

Fake News Classifier

Dataset: <https://www.kaggle.com/c/fake-news/data#>
(<https://www.kaggle.com/c/fake-news/data#>)

In [1]: `import pandas as pd`

In [2]: `df=pd.read_csv('fake-news/train.csv')`

In [3]: `df.head()`

Out[3]:

	id	title	author	text
0	0	House Dem Aide: We Didn't Even See Comey's Let...	Darrell Lucus	House Dem Aide: We Didn't Even See Comey's Let...
1	1	FLYNN: Hillary Clinton, Big Woman on Campus - ...	Daniel J. Flynn	Ever get the feeling your life circles the rou...
2	2	Why the Truth Might Get You Fired	Consortiumnews.com	Why the Truth Might Get You Fired October 29, ...
3	3	15 Civilians Killed In Single US Airstrike Hav...	Jessica Purkiss	Videos 15 Civilians Killed In Single US Aistr...
4	4	Iranian woman jailed for fictional unpublished...	Howard Portnoy	Print \nAn Iranian woman has been sentenced to...

In [4]: `## Get the Independent Features`

```
X=df.drop('label',axis=1)
```

```
In [5]: X.head()
```

```
Out[5]:
```

	id	title	author	text
0	0	House Dem Aide: We Didn't Even See Comey's Let...	Darrell Lucus	House Dem Aide: We Didn't Even See Comey's Let...
1	1	FLYNN: Hillary Clinton, Big Woman on Campus - ...	Daniel J. Flynn	Ever get the feeling your life circles the rou...
2	2	Why the Truth Might Get You Fired	Consortiumnews.com	Why the Truth Might Get You Fired October 29, ...
3	3	15 Civilians Killed In Single US Airstrike Hav...	Jessica Purkiss	Videos 15 Civilians Killed In Single US Aistr...
4	4	Iranian woman jailed for fictional unpublished...	Howard Portnoy	Print \nAn Iranian woman has been sentenced to...

```
In [6]: ## Get the Dependent features
y=df['label']
```

```
In [7]: y.head()
```

```
Out[7]: 0    1
1    0
2    1
3    1
4    1
Name: label, dtype: int64
```

```
In [10]: df.shape
```

```
In [10]: df.shape
```

```
Out[10]: (18285, 5)
```

```
In [9]: from sklearn.feature_extraction.text import CountVectorizer, TfidfVectorizer, HashingVectorizer
```

```
In [9]: df=df.dropna()
```

```
In [11]: df.head(10)
```

```
Out[11]:
```

	id	title	author	text
0	0	House Dem Aide: We Didn't Even See Comey's Let...	Darrell Lucas	House De Aide: We Didn't Ev See Com Let...
1	1	FLYNN: Hillary Clinton, Big Woman on Campus - ...	Daniel J. Flynn	Ever get t feeling yo life circles rou...
2	2	Why the Truth Might Get You Fired	Consortiumnews.com	Why the 1 Might Get You Fired October 2 ...
3	3	15 Civilians Killed In Single US Airstrike Hav...	Jessica Purkiss	Videos 15 Civilians Killed In Single US Aistr...
4	4	Iranian woman jailed for fictional unpublished...	Howard Portnoy	Print \nAr Iranian woman ha been sentenced to...
5	5	Jackie Mason: Hollywood Would Love Trump if He...	Daniel Nussbaum	In these ti times, Jac Mason is Voi...
7	7	Benoît Hamon Wins French	Alissa J. Rubin	PARIS — France ch an idealis

		Socialist Party's Pre...		traditi...
9	9	A Back-Channel Plan for Ukraine and Russia, Co...	Megan Twohey and Scott Shane	A week before Michael T Flynn resigned : nat...
10	10	Obama's Organizing for Action Partners with So...	Aaron Klein	Organizin Action, th activist gr that...
11	11	BBC Comedy Sketch "Real Housewives of ISIS" Ca...	Chris Tomlinson	The BBC produced spoof on t "Real Housewiv

In [12]:

messages=df.copy()

In [13]:

messages.reset_index(inplace=True)

In [14]:

messages.head(10)

