Analyzing Public Perceptions of the Affordable Care Act

CAPP 30254 - Machine Learning for Public Policy

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VERY BRIEF INTRO:

- Core NLP task: Sentiment analysis
- Binary classification: “positive” vs. “negative”
  - **Yelp reviews (labeled)**
    - Our cutoff: 1-2 star “negative”, 3-5 star “positive”
  - **Tweets (unlabeled)**
    - Our solution: 200 sample tweets, human-classified

MODELS WE TRAINED:

- Logistic Regression
- Neural Net
- Random Forest (bad!)
- Support Vector Machines (SVM)
- XGBoost

Grid search to tune hyperparameters

Main metric: **AUC-ROC**

blue = not on CAPP 30254 syllabus

Briefly: RESULTS (Yelp test data)

MODEL	F1 score, majority class (Pos)	F1 score, minority class (Neg)	Accuracy	**AUC-ROC**	Time to train best model
Random Forest	.86	.53	.78855	.78533	**< 2 min**
SVM	**.95**	.83	.9208	**.96804**	~51 min.
Logistic Reg.	**.95**	**.84**	**.92755**	.88618	**< 2 min.**
XGBoost	.94	.81	.91395	.96087	~7 min.
Neural Net	.94	.81	.91075	.87379	~15 min.

Briefly: RESULTS (Twitter data)

MODEL	F1 score, majority class (Neg)	F1 score, minority class (Pos)	Accuracy	**AUC-ROC**
Random Forest	.01	.49	*N/A*	0.50370
SVM	.56	.54	*N/A*	0.60085
Logistic Reg.	*N/A*	*N/A*	*N/A*	*N/A*
XGBoost	.50	.53	*N/A*	0.61481
Neural Net	*N/A*	*N/A*	*N/A*	*N/A*

Briefly: RESULTS (Twitter data)

MODEL	F1 score, majority class (Neg)	F1 score, minority class (Pos)	Accuracy	**AUC-ROC**
Random Forest	.01	.49	*N/A*	0.5
SVM	.56	.54	*N/A*	0.6
Logistic Reg.	*N/A*	*N/A*	*N/A*	*N/A*
XGBoost	.50	.53	*N/A*	0.6
Neural Net	*N/A*	*N/A*	*N/A*	*N/A*

...Massive performance drop for all finalist models

CHALLENGES: DATASETS ARE IMBALANCED IN OPPOSITE DIRECTIONS

	Yelp sample	**Twitter sample**
Sample size	n = 100,000	n = 200
Positive	**.77**	.325
Negative	.23	**.675**

- Yelp data skew very positive... Twitter data skew very negative
  - Sentiment is about words chosen, NOT opinion of the bill!
- We'd expect a big hit to metrics, esp. for Twitter minority class

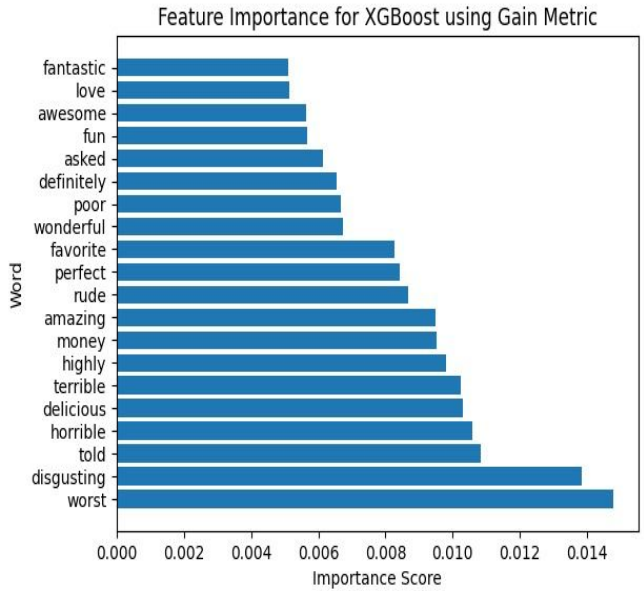
Everyone's negative...even ACA supporters

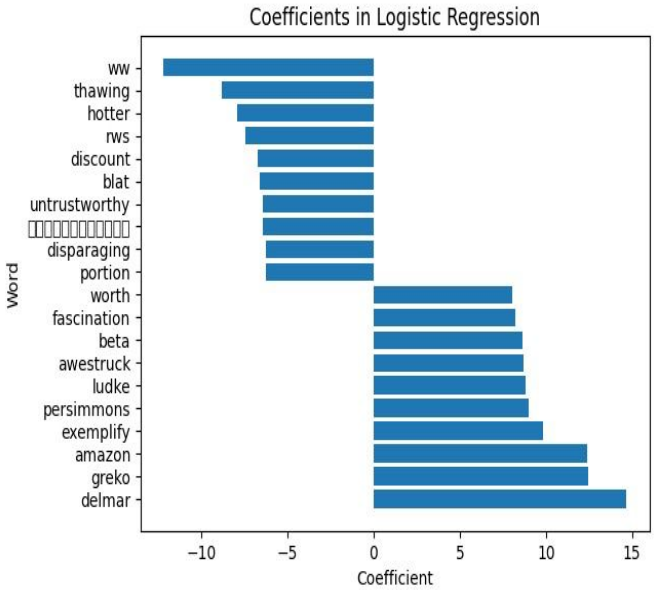
@realDonaldTrump DUMP WANTS TO REPLACE OBAMACARE, WITH "NO" HEALTHCARE !
HIS IMAGE AND POLITICS PRIORITY OVER AMERICAN LIVES ! WITHHELD LIFESAVING INFO, AND LIED. 200K + dead, due to lies and absolute ignorance !
THE TAPE, HOW DO THE SERIOUSLY BRAINWASHED AND BRAIN DEAD CULT MEMBERS, RATIONALIZE

