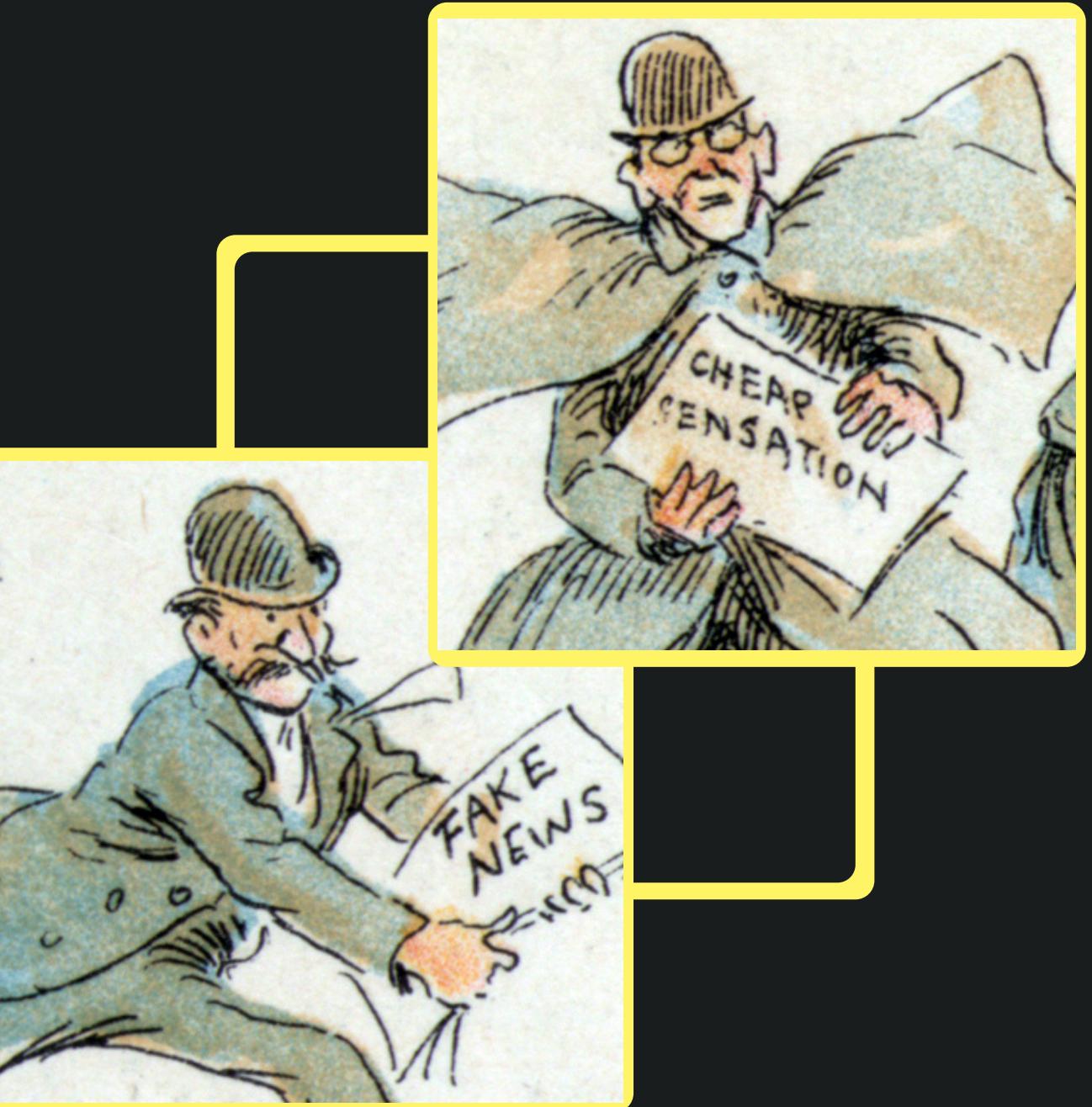


Classifying Fake News

By Marcelo Scatena



Overview

01 Business Problem

02 Data & Methods

03 Modeling

04 Conclusion



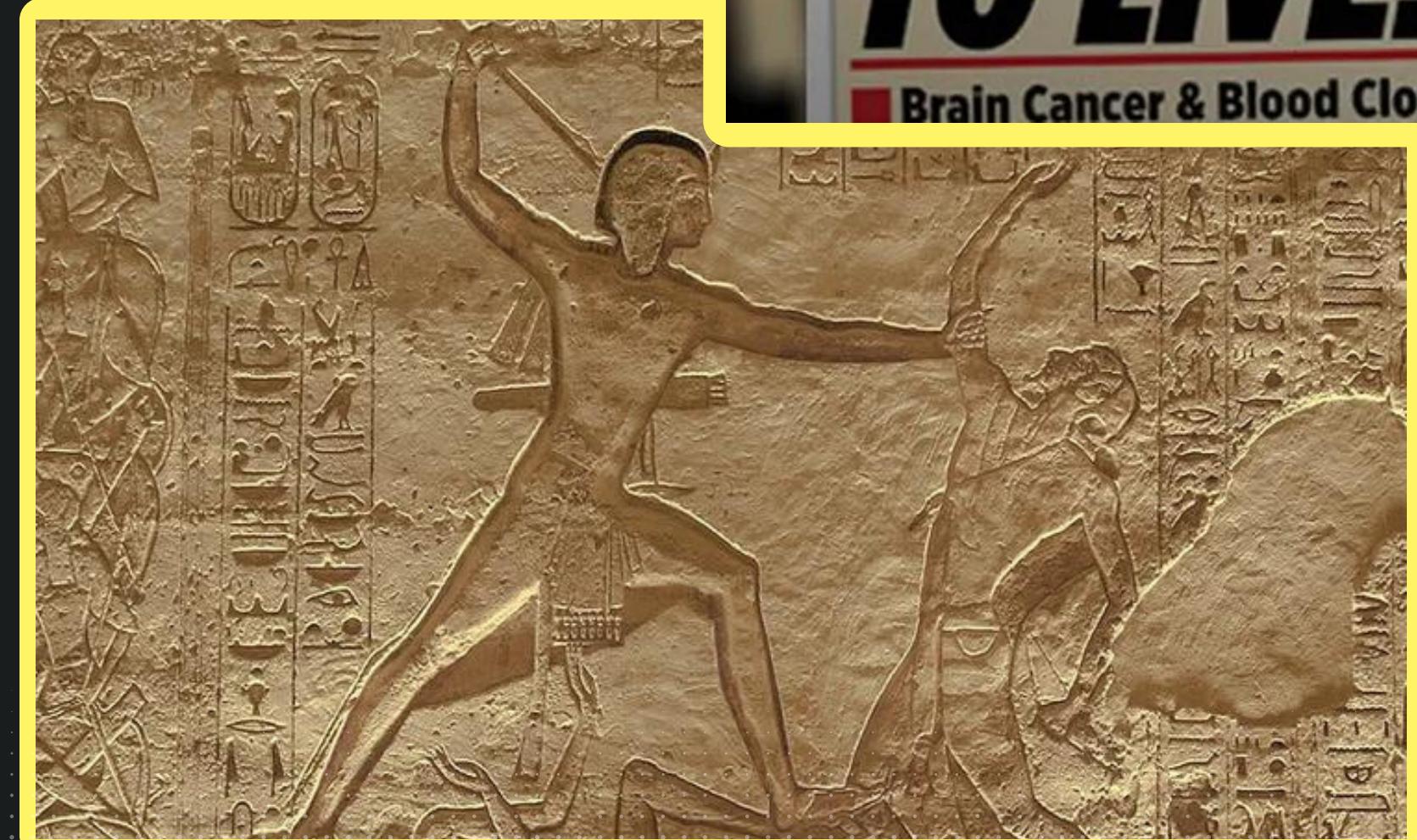
Business Problem

Has been around for a long time

- 2016 US Presidential Election
- WWII Propaganda
- 13th bc Battle of Kadesh

Can have many different types

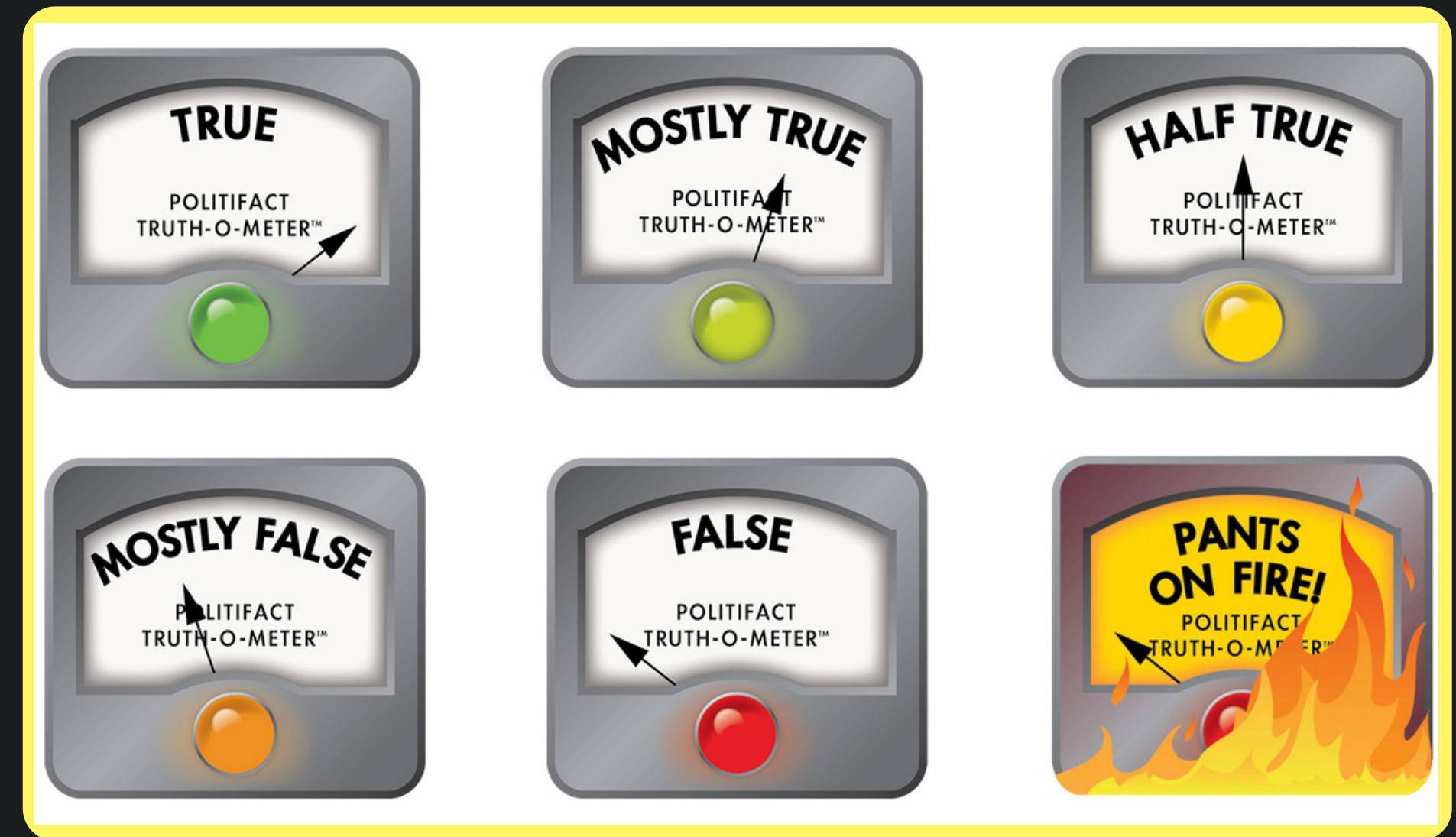
- Fabricated Content
- Manipulated Content
- Parody
- False Connection
- Manipulated Content
- Misleading Content
- Impostor Content



Data & Methods

LIAR dataset

- 12.8 thousand statements
- Collected with a 10 year range
- Humanly labelled in 6 categories
- 12 columns of metadata



Politifact .com



Tweets stated on March 01, 2022 in :

Video shows Ukrainian crisis actors come to life after pretending to be dead.

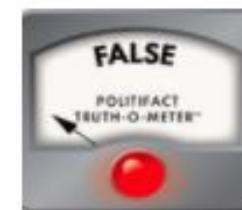
By Samantha Puttermann • March 4, 2022



Facebook posts stated on February 28, 2022 in :

A Ukrainian TikToker shows how to drive an abandoned Russian armored vehicle.

By Samantha Puttermann • March 4, 2022



Facebook posts stated on February 25, 2022 in :

The war in Ukraine is “scripted and staged.”