Out[14]:

	index	id	title	author	tex
0	0	0	House Dem Aide: We Didn't Even See Comey's Let...	Darrell Lucus	Hou Aid Did See Let.
1	1	1	FLYNN: Hillary Clinton, Big Woman on Campus - ...	Daniel J. Flynn	Eve feel life rou
2	2	2	Why the Truth Might Get You Fired	Consortiumnews.com	Wh Mig You Oct ...
3	3	3	15 Civilians Killed In Single US Airstrike	Jessica Purkiss	Vid Civ Kill Sin

			Hav...		Airs
4	4	4	Iranian woman jailed for fictional unpublished...	Howard Portnoy	Prir Irar wor bee sen to...
5	5	5	Jackie Mason: Hollywood Would Love Trump if He...	Daniel Nussbaum	In tl time Ma: Voi.
6	7	7	Benoît Hamon Wins French Socialist Party's Pre...	Alissa J. Rubin	PAI Fra an i trac
7	9	9	A Back-Channel Plan for Ukraine and Russia, Co...	Megan Twohey and Scott Shane	A w befi Mic Flyi resi nat.
8	10	10	Obama's Organizing for Action Partners with So...	Aaron Klein	Org Act acti thal
9	11	11	BBC Comedy Sketch "Real Housewives of ISIS" Ca...	Chris Tomlinson	The pro spo "Re Ho

In [15]: `messages['text'][6]`

Out[15]: 'PARIS — France chose an idealistic, traditional candidate in Sunday's primary to represent the Socialist and parties in the presidential election this spring. The candidate, Benoît Hamon, 49, who ran on the slogan that he would "make France's heart beat," bested Manuel Valls, the former prime minister, whose campaign has promoted more policies and who has a strong background. Mr. Hamon appeared to have won by a wide margin, with incomplete returns showing him with an estimated 58 percent of the vote to Mr. Valls's 41 perc

50 percent of the vote to Mr. Valls's 12 percent. "Tonight the left holds its head up high again it is looking to the future," Mr. Hamon said, addressing his supporters. "Our country needs the left, but a modern, innovative left," he said. Mr. Hamon's victory was the clearest sign yet that voters on the left want a break with the policies of President François Hollande, who in December announced that he would not seek re-election. However, Mr. Hamon's strong showing is unlikely to change widespread assessments that Mr. Hamon's candidates have little chance of making it into the second round of voting in the general election. The first round of the general election is set for April 23 and the runoff for May 7. The Socialist Party is deeply divided, and one measure of its lack of popular enthusiasm was the relatively low number of people voting. About two million people voted in the second round of the primary on Sunday, in contrast with about 2.9 million in the second round of the last presidential primary on the left, in 2011. However, much of the conventional wisdom over how the elections will go has been thrown into question over the past week, because the leading candidate, François Fillon, who represents the main party, the Republicans, was accused of paying his wife large sums of money to work as his parliamentary aide. While nepotism is legal in the French political system, it is not clear that she actually did any work. Prosecutors who specialize in financial malfeasance are reviewing the case. France's electoral system allows multiple candidates to run for president in the first round of voting, but only the top two go on to a second round. Mr. Hamon is entering a race that is already crowded on the left, with candidates who include Mélenchon on the far left, and Emmanuel Macron, an independent who served as economy minister in Mr. Hollande's government and who embraces more liberal policies. Unless he decides to withdraw, Mr. Fillon, the mainstream right candidate, will also run, as will the extreme right candidate Marine Le Pen. The two have been expected to go to the runoff. Mr. Hamon's victory can be attributed at least in part to his image as an idealist and traditional leftist candidate who appeals to union voters as well as more environmentally concerned and socially liberal young people. Unlike Mr. Valls, he also clearly distanced himself from some of Mr. Hollande's more unpopular policies, especially the economic ones. Thomas Kekenbosch, 22, a student and one of the leaders of the group the Youth With Benoît Hamon, said Mr. Hamon embodied a new hope for those on the left. "We have

