PREDICTING ADVERSE DISCLOSURES IN CORPORATE FILINGS

ALEX NOCELLA

INTRODUCTION

- Goal
  - Make money
- Secondary goal
  - Algorithmically process text data in company filings
  - Detect anomalies
  - Use results to inform investment portfolio decisions

PRIOR WORK

- General process
  - Start with SEC Form 10-K
  - Identify fraud terms and features in the cross-section
  - Classify documents/companies as fraudulent
- Required data
  - Form 10-K
  - Tagged dataset of fraudulent documents
- List of things I did not have
  - Tagged dataset of fraudulent documents

PRIOR WORK (CONT'D)

- Typical accuracy around 80-90% in recent papers
  - Consider 50% baseline as many papers match class observations 1:1
- Common models used
  - SVM
  - Naïve Bayes
  - Logistic Regression
- Common feature techniques
  - TF-IDF token weights
  - Part of speech tagging
  - Word counts

PRIOR WORK (CONT'D)

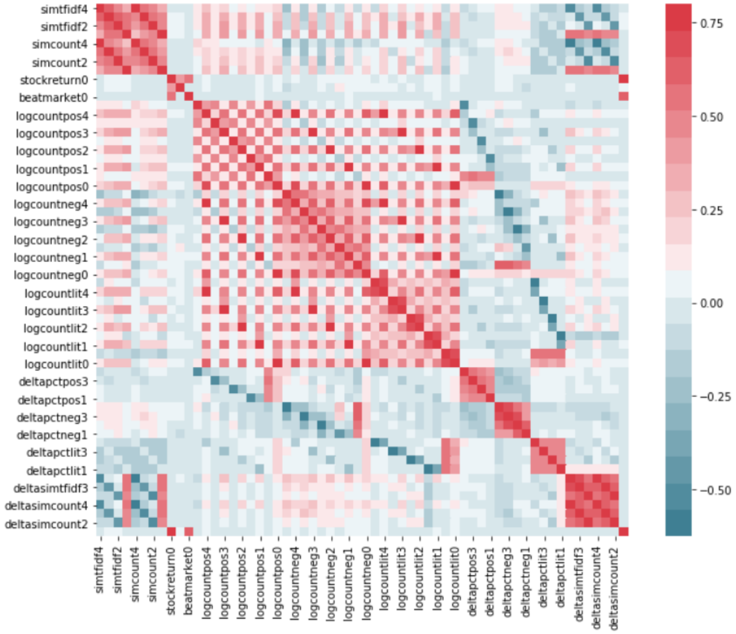
- Li (2006) has a similar idea
  - Go through all the Form 10-K filings you can find
  - Count the number of "risk" or "uncertainty"-like words, apply log
    - Literally, the paper just mentions things like "risk," "risks," "risky," "uncertain", "uncertainty"
  - Account for a lot of other company attributes
    - I don't do this step
    - Fama-French + momentum model
    - Throw away financial companies because seeing "risk" in Form 10-K is not meaningful
  - Paper claims 10% annualized alpha (excess return)
    - Buy low-change-in-risk-log-count names, sell high
    - Big if true

MY WORK

- SEC Form 10-Q and 10-K for current S&P 500 constituents
- Go back as far as possible (earliest 1994)
- Get rid of everything that isn't a word (100K+ word dictionary)
- Get rid of stop words
- Vectorize: TF-IDF and Count
- Count positive/negative/litigious tagged words (couple thousand word dictionary)
- Compute cosine similarity for both vectorizations, today vs each of prior 4 filings
- Compute changes in cosine similarities, tagged word counts, tagged word frequencies
- Target is whether stock outperforms market between now and next file date