By Gabrielle Settles • March 4, 2022



Preprocessing

Original Statement

**"Twitter, Google and Facebook are burying the FBI
criminal investigation of Clinton. Very dishonest media!"**

Split words,
remove punctuation &
lowercase

**twitter, google, and, facebook, are, burying, the, fbi,
criminal, investigation, of, clinton, very, dishonest, media**

Remove Stopwords

**twitter, google, facebook, burying, fbi, criminal,
investigation, clinton, dishonest, media**



Preprocessing

Categorical Encoding

**twitter, google, facebook, burying, fbi, criminal,
investigation, clinton, dishonest, media**

twitter: 0

google: 1

facebook: 2

burying: 3

...

media: 9



Preprocessing

Categorical Encoding

**twitter, google, facebook, burying, fbi, criminal,
investigation, clinton, dishonest, media**

twitter: 0
google: 1
facebook: 2
burying: 3
...
media: 9



[0, 1, 2, 3...9]



Preprocessing

Categorical Encoding

twitter, google, facebook, burying, fbi, criminal,
investigation, clinton, dishonest, media

twitter: 0
google: 1
facebook: 2
burying: 3
...
media: 9



[0, 1, 2, **3**...9]



[1, 0, 0, 0, 0, 0, 0, 0, 0]
[0, 1, 0, 0, 0, 0, 0, 0, 0]
[0, 0, 1, 0, 0, 0, 0, 0, 0]
...
[0, 0, 0, 0, 0, 0, 0, 0, 1]