ave a perspective we have something to do, to build,” Mr. Kekenbosch said. Mr. Hollande had disappointed many young people because under him the party abandoned ideals, such as support for workers, that many voters believe in, according to Mr. Kekenbosch. Mr. Hollande’s government, under pressure from the European Union to meet budget restraints, struggled to pass labor code reforms to make the market more attractive to foreign investors and also to encourage French businesses to expand in France. The measures ultimately passed after weeks of strikes, but they were watered down and generated little concrete progress in improving France’s roughly 10 percent unemployment rate and its nearly 25 percent youth joblessness rate. Mr. Hamon strongly endorses a stimulus approach to improving the economy and has promised to phase in a universal income, which would especially help young people looking for work, but would also supplement the livelihood of French workers. The end goal would be to have everyone receive 750 euros per month (about \$840). “We have someone that trusts us,” Mr. Kekenbosch said, “who says: ‘I give you enough to pay for your studies. You can have a scholarship which spares you from working at McDonald’s on provisional contracts for 4 years.’” Mr. Hamon advocates phasing out diesel fuel and encouraging drivers to replace vehicles that use petroleum products with electrical ones. His leftist pedigree began early. His father worked at an arsenal in Brest, a city in the far west of Brittany, and his mother worked off and on as a secretary. He was an early member of the Movement of Young Socialists, and he has continued to work closely with them through his political life. He also worked for Martine Aubry, now the mayor of Lille and a former Socialist Party leader.’

```
In [ ]: from nltk.corpus import stopwords
from nltk.stem.porter import PorterStemmer
import re
ps = PorterStemmer()
corpus = []
for i in range(0, len(messages)):
    review = re.sub('[^a-zA-Z]', ' ', message)
    review = review.lower()
    review = review.split()

    review = [ps.stem(word) for word in review
              if not word in stopwords.words('english')]
    review = ' '.join(review)
    corpus.append(review)
```

In [24]: corpus[3]

Out[24]: 'civilian kill singl us airstrik identifi'

In []:

In [17]: **## TFidf Vectorizer**
from sklearn.feature_extraction.text import T
fidfVectorizer
tfidf_v=TFidfVectorizer(max_features=5000, ngr
am_range=(1,3))
X=tfidf_v.fit_transform(corpus).toarray()

In [18]: X.shape

Out[18]: (18285, 5000)

In [19]: y=messages['label']

In [20]: **## Divide the dataset into Train and Test**
from sklearn.model_selection import train_tes
t_split
X_train, X_test, y_train, y_test = train_test
_split(X, y, test_size=0.33, random_state=0)

In [21]: tfidf_v.get_feature_names()[:20]

Out[21]: ['abandon',
'abc',
'abc news',
'abduct',
'abe',
'abedin',
'abl',
'abort',
'abroad',
'absolut',
'abstain',
'absurd',
'abus',
'abus new',
'abus new york',
'academi',
'accept',
'access',
'access pipelin',
'access pipelin protest']

In [22]: tfidf_v.get_params()

Out[22]: {'analyzer': 'word',
'binary': False,
'decode_error': 'strict',
'dtype': numpy.int64,
'encoding': 'utf-8',
... ..}


```

'input': 'content',
'lowercase': True,
'max_df': 1.0,
'max_features': 5000,
'min_df': 1,
'ngram_range': (1, 3),
'norm': 'l2',
'preprocessor': None,
'smooth_idf': True,
'stop_words': None,
'strip_accents': None,
'sublinear_tf': False,
'token_pattern': ' (?u)\\b\\w\\w+\\b',
'tokenizer': None,
'use_idf': True,
'vocabulary': None}

```

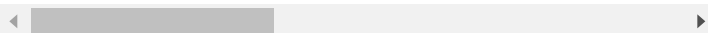
```
In [23]: count_df = pd.DataFrame(X_train, columns=tfidf_v.get_feature_names())
```

```
In [27]: count_df.head()
```

```
Out[27]:
```

	abandon	abc	abc news	abduct	abe	abedin	abl	at
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.