SIZE OF DATA

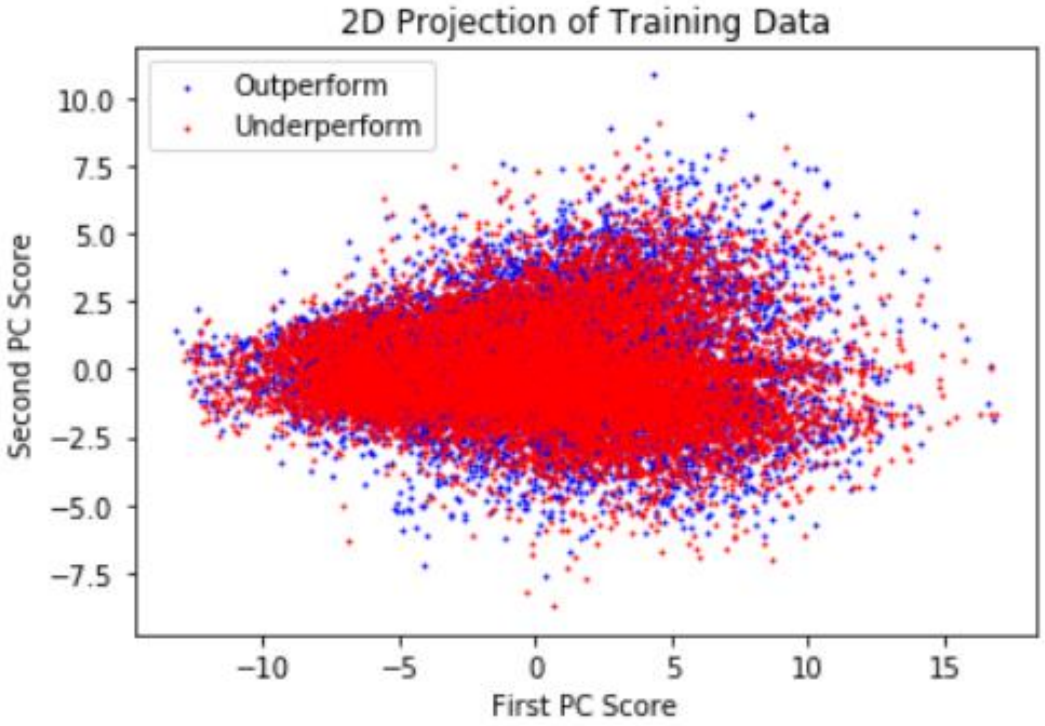
- Roughly 38,000 rows (row = 1 form filing, aka firm-quarter)
- 60 features



MACHINE LEARNING

- Binomial response variable
- Test data
  - Filing date 2015-present
  - > 5,000 records
- Dev data
  - Randomized 30% of the ~33,000 remaining records
- Easy candidates for linearly separable data
  - Logistic regression
  - SVM
  - PCA

LINEARLY SEPARABLE?



NONLINEAR ATTEMPTS

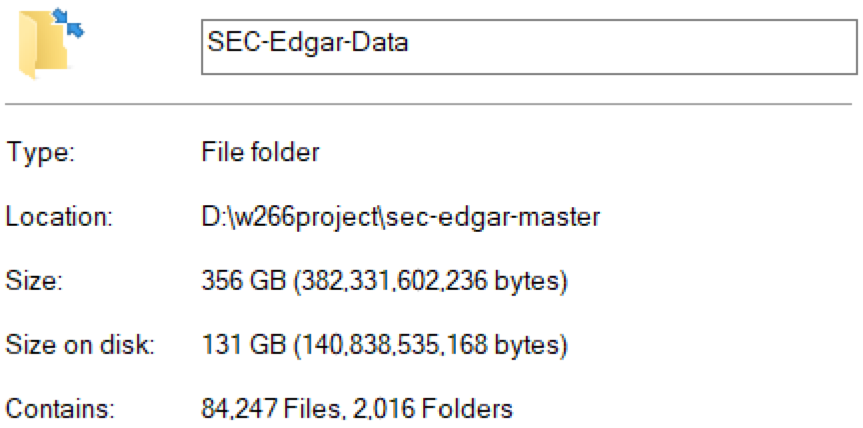
- K-nearest neighbors
  - Frequently worse than guessing one class every time
- Naïve Bayes
  - In most trials, identical accuracy to guessing one class every time
- Decision trees
  - Had trouble generalizing – extremely impressive, but overfit, accuracy

NONLINEAR ATTEMPTS (CONT'D)

- Multilayer perceptron
  - 4 hidden layers each with 100 neurons
  - Still suffered from overfitting
  - Dev data
    - 52.7% accuracy conditional / 53.1% unconditional
    - 57.0% precision conditional / 50.1% unconditional
    - 57.7% recall conditional / 39.3% unconditional
  - Test data
    - 52.3% accuracy conditional / 50.4% conditional
    - 56.7% precision conditional / 54.2% conditional
    - 17.7% recall conditional / 14.1% unconditional
    - Only 671 predictions out of > 3,000 samples in conditioned set (predicted prob > 0.64)

NOT SO FUN FACTS

- Akamai has their own binomial classification system
  - The amount of data I downloaded from the SEC led to an IP ban
  - I learned that Akamai hosts tons of content, like comcast.com, fidelity.com, vue.playstation.com



SEC-Edgar-Data

Type:	File folder
Location:	D:\w266project\sec-edgar-master
Size:	356 GB (382,331,602,236 bytes)
Size on disk:	131 GB (140,838,535,168 bytes)
Contains:	84,247 Files, 2,016 Folders

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