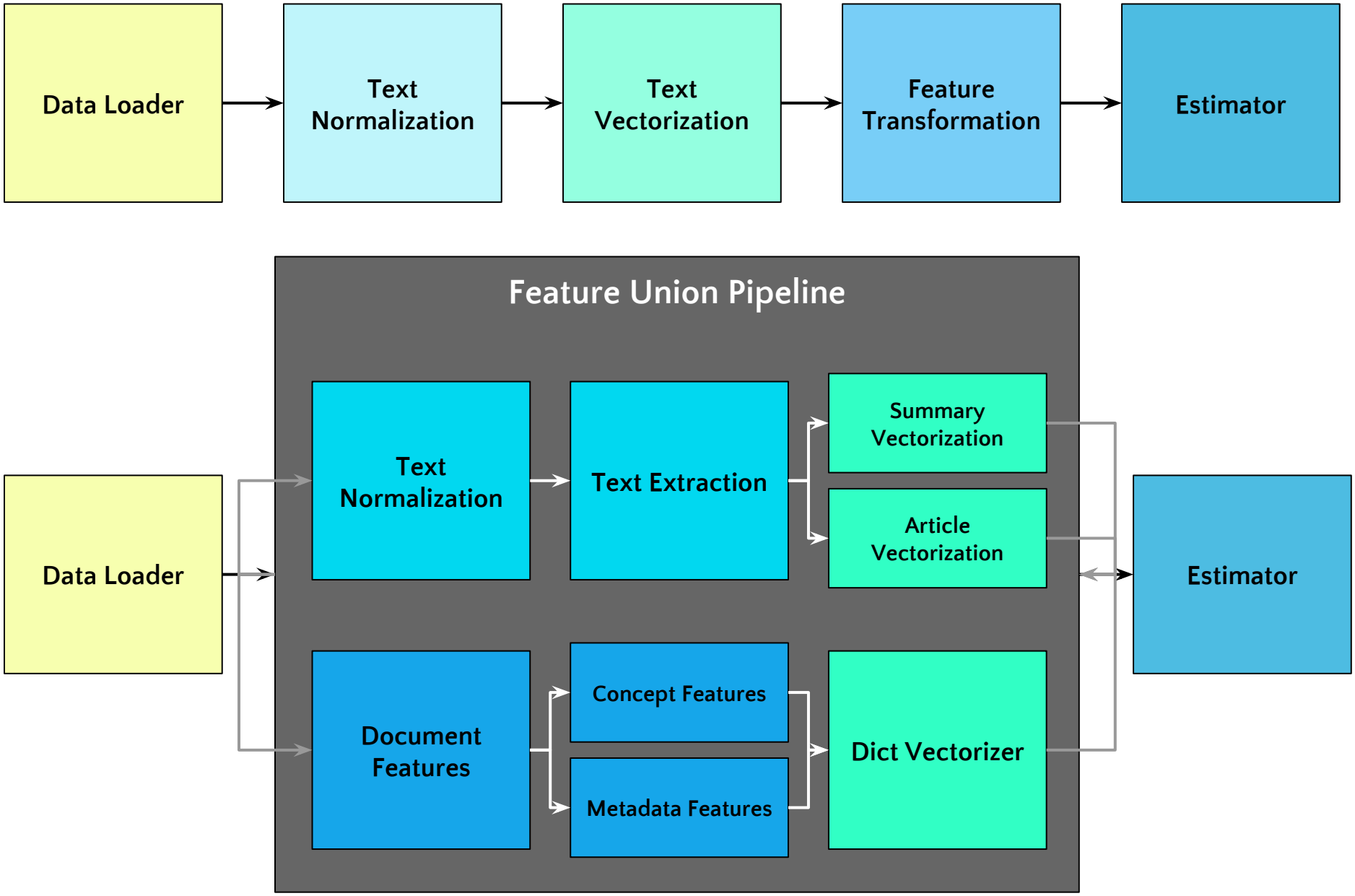


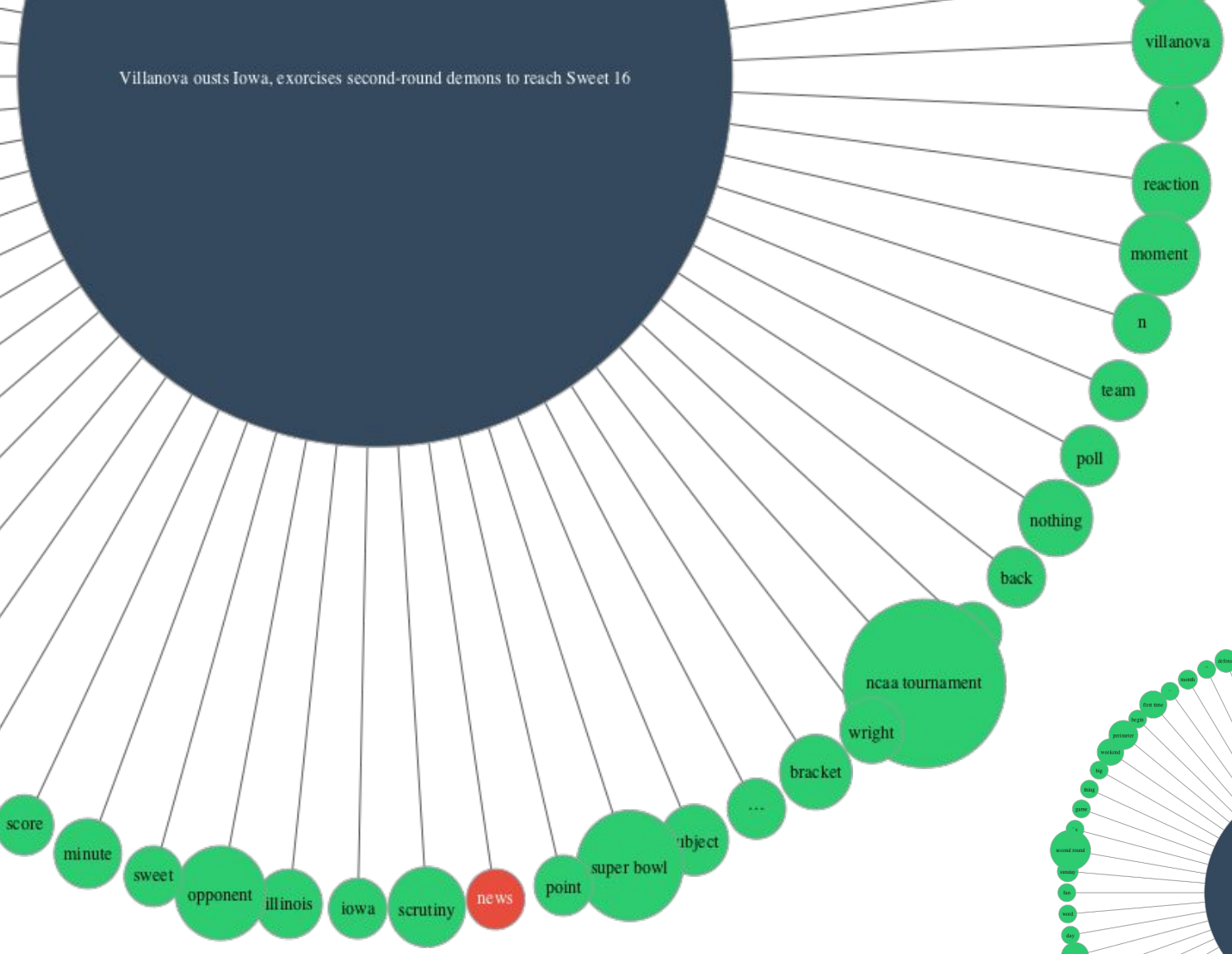

Visualize top tokens, document distribution & part-of-speech tagging

```
Algebra ( from Arabic `` al-jabr '' meaning `` reunion of broken parts '' ) is one of the bro
ad parts of mathematics , together with number theory , geometry and analysis . In its most g
eneral form , algebra is the study of mathematical symbols and the rules for manipulating the
se symbols ; it is a unifying thread of almost all of mathematics .
```