Preprocessing

Word Embedding

- Word2Vec



Preprocessing

Word Embedding

- Word2Vec



health

```
array([-0.95737183,  0.30383423,  0.36267897, -0.3145774 , -0.40760833,
       -0.9460593 ,  0.49187672,  1.4210457 , -0.30092633, -0.20819204,
       -0.770027 , -0.7723512 , -0.33388203, -0.1773534 ,  0.20409673,
       -0.5343583 , -0.39575577, -0.93514854, -0.06234565, -1.7523842 ,
       0.22604117,  0.65160227,  0.5052533 , -0.26991683, -0.3610879 ,
       -0.53496146, -0.32183996, -0.92692065,  0.07382824,  0.26401505,
       0.7777989 ,  0.04584725,  0.21644872, -0.6334908 ,  0.10794742,
       1.0837792 ,  0.05388981,  0.19897468,  0.6462655 , -1.1305623 ,
       0.15471256, -0.7179126 , -0.15460503, -0.32296193,  0.1598994 ,
       -0.5075027 , -0.7410554 ,  0.5247071 ,  0.0338988 ,  0.06148871,
       -0.26969084, -0.40099415,  0.30752096,  0.11141815, -0.5975455 ,
       0.9567183 ,  0.71071416, -0.3935786 , -0.60557264,  0.17251973,
       0.42103177,  0.02287591,  0.02722805, -0.9834109 , -0.35429567,
       0.23459306,  0.19908333,  0.42050263, -0.80189645,  0.11037309,
       -0.26703724,  0.9878612 ,  0.63543224, -0.02554742,  0.96865296,
       0.15772453,  0.29907194, -0.0074525 , -1.3398806 ,  0.17438231,
       -0.1138156 ,  0.4435544 , -0.30574077,  0.52437586,  0.2716861 ,
       -0.13374457,  0.034655 ,  0.8558606 ,  0.20205818, -0.17715032,
       0.5058484 ,  0.09029104,  0.16534522, -0.28038573,  1.0729178 ,
       1.0143198 , -0.3190712 , -0.8396994 ,  0.5295455 ,  0.6986663 ],
      dtype=float32)
```



Preprocessing

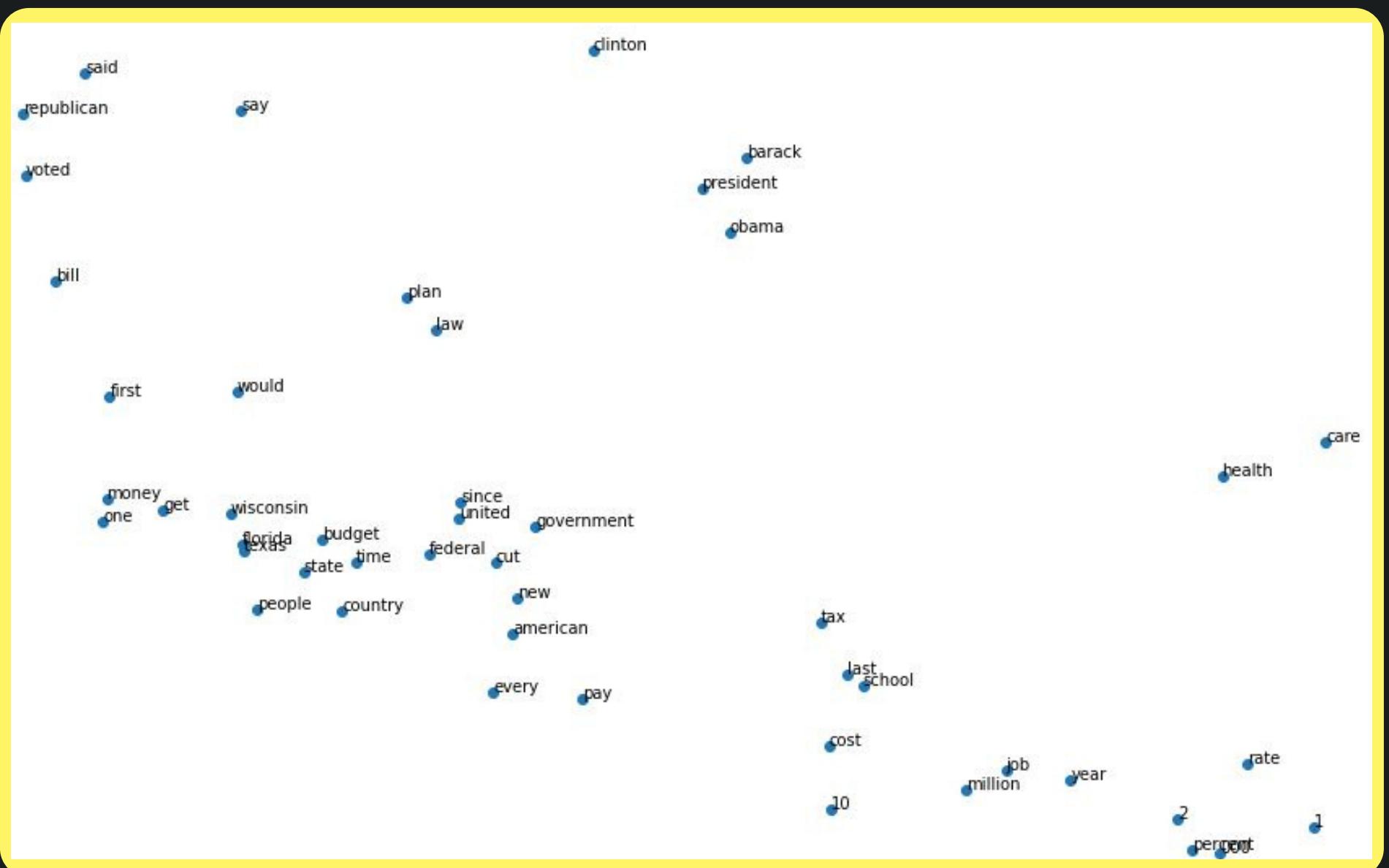
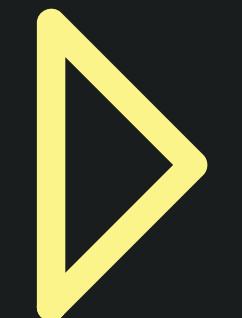
Word Embedding

- Word2Vec



health

```
array([-0.95737183,  0.30383423,  0.36267897, -0.3145774 , -0.40760833,
       -0.9460593 ,  0.49187672,  1.4210457 , -0.30092633, -0.20819204,
       -0.770027 , -0.7723512 , -0.33388203, -0.1773534 ,  0.20409673,
       -0.5343583 , -0.39575577, -0.93514854, -0.06234565, -1.7523842 ,
       0.22604117,  0.65160227,  0.5052533 , -0.26991683, -0.3610879 ,
       -0.53496146, -0.32183996, -0.92692065,  0.07382824,  0.26401505,
       0.7777989 ,  0.04584725,  0.21644872, -0.6334908 ,  0.10794742,
       1.0837792 ,  0.05388981,  0.19897468,  0.6462655 , -1.1305623 ,
       0.15471256, -0.7179126 , -0.15460503, -0.32296193,  0.1598994 ,
       -0.5075027 , -0.7410554 ,  0.5247071 ,  0.0338988 ,  0.06148871,
       -0.26969084, -0.40099415,  0.30752096,  0.11141815, -0.5975455 ,
       0.9567183 ,  0.71071416, -0.3935786 , -0.60557264,  0.17251973,
       0.42103177,  0.02287591,  0.02722805, -0.9834109 , -0.35429567,
       0.23459306,  0.19908333,  0.42050263, -0.80189645,  0.11037309,
       -0.26703724,  0.9878612 ,  0.63543224, -0.02554742,  0.96865296,
       0.15772453,  0.29907194, -0.0074525 , -1.3398806 ,  0.17438231,
       -0.1138156 ,  0.4435544 , -0.30574077,  0.52437586,  0.2716861 ,
       -0.13374457,  0.034655 ,  0.8558606 ,  0.20205818, -0.17715032,
       0.5058484 ,  0.09029104,  0.16534522, -0.28038573,  1.0729178 ,
       1.0143198 , -0.3190712 , -0.8396994 ,  0.5295455 ,  0.6986663 ],
      dtype=float32)
```