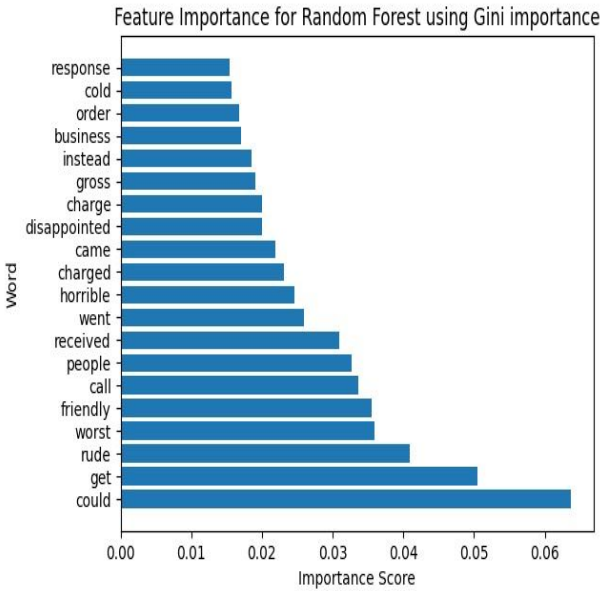
@HillaryClinton It's a good thing trump hasn't been able to repeal #Obamacare because a burn this bad will be a preexisting condition. https://t.co/4JShjQVM6B

CHALLENGES: YELP ≠ TWITTER

- Food reviews ≠ politics
- The sites' discourse norms are very different
- Did "food words" get stuck in our features, make our model worse? Let's check The Data™!







- **Food words:** ‘delicious’, ‘thawing’, ‘hotter’, ‘persimmons’, ‘cold’…
- **Service words:** ‘rude’, ‘friendly’…
- **???:** ‘greko’, ‘delmar’, ‘ludke’, ‘この店に向かうことにした’…

CHALLENGES: SARCASM / SNARK

@BillOReilly I thought Obamacare already fixed all that.

All our models: “positive”

In context: “negative”

- “Real” sentiment is the opposite of naive label
- Can we build a “sarcasm detector”...?

(Bill O’Reilly is a right-wing talk show host who opposes Obamacare. This user probably opposes it too)

CHALLENGES: "MERELY INFORMATIVE" AND IRRELEVANT TWEETS

Enrollment for Obamacare opens today to 12/15/20 https://t.co/S7qdER87fJ

- Our decision: label "positive"
- SVM and XGBoost: negative!

Colorado nurse transforms Covid vaccine vials into a work of art to show appreciation for health care workers - CNN https://t.co/NRrJ1m6A6a #HealthCare #HealthInsurance **#ACA #ObamaCare**

(↑ hashtags just added to boost engagement?)

- All models: "positive"

Inconsistently handled!

- Redo models w/ a "neutral" class?

CHALLENGES: AMBIVALENT DATA

@GovernorSununu On point! “Bernie Sanders is doing a **great** job of showing what a **disaster** ObamaCare is”

Our classification: “negative”

All three models: “positive”

What is the “correct” label???

(Context: Governor Sununu, a Republican, leads the state of New Hampshire. He opposes Obamacare. Bernie Sanders supports it.)

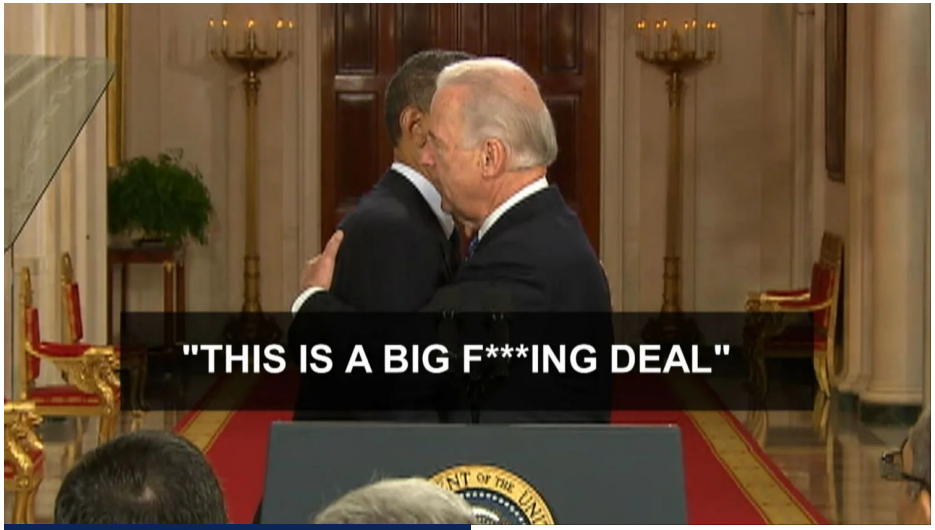
(*emphasis added*)

AVENUES FOR FUTURE INVESTIGATION

- Sentiment by term: “Affordable Care Act” vs. “Obamacare”
- Sentiment change over time (2019-2023)
- Other NLP methods: n-grams?
- Filter data for “tweet-like” Yelp reviews?
    - Limit to Twitter-like length? (max. 280 characters)

CONCLUSION

ML is a “big deal” -- but simple models trained in one context don’t magically generalize to others



The Guardian

Joe Biden: 'This is a big fucking deal'

The vice-president's loose lips fail him again as a microphone picks up an Anglo-Saxon aside meant for Obama's ears

Richard Adams

Tue 23 Mar 2010 13.13 EDT

Thank You!

(end of presentation)