Data Challenge Workshop: Classification of business-related News Articles

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STATISTICS CANADA

ONE HUNDRED YEARS AND COUNTING

STATISTIQUE CANADA

CENT ANS BIEN COMPTÉS

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Code & data available at
https://github.com/chritter/Talks/tree/master/2018/Data_Challenge_UOttawa

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II. Our team & mandate

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Motivation

The problem

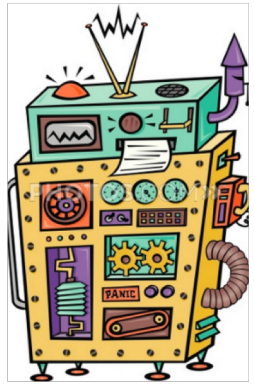
- Business analysts in enterprise statistics division spend large amounts of time to search for information
- Amount of news exponentially growing
- What happened? When? Where? Who?

The solution

- Automatic analysis of text
- Capture more information faster
- Event and trend detection of unexpected news
- Knowledge extraction for companies and industries

Approach

Event detector



Filter non-economic relevant news
(keywords, publisher)

Deduplication & grouping

Canadian News Sources

Event type
Companies involved

Merger & Acquisition

Bankruptcy

events

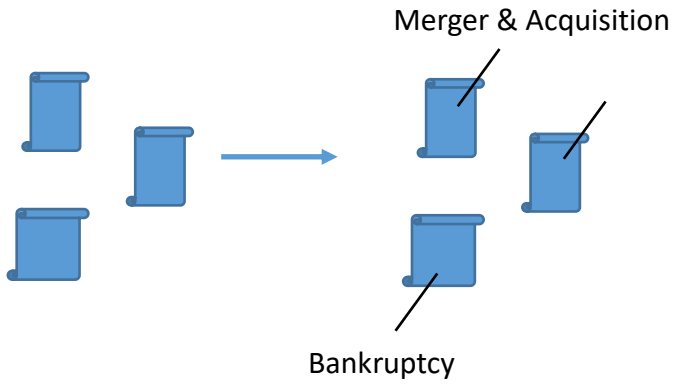
Company X
Merger
1/1/11

time

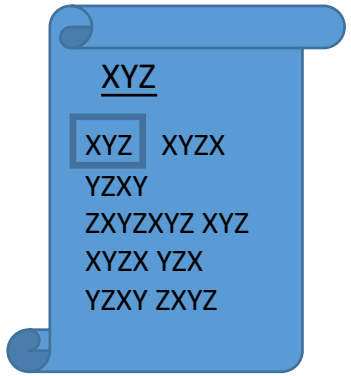
The event detector: Supervised machine learning

A) Creating a labeled dataset

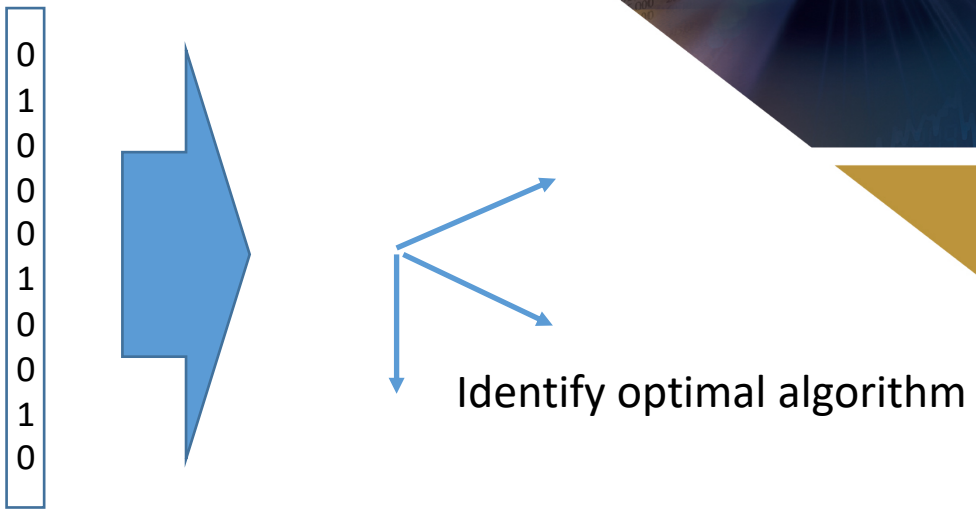
News Articles



B) Feature engineering



C) Classification



- Document-level event detection
- Name-entity recognition for deduplication and to identify companies involved