Preprocessing

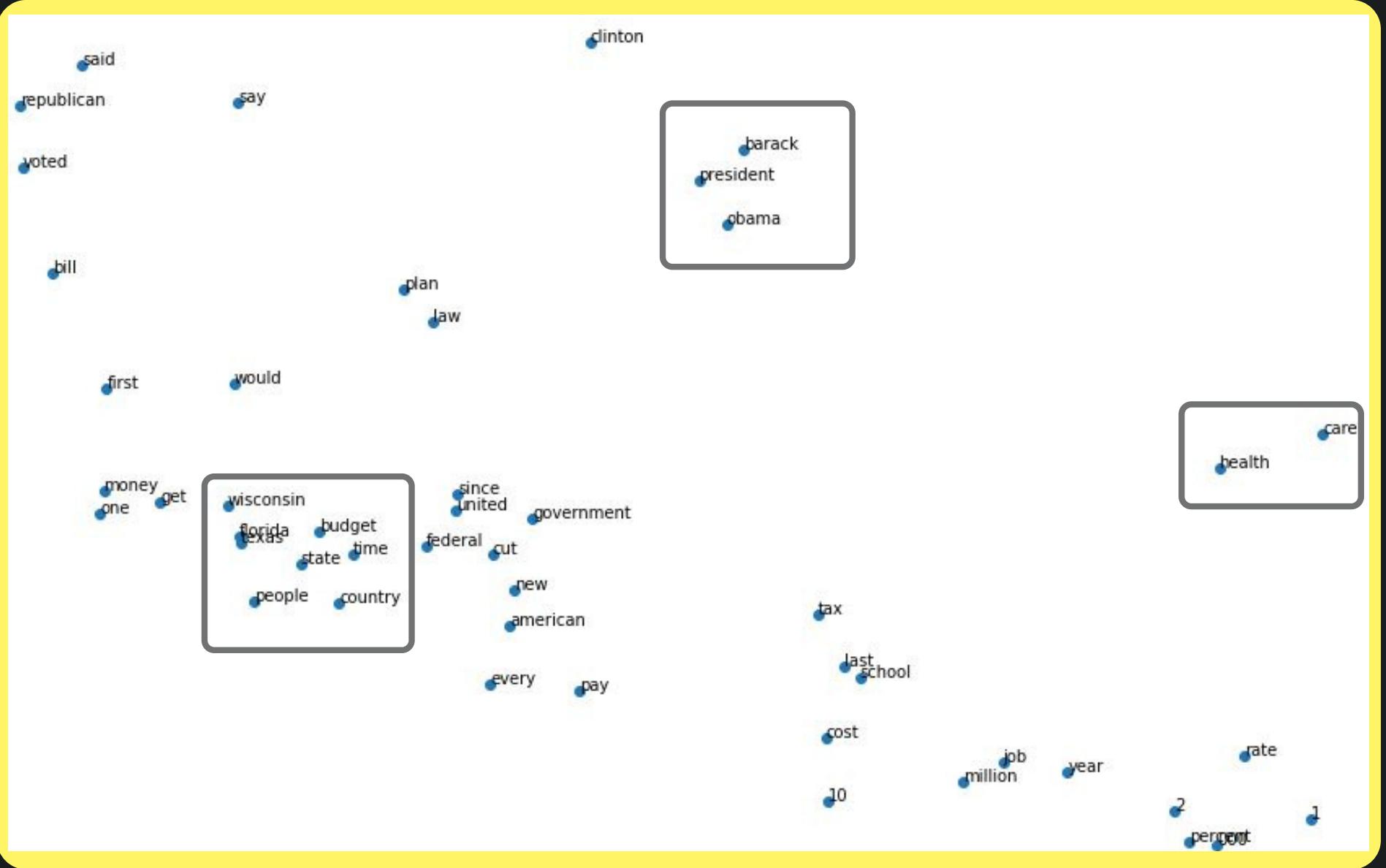
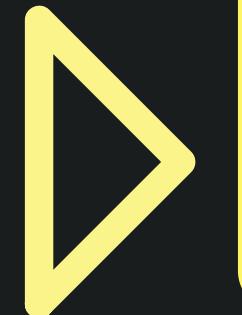
Word Embedding

