TEXT MINING

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Co-author: *Data Mining for Business Intelligence* (2nd ed., 2010)

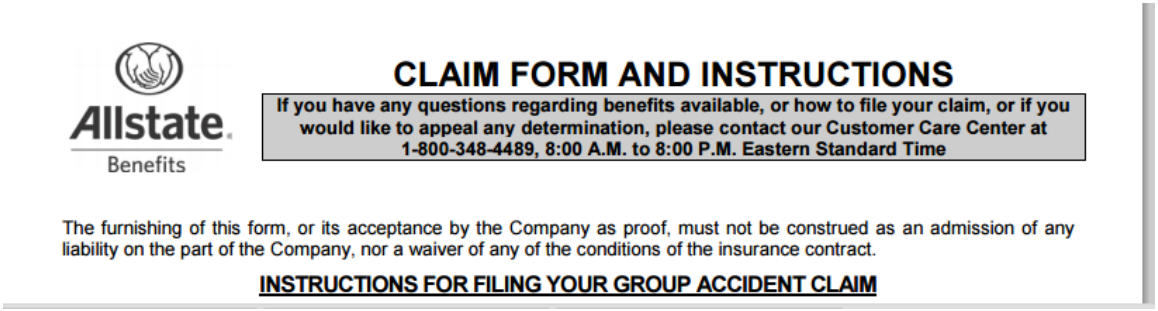
Author: *Introductory Statistics and Analytics* (2014)

Text data

- Up to now we have been dealing with structured quantitative data
  - Numerical
  - Binary (yes/no)
  - Multicategory
- Now we turn to unstructured text

Applications of Text Mining

- Insurance fraud – notes in claim forms can be mined and transformed into predictor variables for a predictive model
- The model is trained on prior claims in two classes – found to be fraudulent, and not found to be fraudulent
- The model is then applied to new claims



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Benefits

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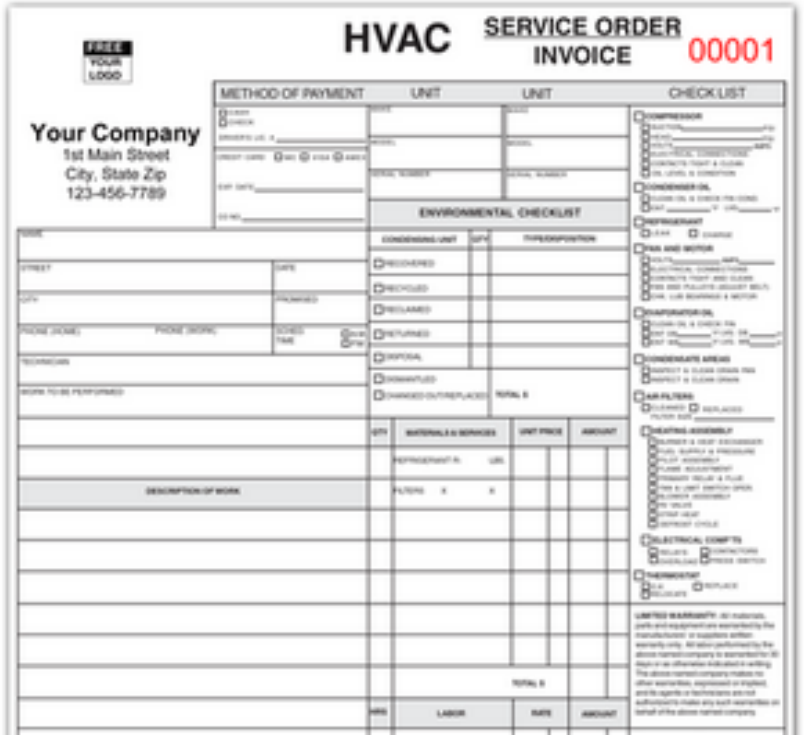
The furnishing of this form, or its acceptance by the Company as proof, must not be construed as an admission of any liability on the part of the Company, nor a waiver of any of the conditions of the insurance contract.