# Minke

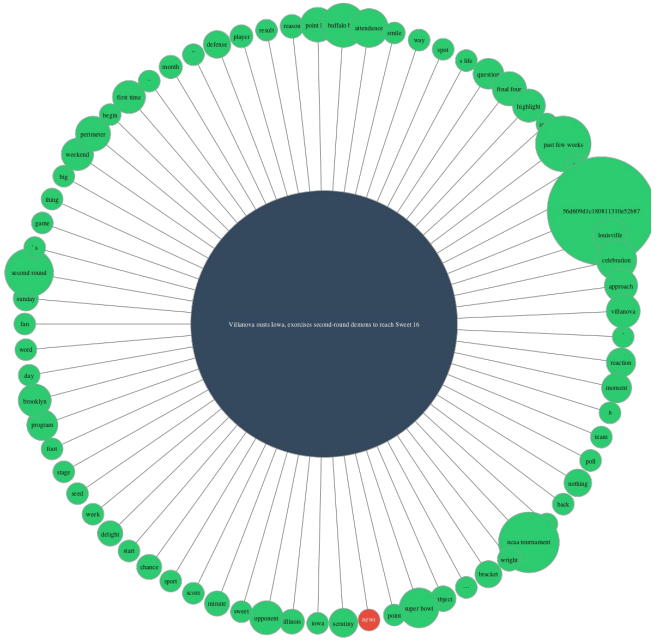

Data Loader
Text Normalization
Text Vectorization
Feature Transformation
Estimator
Feature Union Pipeline
Data Loader
Text Normalization
Text Extraction
Summary Vectorization
Article Vectorization
Document Features
Concept Features
Metadata Features
Dict Vectorizer
Estimator


Dynamic graph
analysis




Keyphrase Graph:

- 2.7 M nodes
- 47 M edges
- Average degree of 35

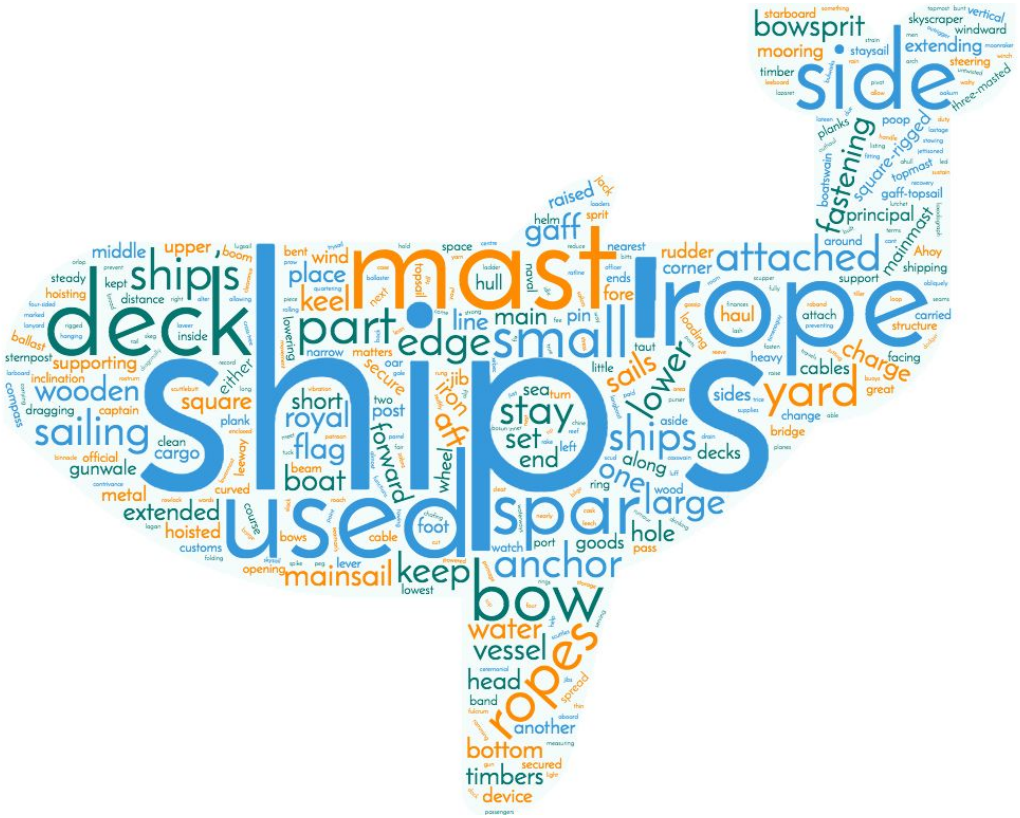


1.5 M documents, 7,500 jobs, 524 GB (uncompressed)

# Lessons learned

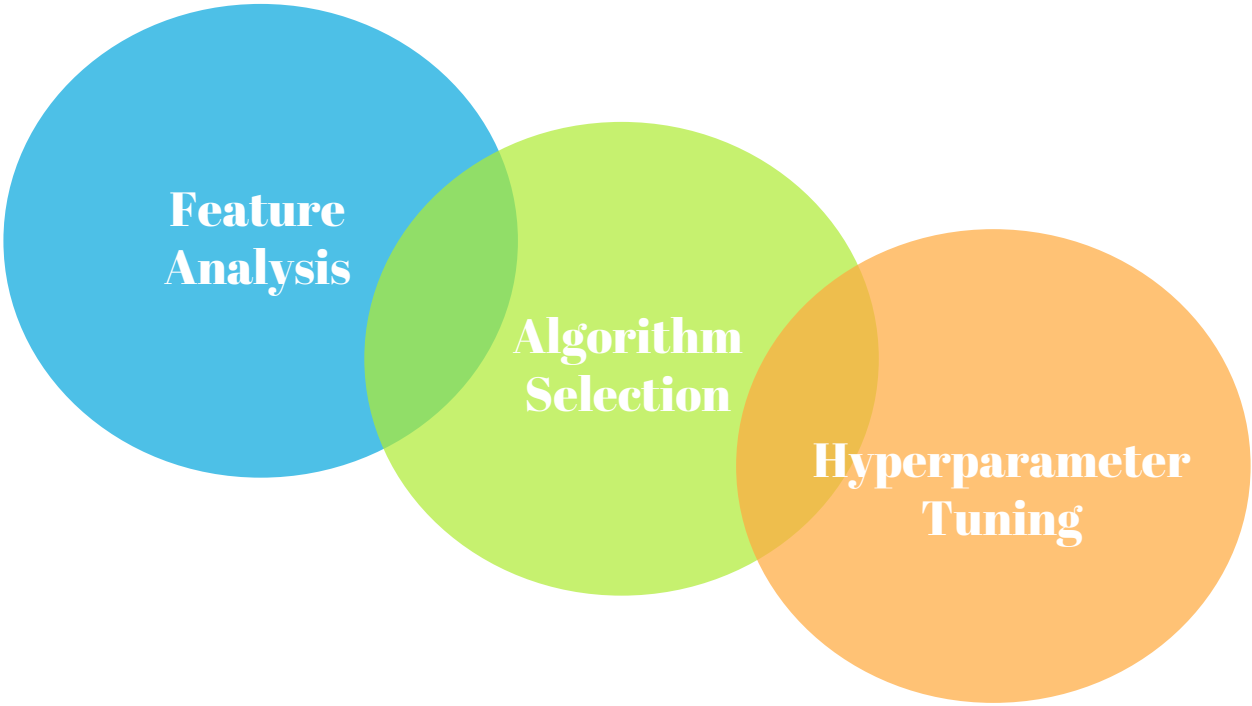
Meaningfully literate data products rely on...

...a custom, domain-specific corpus.