Feature engineering

- Major challenge in data science workflow
- Design characteristics from which your algorithm can learn to distinguish between classes
- In our case: Lexical and syntactic features
- For example:
  - **Type of word, compound (n-gram) words**
  - **Weight occurrence of each word: Term frequency–Inverse document frequency (tfidf)**

t: term
d: document
D: all documents

$$\mathrm{tfidf}(t, d, D) = \mathrm{tf}(t, d) \cdot \mathrm{idf}(t, D)$$

Linear Regression

- Advantage to start with simple model
- Easy to interpret due to linear relationship with input x and output y
- Fast baseline model
- Logistic regression for classification

Decision threshold

Feature 0

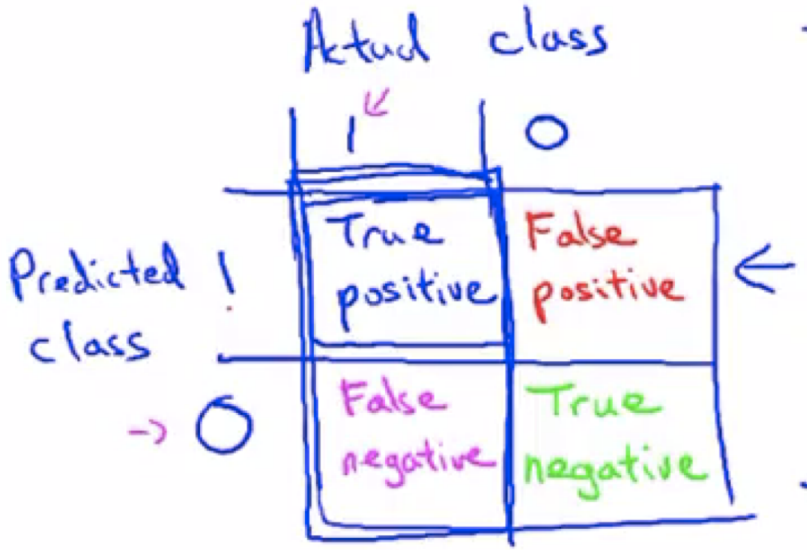
Weight 0

$$\hat{y} = w[0]x[0] + w[1]x[1] + \ldots + w[p] * x[p] + b > 0$$

Evaluation Metrics

Precision/Recall

$y = 1$ in presence of rare class that we want to detect



→ **Precision**

(Of all patients where we predicted $y = 1$, what fraction actually has cancer?)

$$\frac{\text{True positives}}{\#\text{predicted positive}} = \frac{\text{True positive}}{\text{True pos} + \text{False pos}}$$