- Word2Vec

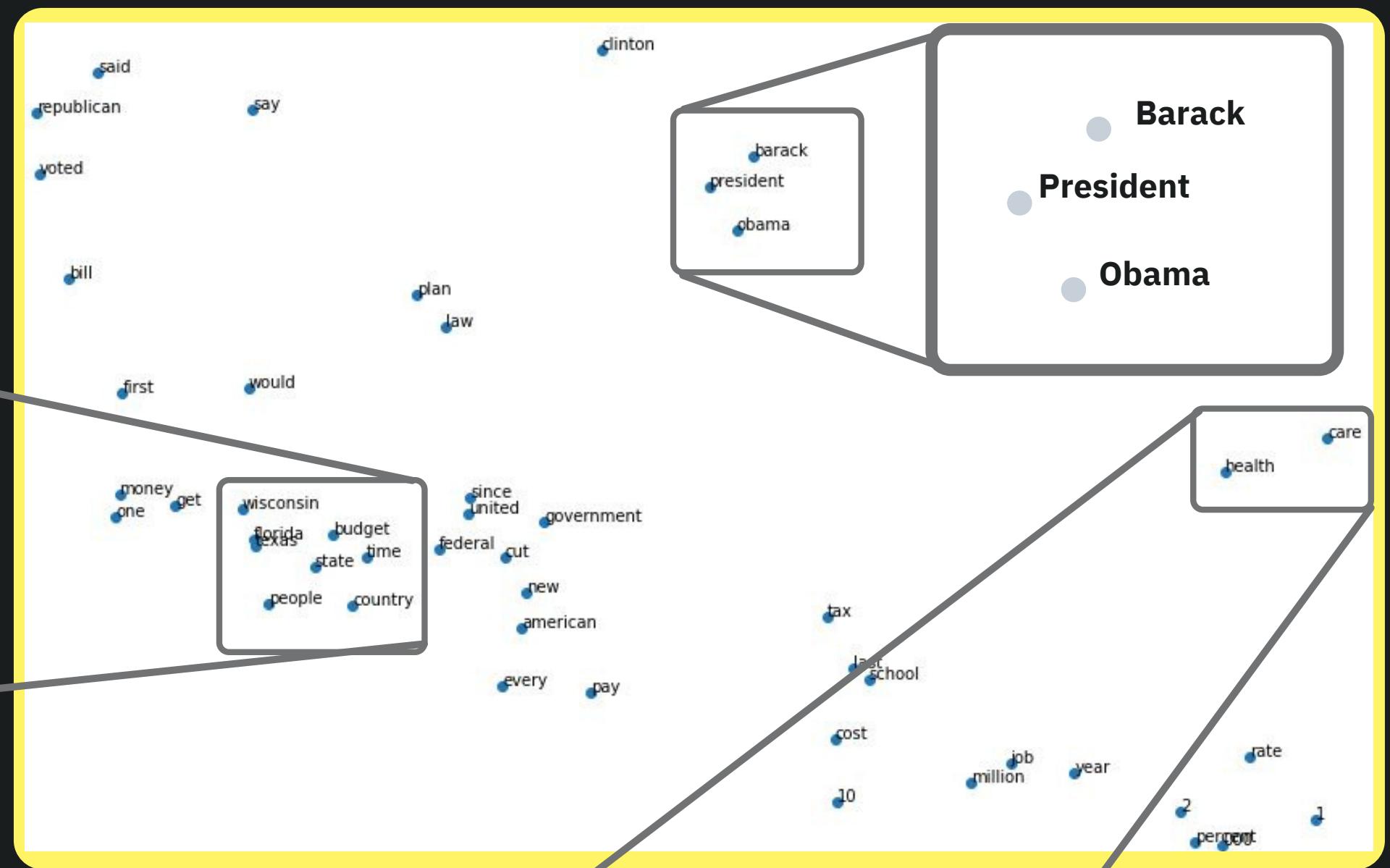
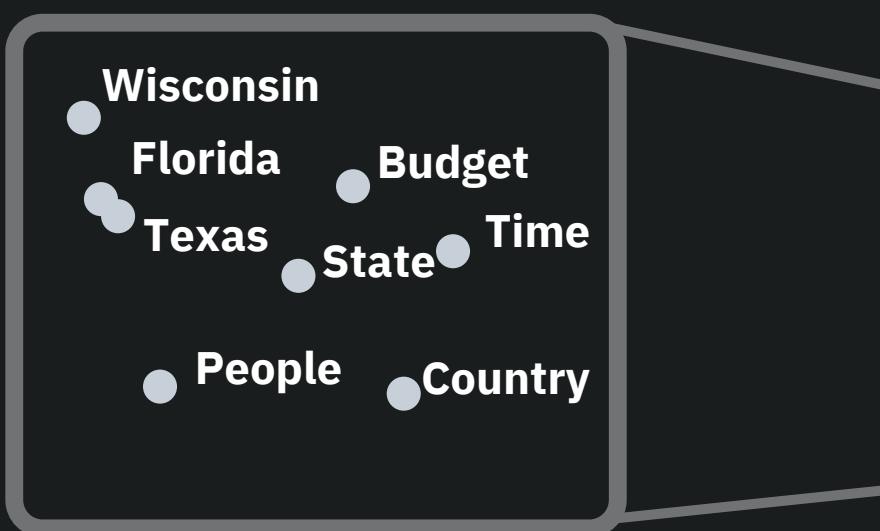


health

```
array([-0.95737183,  0.30383423,  0.36267897, -0.3145774 , -0.40760833,
       -0.9460593 ,  0.49187672,  1.4210457 , -0.30092633, -0.20819204,
       -0.770027 , -0.7723512 , -0.33388203, -0.1773534 ,  0.20409673,
       -0.5343583 , -0.39575577, -0.93514854, -0.06234565, -1.7523842 ,
       0.22604117,  0.65160227,  0.5052533 , -0.26991683, -0.3610879 ,
       -0.53496146, -0.32183996, -0.92692065,  0.07382824,  0.26401505,
       0.7777989 ,  0.04584725,  0.21644872, -0.6334908 ,  0.10794742,
       1.0837792 ,  0.05388981,  0.19897468,  0.6462655 , -1.1305623 ,
       0.15471256, -0.7179126 , -0.15460503, -0.32296193,  0.1598994 ,
       -0.5075027 , -0.7410554 ,  0.5247071 ,  0.0338988 ,  0.06148871,
       -0.26969084, -0.40099415,  0.30752096,  0.11141815, -0.5975455 ,
       0.9567183 ,  0.71071416, -0.3935786 , -0.60557264,  0.17251973,
       0.42103177,  0.02287591,  0.02722805, -0.9834109 , -0.35429567,
       0.23459306,  0.19908333,  0.42050263, -0.80189645,  0.11037309,
       -0.26703724,  0.9878612 ,  0.63543224, -0.02554742,  0.96865296,
       0.15772453,  0.29907194, -0.0074525 , -1.3398806 ,  0.17438231,
       -0.1138156 ,  0.4435544 , -0.30574077,  0.52437586,  0.2716861 ,
       -0.13374457,  0.034655 ,  0.8558606 ,  0.20205818, -0.17715032,
       0.5058484 ,  0.09029104,  0.16534522, -0.28038573,  1.0729178 ,
       1.0143198 , -0.3190712 , -0.8396994 ,  0.5295455 ,  0.6986663 ],
      dtype=float32)
```



Preprocessing



Preprocessing

Sentence Embedding

- Universal Sentence Encoder



Statement

"Hillary Clinton agrees with John..."
"Health Care reform legislation is..."



Preprocessing

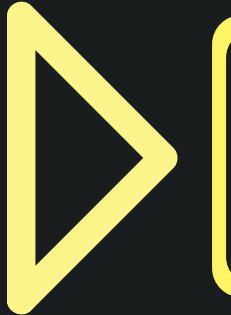
Sentence Embedding

- Universal Sentence Encoder



Statement

"Hillary Clinton agrees with John..."
"Health Care reform legislation is..."



Embedded Statement

[0.4, 0.9, 0.2, ...]
[0.2, 0.7, 0.1, ...]

Embed



Preprocessing

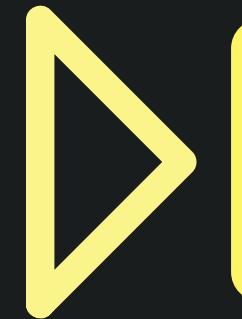
Sentence Embedding

- Universal Sentence Encoder



Statement

"Hillary Clinton agrees with John..."
"Health Care reform legislation is..."



Embed

[0.4, 0.9, 0.2, ...]
[0.2, 0.7, 0.1, ...]



