Exploring Text Mining and NLP with the Insurance Industry

Big Data News Analytics

Ozzie Liu

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Background

I interned at a big insurance company and worked on some very interesting projects

Goals:

- Provide insight into data science in insurance
- Introduce Natural Language Processing

How Do Insurance Companies Use Data Science?

- Auto Insurance
- Life Insurance
- Commercial Insurance
    - Flood and Property
    - Workers Compensation
    - Cybersecurity
    - Directors & Officers Liability

Data Science vs. Actuarial Science

Actuary - Subset of statistics that focuses on insurance

There's a lot of overlap

But here's what I've found about data scientists

- Have skills to look at really big data sets...
- bring practical perspective and insight in data interpretation
- Wields various and potentially more accurate models
- Data science scales better

Directors and Officers Insurance

... is a liability insurance payable to the directors and officers of a company, or to the organization(s) itself, as indemnification (reimbursement) for losses or advancement of defense costs in the event an insured suffers such a loss as a result of a legal action brought for alleged wrongful acts in their capacity as directors and officers. Such coverage can extend to defense costs arising out of criminal and regulatory investigations/trials as well; in fact, often civil and criminal actions are brought against directors/officers simultaneously...
Source: Wikipedia

Directors and Officers Insurance

Protection when a company's officers get sued.

- Security Class Action (SCA)
- Non-Security Class Action
    - Customers
    - Regulators
    - Competitors (anti-trust or unfair trade practices)

Hypothesis

Can we use news data to predict D&O non-SCA claims?

Goal: Provide tool for underwriters to search news on a potential new customer to gauge insurability and price premium factor

Data available:

- All claims and details from past 15 years
- Rough industry averages
- News data - 100 million english news articles in 2 year period

Approach

Simple enough: find all companies listed in news articles

Problems:

- That's a lot of articles!
- No predetermined list of companies to search for
- How can I tell if the articles are positive or negative?

Constraints

News data was only a trial
One month left
I cannot keep raw text data

Step 1 - Stopwords

Take out **stopwords**
[and, or, if, but, to, the, a, you, we, I, they, it, be, not, that, this...]

"Walmart announced Friday that it is closing 269 stores worldwide as it sharpens its focus on its supercenters and e-commerce business."

Walmart announced Friday closing 269 stores worldwide sharpens focus supercenters e-commerce business.

Step 1 - Stopwords - Limitations

"To be or not to be that is the question
Whether tis nobler in the mind to suffer"

question whether nobler mind suffer

But what about:

- Bank **of** America
- Teach **for** America
- **The Who**
- **We** Work

Step 1.5 - Named Entity Recognition

Ideal solution: Named Entity Recognition (NER)

"Warren Buffett's Berkshire Hathaway said Monday it agreed to spend $37.2 billion for Precision Castparts -- the most it has ever paid for a company." [link]

Warren Buffett's Berkshire Hathaway said Monday it agreed to spend $37.2 billion for Precision Castparts-- the most it has ever paid for a company.

Step 2 - ngrams

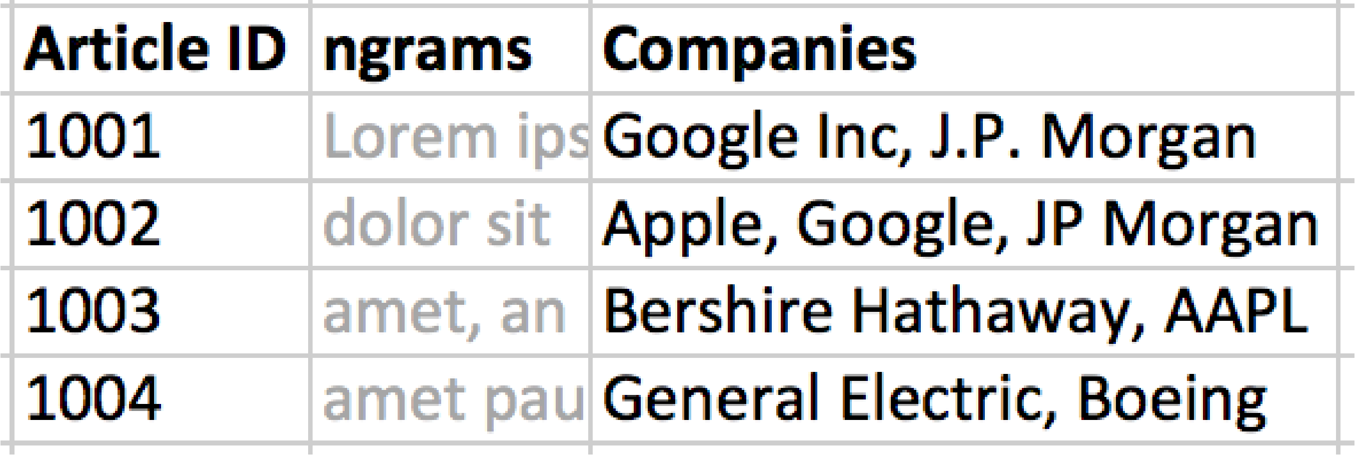
n-grams separates text in n word chunks

"*To be or not to be that is the question*" in 2-grams:

[(to be), (be or), (or not), (not to), (to be), (be that), (this is), (is the), (the question)]

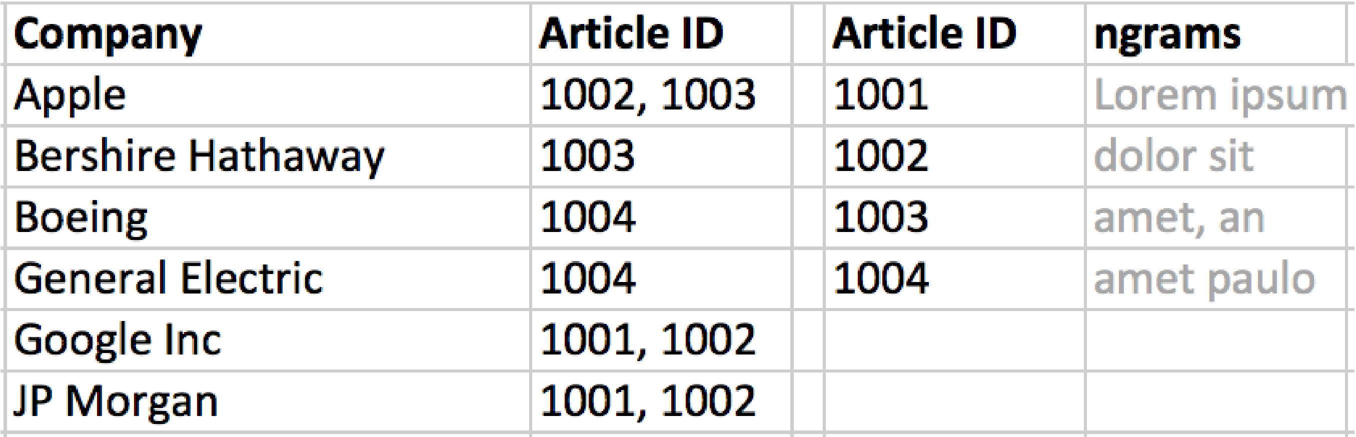
Step 3 - Transforming Data

To look up articles from companies - transform from wide to long table



Article ID	ngrams	Companies
1001	Lorem ips	Google Inc, J.P. Morgan
1002	dolor sit	Apple, Google, JP Morgan
1003	amet, an	Bershire Hathaway, AAPL
1004	amet pau	General Electric, Boeing

Step 3 - Transforming Data



Company	Article ID
Apple	1002, 1003
Bershire Hathaway	1003
Boeing	1004
General Electric	1004
Google Inc	1001, 1002
JP Morgan	1001, 1002

Article ID	ngrams
1001	Lorem ipsum
1002	dolor sit
1003	amet, an
1004	amet paulo

Step 3.5 - Fuzzy Matching

Fuzzy Matching or approximate string matching is the technique of finding strings that match a pattern approximately. [source]

Fuzzy matching - Edit (Levenshtein) Distance

Counts the number of edits from 1 string to another.

Edits are **insertion, deletion, or substitution**

kitten → **sitten** (substitution of "s" for "k")
sitten → **sittin** (substitution of "i" for "e")
sittin → **sitting** (insertion of "g" at the end)

Edit distance of 3

Fuzzy matching - Jaccard Similarity

$$J(A,B) = \frac{|A \cap B|}{|A \cup B|} = \frac{|A \cap B|}{|A| + |B| - |A \cap B|}.$$

kitten = [(ki), (it), (tt), (te), (en)]
sitting = [(si), (it), (tt), (ti), (in), (ng)]
Jaccard index = 2/9

google = [(go), (oo), (og), (gl), (le)]
google inc = [(go), (oo), (og), (gl), (le), (ei), (in), (nc)]
Jaccard index = 5/8

Fuzzy matching - Cosine Similarity

$$\text{similarity} = \cos(\theta) = \frac{\mathbf{A} \cdot \mathbf{B}}{\|\mathbf{A}\|\|\mathbf{B}\|} = \frac{\sum\limits_{i=1}^{n} A_i B_i}{\sqrt{\sum\limits_{i=1}^{n} A_i^2}\sqrt{\sum\limits_{i=1}^{n} B_i^2}}$$