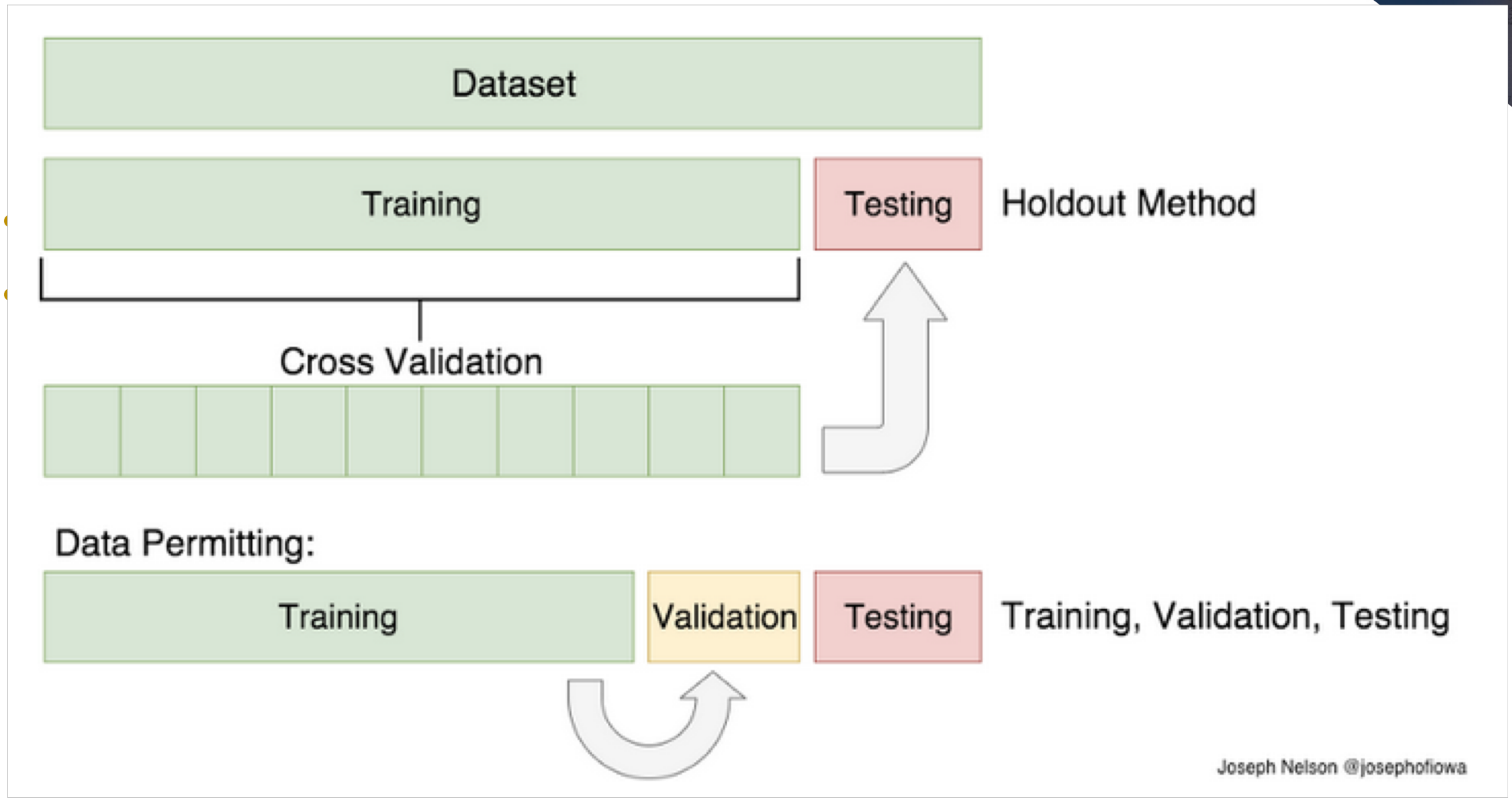
→ **Recall**

(Of all patients that actually have cancer, what fraction did we correctly detect as having cancer?)

$$\frac{\text{True positives}}{\#\text{actual positives}} = \frac{\text{True positives}}{\text{True pos} + \text{False neg}}$$

Slide by Andrew Ng (Machine Learning on Coursera)

Cross validation



Implementation tips

- Do you have a regression or classification problem?
- Do you have training data and what is the quality?
- Could you leverage open data and algorithms?
- Which features could help to distinguish between the classes? Features often matter more than algorithms
- Each model needs cross validation

Q&A

- Code & data available at https://github.com/chritter/Talks/tree/master/2018/Data_Challenge_UOttawa
- Could you adopt classification in your problem case?