Classify

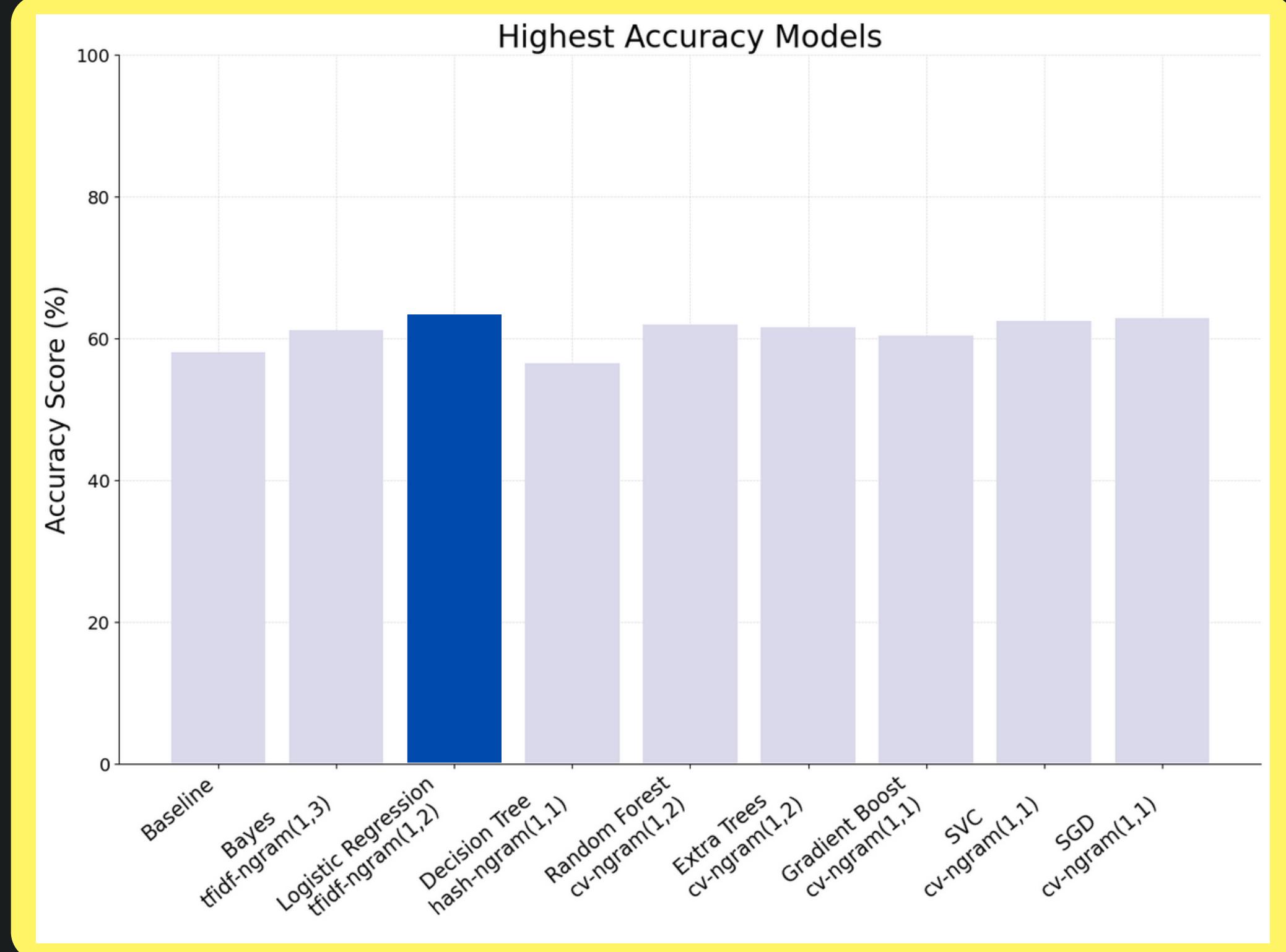


(62%) "Hillary Clinton..."
(24%) "Health Care..."