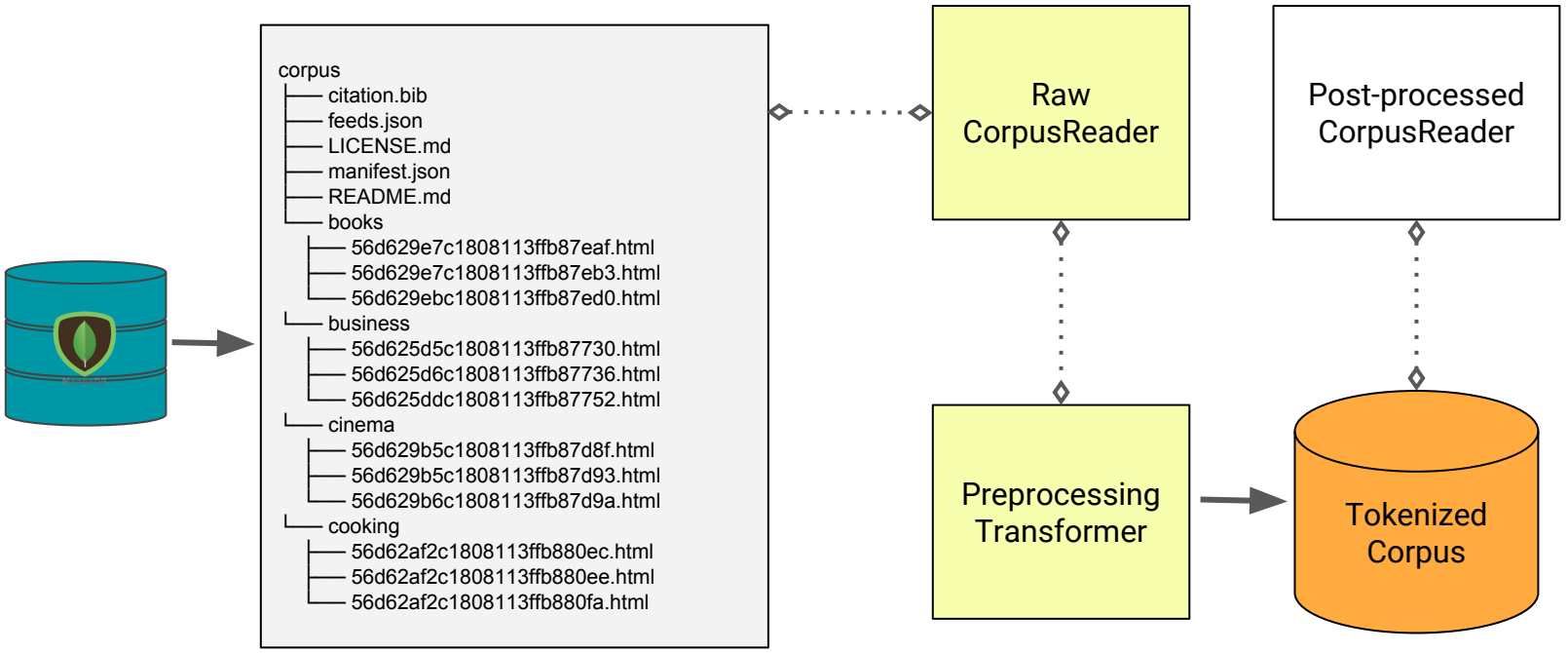
Meaningfully literate data products rely on...

...a data management layer for flexibility and iteration during modeling.