5 rows × 5000 columns



```
In [28]: import matplotlib.pyplot as plt
```

```
In [29]: def plot_confusion_matrix(cm, classes,
                                normalize=False,
                                title='Confusion matrix',
                                cmap=plt.cm.Blues):
    """
    See full source and example:
    http://scikit-learn.org/stable/auto_examples/model_selection/plot_confusion_matrix.html

    This function prints and plots the confusion matrix.
    Normalization can be applied by setting `normalize=True`.
    """
```

```

plt.imshow(cm, interpolation=nearest, cmap=cmap)
plt.title(title)
plt.colorbar()
tick_marks = np.arange(len(classes))
plt.xticks(tick_marks, classes, rotation=45)
plt.yticks(tick_marks, classes)

if normalize:
    cm = cm.astype('float') / cm.sum(axis=1)[:, np.newaxis]
    print("Normalized confusion matrix")
else:
    print('Confusion matrix, without normalization')

thresh = cm.max() / 2.
for i, j in itertools.product(range(cm.shape[0]), range(cm.shape[1])):
    plt.text(j, i, cm[i, j],
             horizontalalignment="center",
             color="white" if cm[i, j] > thresh else "black")

plt.tight_layout()
plt.ylabel('True label')
plt.xlabel('Predicted label')

```

MultinomialNB Algorithm

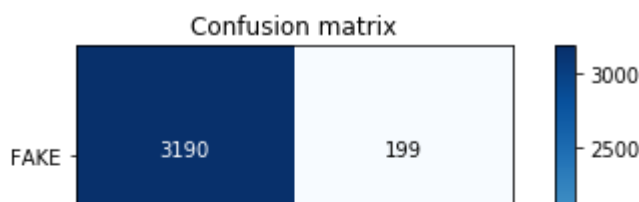
```
In [30]: from sklearn.naive_bayes import MultinomialNB
classifier=MultinomialNB()
```

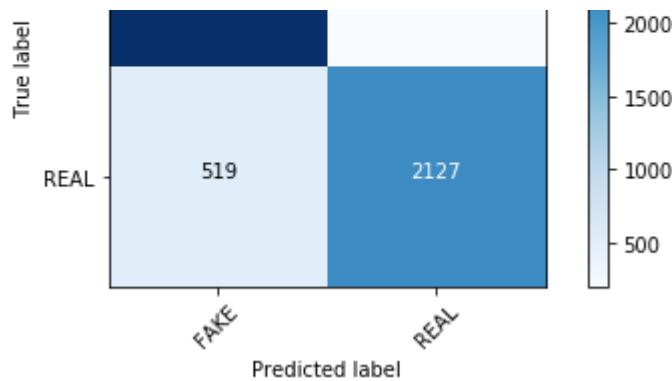
```
In [31]: from sklearn import metrics
import numpy as np
import itertools
```

```
In [32]: classifier.fit(X_train, y_train)
pred = classifier.predict(X_test)
score = metrics.accuracy_score(y_test, pred)
print("accuracy: %0.3f" % score)
cm = metrics.confusion_matrix(y_test, pred)
plot_confusion_matrix(cm, classes=['FAKE', 'REAL'])
```

accuracy: 0.881

Confusion matrix, without normalization





```
In [33]: classifier.fit(X_train, y_train)
pred = classifier.predict(X_test)
score = metrics.accuracy_score(y_test, pred)
score
```

Out[33]: 0.8810273405136703

```
In [34]: y_train.shape
```

Out[34]: (12250,)

Passive Aggressive Classifier Algorithm

```
In [35]: from sklearn.linear_model import PassiveAggressiveClassifier
linear_clf = PassiveAggressiveClassifier(n_iter=50)
```

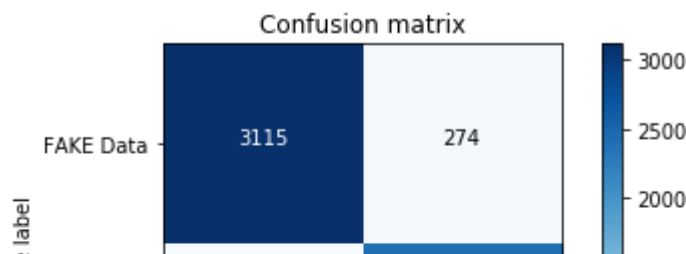
```
In [36]: linear_clf.fit(X_train, y_train)
pred = linear_clf.predict(X_test)
score = metrics.accuracy_score(y_test, pred)
print("accuracy: %0.3f" % score)
cm = metrics.confusion_matrix(y_test, pred)
plot_confusion_matrix(cm, classes=['FAKE Data', 'REAL Data'])
```