INSTRUCTIONS FOR FILING YOUR GROUP ACCIDENT CLAIM

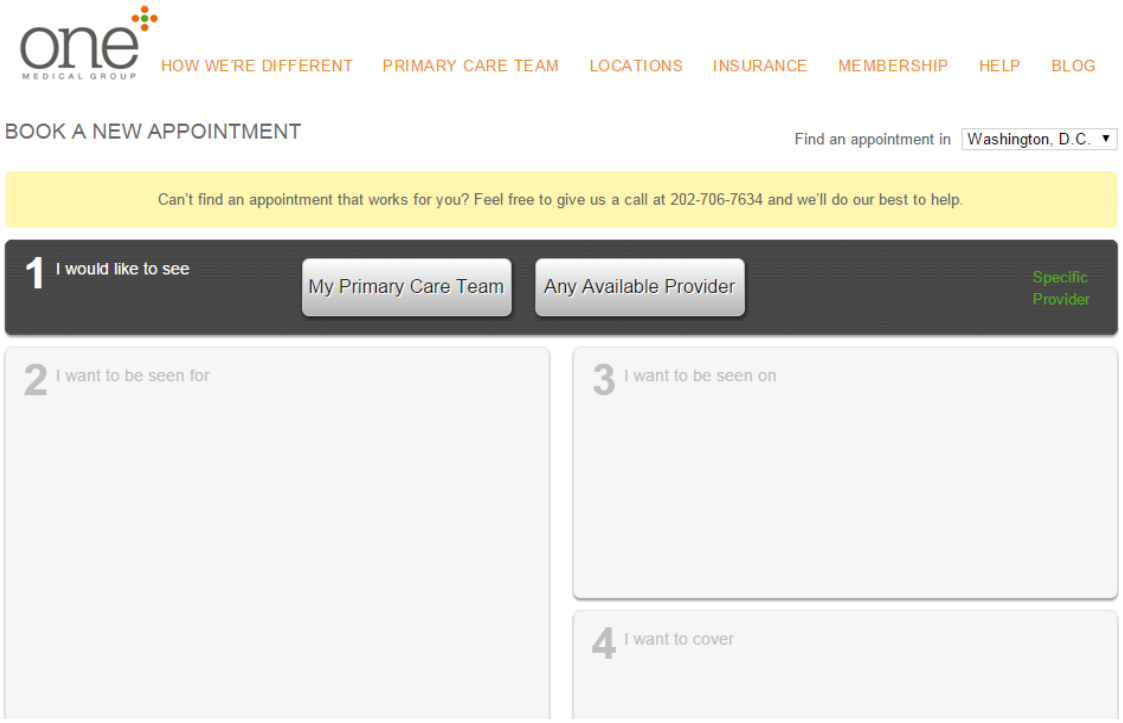
Applications, cont.

- Maintenance or support tickets often contain text fields
- These fields could be mined to classify ticket in several ways:
  - How urgent?
  - How much time to fix?
  - What category of technician is needed to fix?



Applications, cont.

- Medical triage/diagnosis
- Clinics could use patient online appointment request forms to route requests
  - Admin asst.
  - Nurse
  - Doctor



What exactly is text mining?

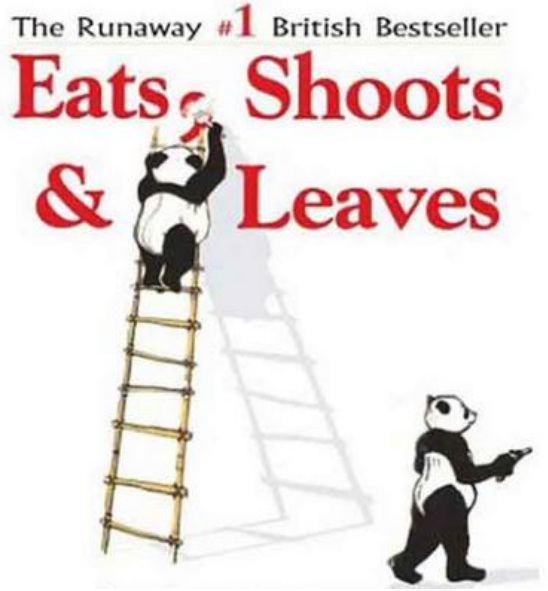
- Extract meaning from a single document – interpreting it like a human reads language
- Extract meaning to describe a set of documents
- Classify (label) thousands of documents

Natural Language Processing (NLP)

- Operates at the level of a single document
- It must master the complex “algorithms” of human language that have evolved over thousands of years
- Grammar, spelling, syntax, punctuation – they all matter
- Getting the meaning of a single document is a major challenge

Example: Adding a comma completely changes the meaning

- Consider the phrase “Eats, shoots and leaves”
- Is it a café robbery (with comma)?
- Or a bear’s eating habits (no comma)?



Or consider this sentence:

“Hitchcock shot The Birds in Bodega Bay”

- To someone indifferent to capitalization, and unfamiliar with movies, it might be about duck hunting.

Classification (labeling) and clustering

- No attempt to extract overall document meaning from a single document
- Focus is on assigning a label or class to numerous documents
- As with numerical data mining, the goal is to do better than guessing

“Bag-of-words”

- Grammar, syntax, punctuation, word order are ignored
- The document is considered as a “bag of words”
- This approach is, nonetheless, effective when the goal is to decide which category or cluster a document falls in
- A typical application is supervised learning
- Requires lots of documents (a corpus)*
- Do not need 100% accuracy

*“Corpus” often refers to a fixed standard set of documents that many researchers can use to develop and tune text mining algorithms.

The spreadsheet model of text

- Columns are terms
- Rows are documents
- Cells indicate presence/absence (or frequency) of terms in documents
- Consider the two sentences:
  - S1 First we consider the spreadsheet model
  - S2 Then we consider another model

Here is the resulting spreadsheet, using presence/absence:

	first	we	consider	the	spreadsheet	model	then	another
S1	1	1	1	1	1	1	0	0
S2	0	1	1	0	0	1	1	0

Exercise

Create a similar spreadsheet for the following two sentences:

S1: My job interview is Thursday

S2: My boss canceled my Thursday job interview

Create one spreadsheet where the cell entries are binary, indicating presence/absence, and another spreadsheet where the cell entries indicate frequency.