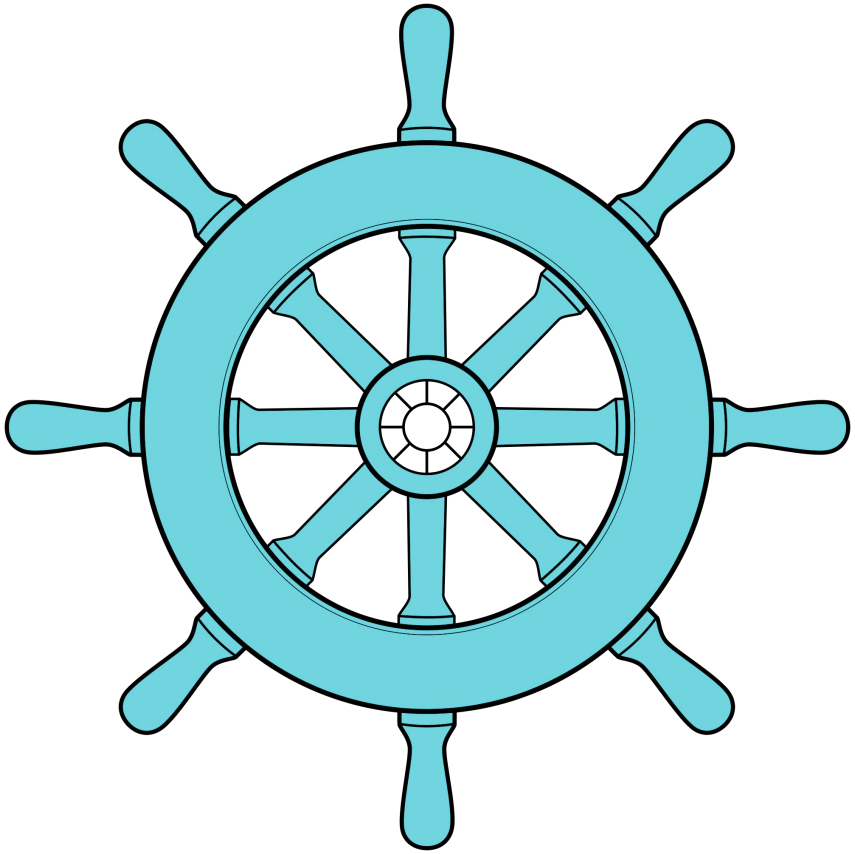
# Meaningfully literate data products rely on...

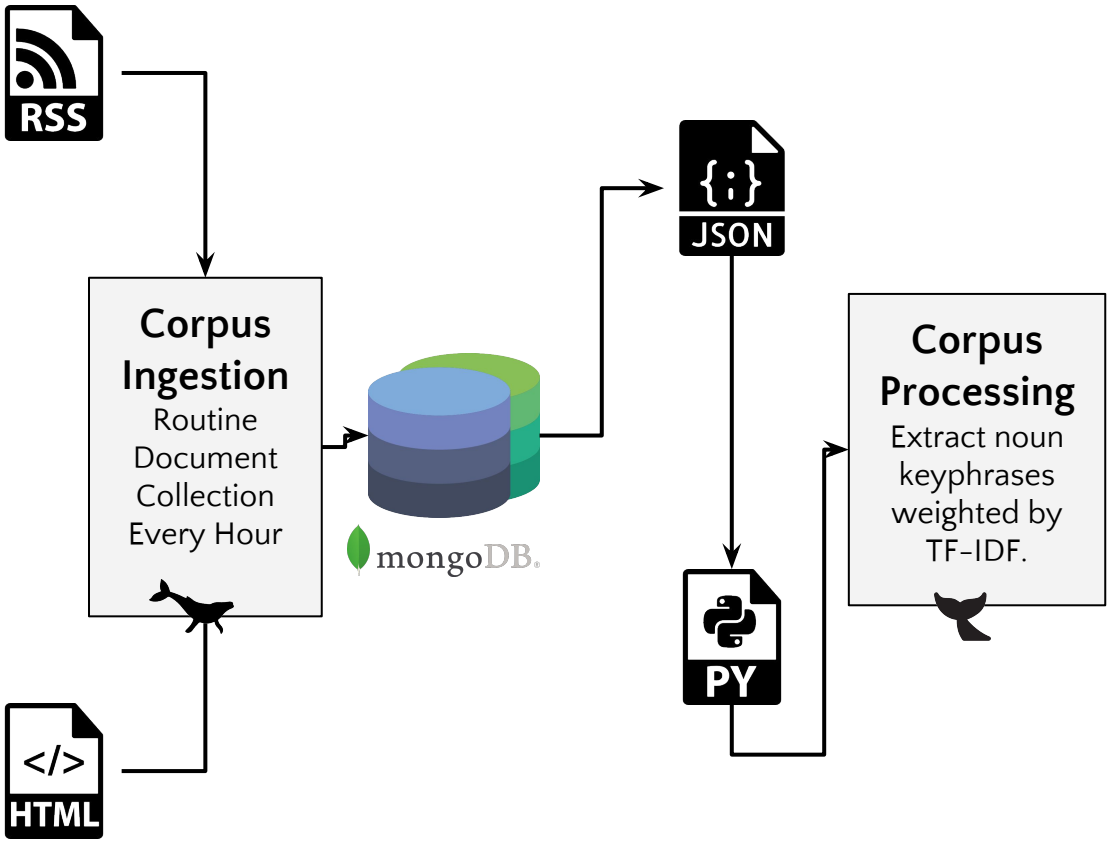
...a custom CorpusReader for streaming, and also intermediate storage.