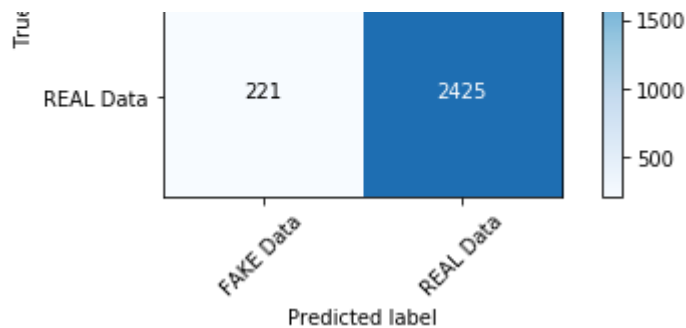
c:\users\krish.naik\appdata\local\continuum\anaconda3\envs\nlp\lib\site-packages\sklearn\linear_model\stochastic_gradient.py:117: DeprecationWarning: n_iter parameter is deprecated in 0.19 and will be removed in 0.21. Use max_iter and tol instead.

DeprecationWarning)

accuracy: 0.918

Confusion matrix, without normalization





Multinomial Classifier with Hyperparameter

```
In [37]: classifier=MultinomialNB(alpha=0.1)
```

```
In [38]: previous_score=0
for alpha in np.arange(0,1,0.1):
    sub_classifier=MultinomialNB(alpha=alpha)
    sub_classifier.fit(X_train,y_train)
    y_pred=sub_classifier.predict(X_test)
    score = metrics.accuracy_score(y_test, y_
pred)
    if score>previous_score:
        classifier=sub_classifier
    print("Alpha: {}, Score : {}".format(alpha,score))
```

```
c:\users\krish.naik\appdata\local\continuum\anaconda3\envs\nlp\lib\site-packages\sklearn\n
aive_bayes.py:472: UserWarning: alpha too sma
ll will result in numeric errors, setting alp
ha = 1.0e-10
```

```
'setting alpha = %.1e' % _ALPHA_MIN)
```

```
Alpha: 0.0, Score : 0.8662800331400166
```

```
Alpha: 0.1, Score : 0.8777133388566695
```

```
Alpha: 0.2, Score : 0.8801988400994201
```

```
Alpha: 0.30000000000000004, Score : 0.8798674
3993372
```

```
Alpha: 0.4, Score : 0.8808616404308203
```

```
Alpha: 0.5, Score : 0.8806959403479702
```

```
Alpha: 0.6000000000000001, Score : 0.88152444
07622204
```

```
Alpha: 0.7000000000000001, Score : 0.88135874
06793704
```

```
Alpha: 0.8, Score : 0.8816901408450705
```

```
Alpha: 0.9, Score : 0.8816901408450705
```

```
In [106]: ## Get Features names
feature_names = cv.get_feature_names()
```

```
In [109]: classifier.coef_[0]
```

```
Out[109]: array([-9.10038883, -8.62276128, -9.100388
83, ..., -10.79498456,
0.01467160, 0.220647401])
```

```
-0.7140/107, -7.52004/477)
```

```
In [107]: ### Most real
sorted(zip(classifier.coef_[0], feature_names), reverse=True)[:20]
```

```
Out[107]: [(-4.000149156604985, 'trump'),
(-4.287872694443541, 'hillari'),
(-4.396389621061519, 'clinton'),
(-4.899969726208735, 'elect'),
(-5.176598600897756, 'new'),
(-5.234730366348767, 'comment'),
(-5.273968180973631, 'video'),
(-5.3868167681180115, 'war'),
(-5.396821854078974, 'us'),
(-5.412019714988405, 'hillari clinton'),
(-5.417137433425386, 'fbi'),
(-5.48068448454208, 'vote'),
(-5.566255475855405, 'email'),
(-5.578238842742501, 'world'),
(-5.634015380199913, 'obama'),
(-5.734501455772904, 'donald'),
(-5.763095255139644, 'donald trump'),
(-5.785090276725191, 'russia'),
(-5.846224665218559, 'day'),
(-5.862110622807369, 'america')]
```

```
In [135]: ### Most fake
sorted(zip(classifier.coef_[0], feature_names))[:5000]
```

```
Out[135]: [(-10.794984555596727, 'abe'),
(-10.794984555596727, 'abroad'),
(-10.794984555596727, 'abus new'),
(-10.794984555596727, 'abus new york'),
(-10.794984555596727, 'act new'),