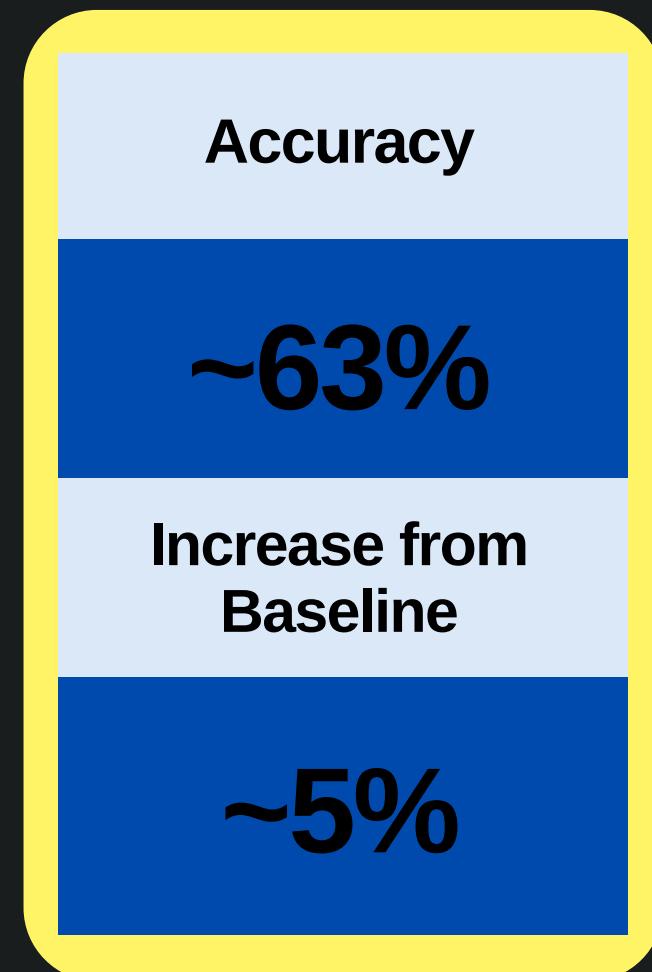


Confidence
in Truthness

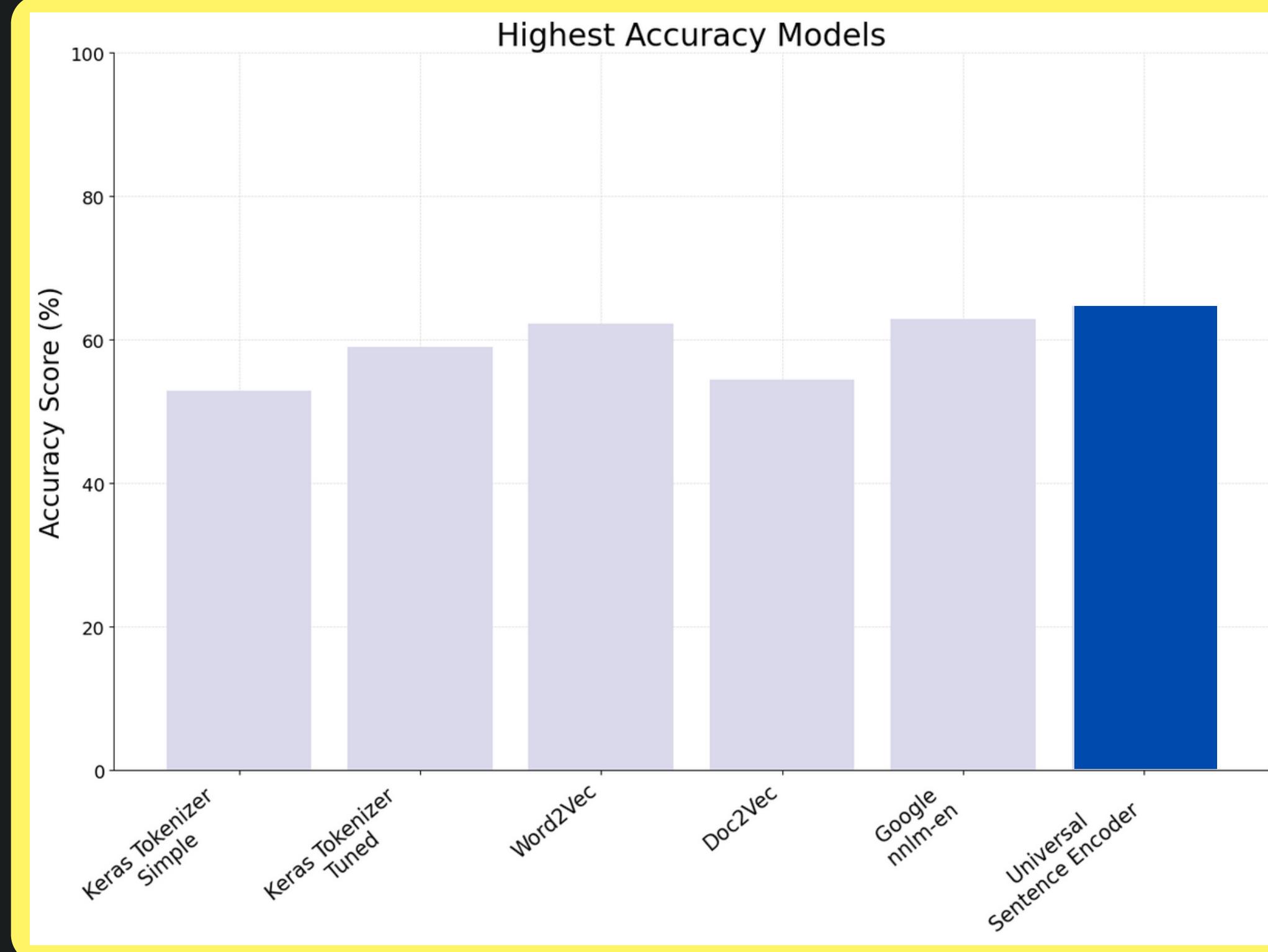
Encoding Models Performances



Tuned Logistic Regression



Embedding Models Performances



Universal
Sencence Encoder

Accuracy

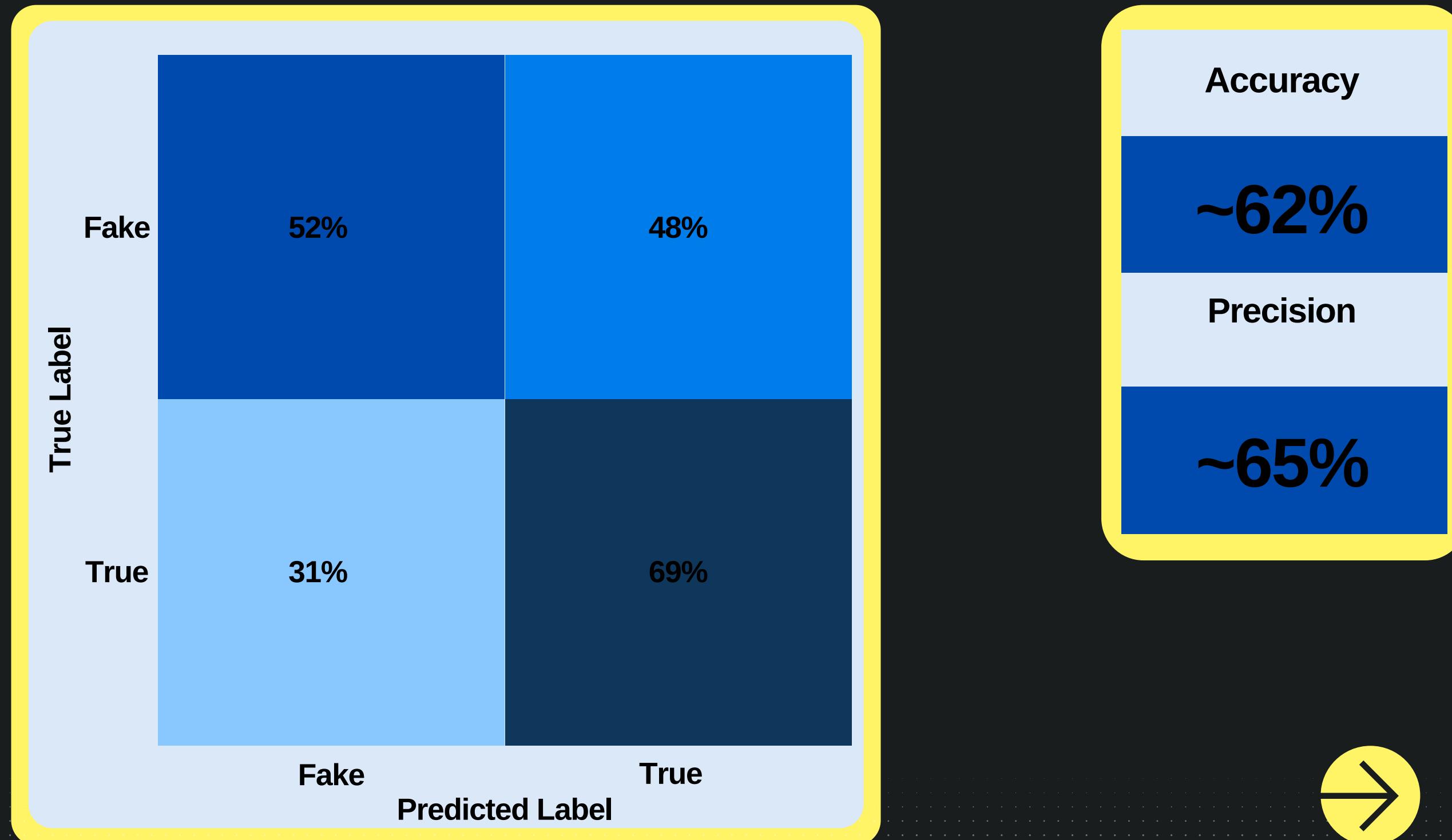
~64%

Increase from
Baseline

~6%

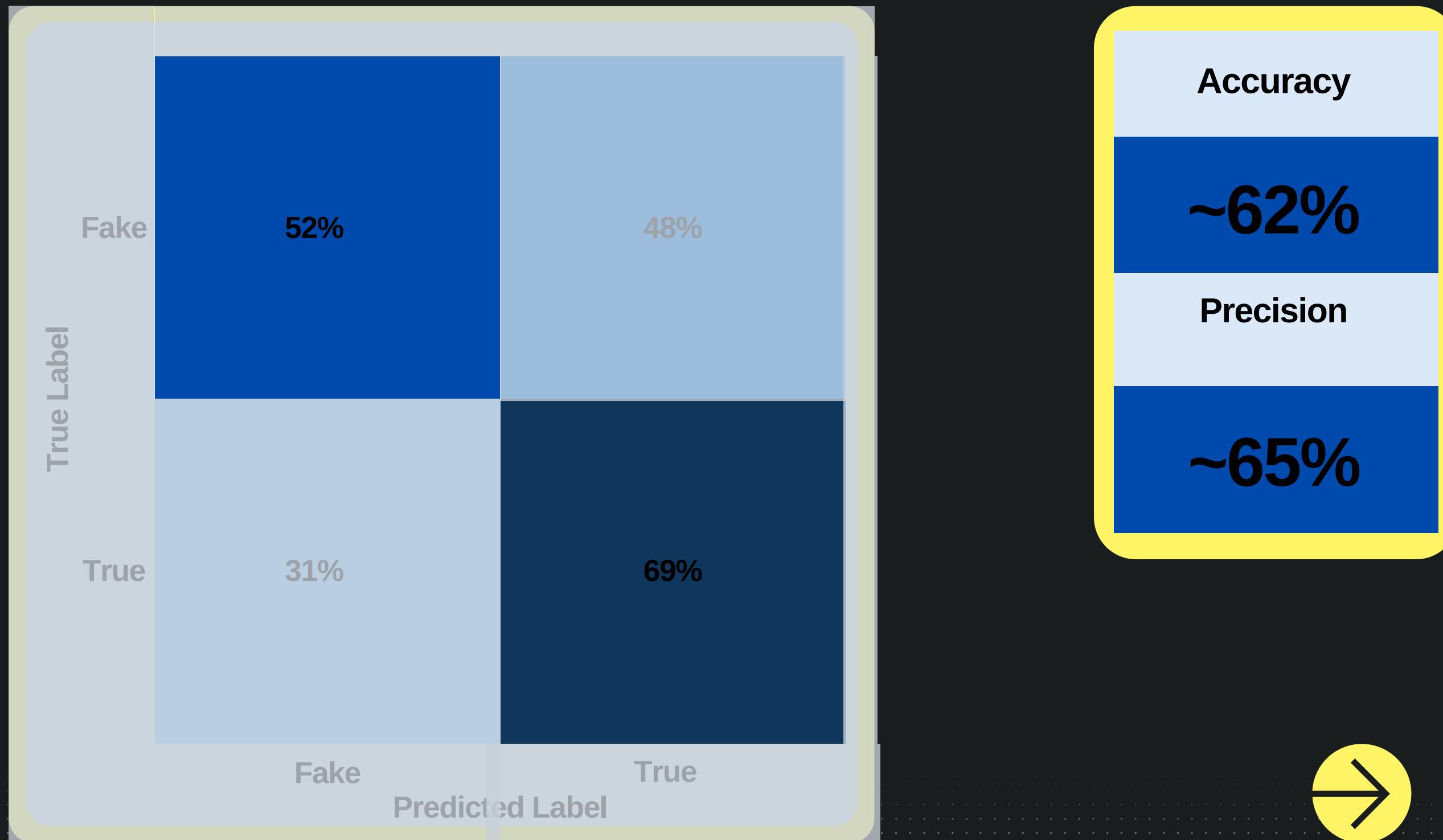
Universal Sentence Encoding

Confusion Matrix



Universal Sentence Encoding

Confusion Matrix



Limitations

"The cost of health care is now the single-biggest factor driving down the federal budget deficit."

**Barack Obama
2011**

"Twelve judges have thrown out legal challenges to the health care law because they rejected the notion that the health care law was unconstitutional."

**Barack Obama
2011**



Limitations

TRUE

"The cost of health care is now the single-biggest factor driving down the federal budget deficit."

Barack Obama
2011

FALSE