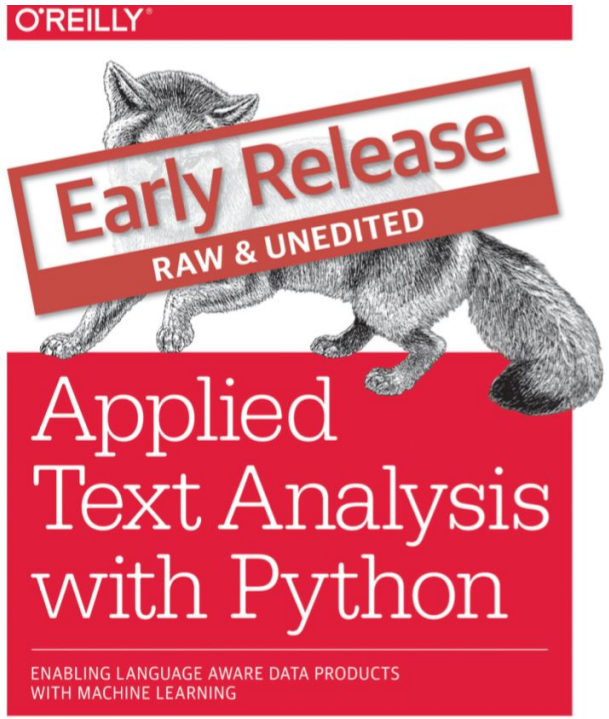


Meaningfully literate data products rely on...

...visual steering and graph analysis for interpretation.






Benjamin Bengfort,
Rebecca Bilbro & Tony Ojeda

# Baleen & Minke



## Baleen

An automated ingestion service for blogs to construct a corpus for NLP research.

build passing | coverage 61% | docs latest | Ready 3


## Minke

Graph extraction and NLP analysis for Baleen Corpora

build passing | coverage 15% | health 80% | Ready 3

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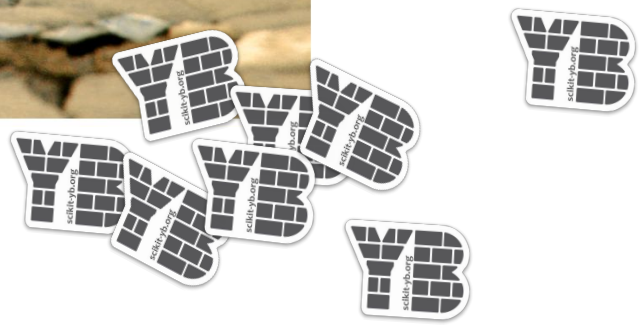
# Yellowbrick



## Yellowbrick

build passing | coverage 80% | health 91% | docs latest | Ready 8

**Visual analysis and diagnostic tools to facilitate machine learning model selection.**



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**Getting data**

- **(Tutorial)** “Fantastic Data and Where to Find Them” by Nicole Donnelly
- **(Poster)** “On the Hour Data Ingestion” by Benjamin Bengfort and Will Voorhees

**Speed to insight**

- **(Talk)** “Human-Machine Collaboration” by Tony Ojeda
- **(Poster)** “A Framework for Exploratory Data Analysis” by Tony Ojeda and Sasan Bahadaran

**Machine learning**

- **(Poster)** “Model Management Systems” by Benjamin Bengfort and Laura Lorenz
- **(Poster)** “Yellowbrick” by Benjamin Bengfort and Rebecca Bilbro

Also, **sprints**!

**pycon.districtdatalabs.com**

# Thank you!


## Rebecca Bilbro

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