[(go), (oo), (og), (gl), (le), (ei), (in), (nc)]
google = [1, 1, 1, 1, 1, 0, 0, 0]
google inc = [1, 1, 1, 1, 1, 1, 1, 1]

cosine similarity = 0.79

Fuzzy matching - Cosine Similarity

Two vectors **a = [4,3], b = [4,0]**

Big Data Application

Hadoop:

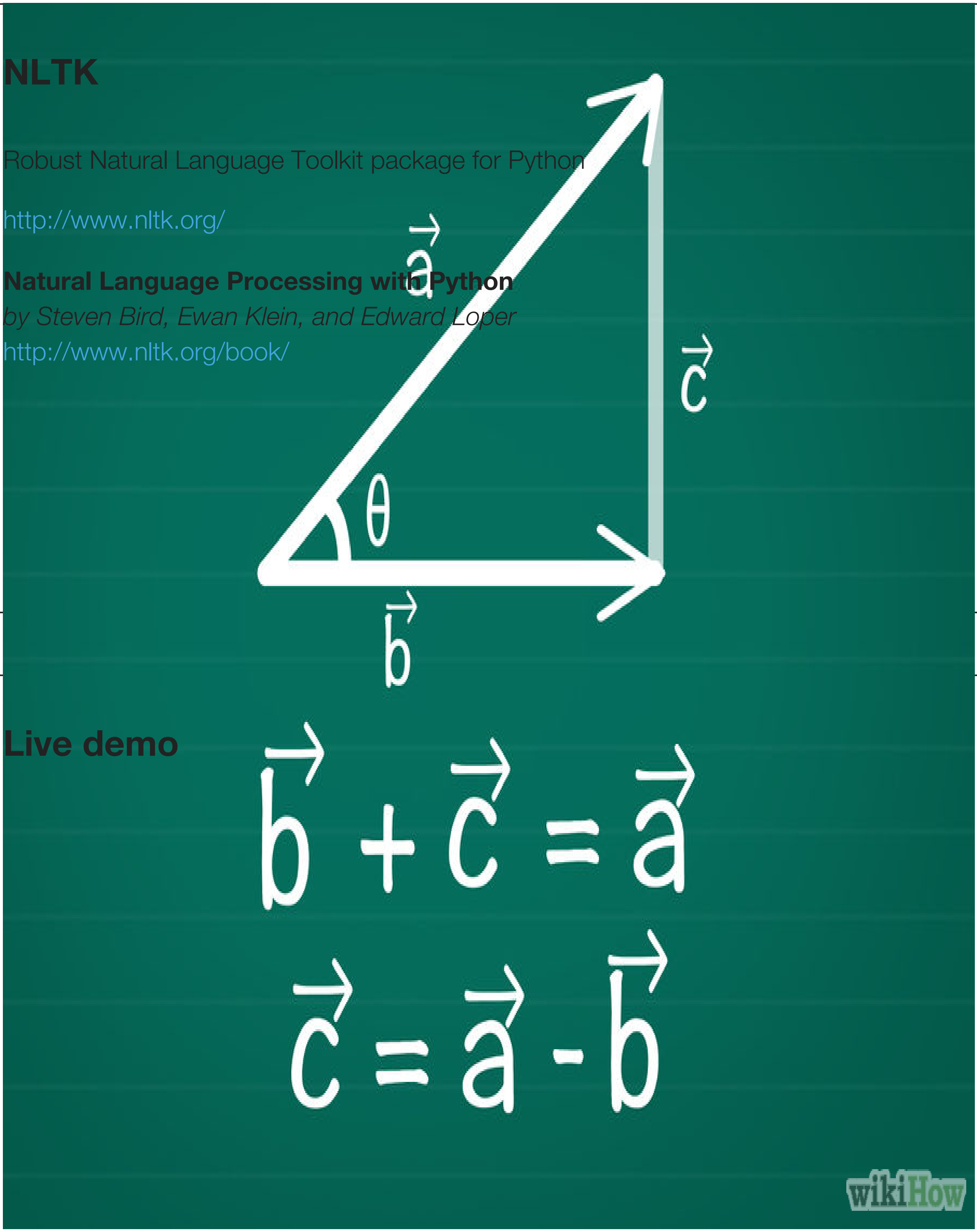
- HDFS - distributed file systems
- Pig - High level platform for using MapReduce
- Hive - Database engine based on SQL
- UDFs in Python

NLTK

Robust Natural Language Toolkit package for Python

http://www.nltk.org/

Natural Language Processing with Python
by Steven Bird, Ewan Klein, and Edward Loper
http://www.nltk.org/book/



Live demo

Ozzie Liu

http://ozzieliu.com