"Twelve judges have thrown out legal challenges to the health care law because they rejected the notion that the health care law was unconstitutional."

Barack Obama
2011



Next Steps

Use other embeddings

- There are other embeddings techniques to pursue. Bert, InferSent, Elmo are a few to try. Also, finding one that has been trained in a corpus with more relevant material to this objective might yield better results.

Use Metadata

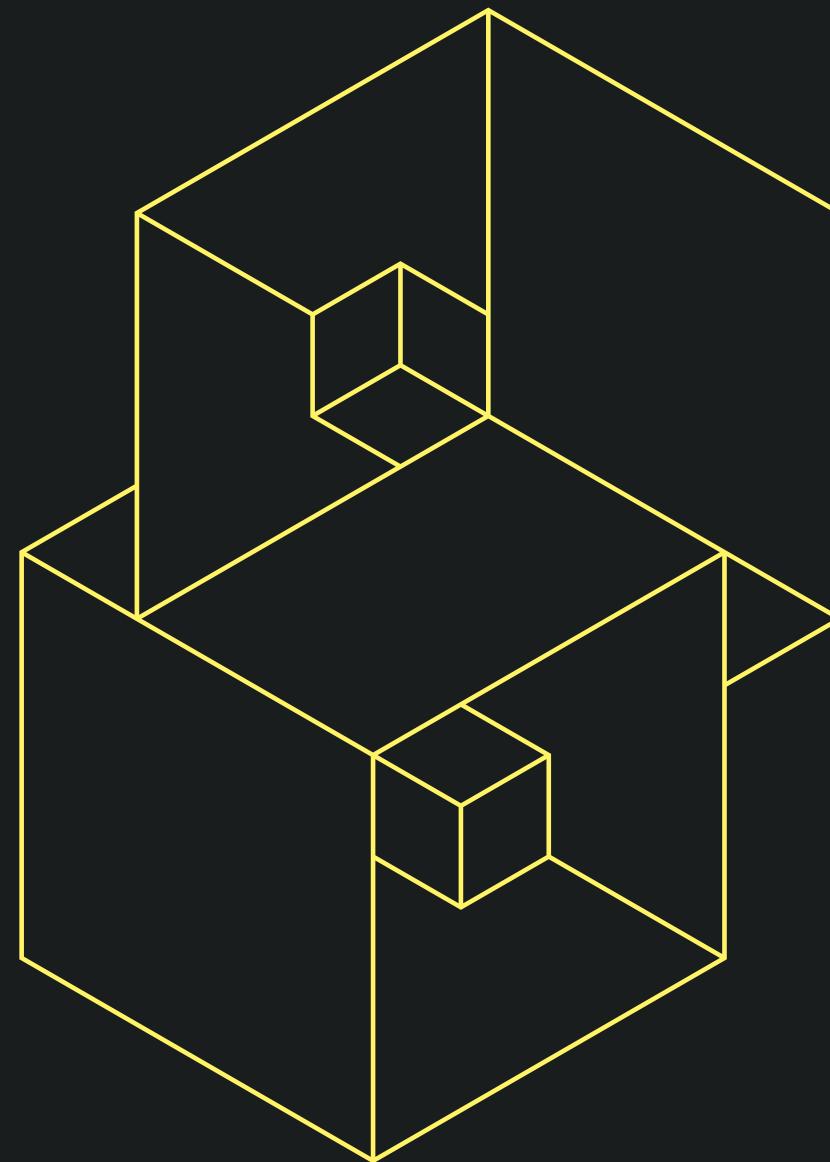
- The person making the statement, their political affiliation and other characteristics may affect how the model operates. If we have that information for new statements, it could give us a more accurate classification

Different Languages

- The model can be adapted to perform in different languages if there is a pre-trained model with that language vocabulary embedded



Thank you



Marcelo Scatena



marcelo.odd@gmail.com



github.com/moscatena