(-10.794984555596727, 'act new york'),
(-10.794984555596727, 'advic'),
(-10.794984555596727, 'advis new'),
(-10.794984555596727, 'advis new york'),
(-10.794984555596727, 'age new'),
(-10.794984555596727, 'age new york'),
(-10.794984555596727, 'agenda breitbart'),
(-10.794984555596727, 'ail'),
(-10.794984555596727, 'aleppo new'),
(-10.794984555596727, 'aleppo new york'),
(-10.794984555596727, 'ali'),
(-10.794984555596727, 'america breitbart'),
(-10.794984555596727, 'america new york'),
(-10.794984555596727, 'american breitbart'),
(-10.794984555596727, 'american new'),
(-10.794984555596727, 'american new york'),
(-10.794984555596727, 'ami'),
(-10.794984555596727, 'ami schumer'),
(-10.794984555596727, 'amp'),
(-10.794984555596727, 'ann'),
(-10.794984555596727, 'ann coulter'),
(-10.794984555596727, 'applaud'),
(-10.794984555596727, 'arab')]
```

```
(-10.794984555596727, 'asian'),
(-10.794984555596727, 'assail'),
(-10.794984555596727, 'athlet'),
(-10.794984555596727, 'attack breitbart'),
(-10.794984555596727, 'attack new'),
(-10.794984555596727, 'attack new york'),
(-10.794984555596727, 'attack syria'),
(-10.794984555596727, 'attend'),
(-10.794984555596727, 'avert'),
(-10.794984555596727, 'away new'),
(-10.794984555596727, 'away new york'),
(-10.794984555596727, 'back new'),
(-10.794984555596727, 'back new york'),
(-10.794984555596727, 'baltimor'),
(-10.794984555596727, 'ban breitbart'),
(-10.794984555596727, 'ban new'),
(-10.794984555596727, 'ban new york'),
(-10.794984555596727, 'bangladesh'),
(-10.794984555596727, 'barron trump'),
(-10.794984555596727, 'basic'),
(-10.794984555596727, 'basketbal'),
(-10.794984555596727, 'basketbal player'),
(-10.794984555596727, 'baton'),
(-10.794984555596727, 'baton roug'),
(-10.794984555596727, 'battl new'),
(-10.794984555596727, 'battl new york'),
(-10.794984555596727, 'bay'),
(-10.794984555596727, 'beach new'),
(-10.794984555596727, 'beach new york'),
(-10.794984555596727, 'begin new'),
(-10.794984555596727, 'behead photo'),
(-10.794984555596727, 'behind trump'),
(-10.794984555596727, 'berkeley breitbart'),
(-10.794984555596727, 'betsi'),
(-10.794984555596727, 'betsi devo'),
(-10.794984555596727, 'bill breitbart'),
(-10.794984555596727, 'bill new'),
(-10.794984555596727, 'bill new york'),
(-10.794984555596727, 'bill reilli'),
(-10.794984555596727, 'billi'),
(-10.794984555596727, 'blue state'),
(-10.794984555596727, 'blue state blue'),
(-10.794984555596727, 'bolster'),
(-10.794984555596727, 'border patrol'),
(-10.794984555596727, 'border patrol agen
t'),
(-10.794984555596727, 'border state'),
(-10.794984555596727, 'border wall'),
(-10.794984555596727, 'border wall breitbar
t'),
(-10.794984555596727, 'bowl'),
(-10.794984555596727, 'box offic'),
(-10.794984555596727, 'bradi'),
(-10.794984555596727, 'breath'),
(-10.794984555596727, 'breitbart news dail
i'),
(-10.794984555596727, 'brief new'),
```

```
(-10.794984555596727, 'brief new york'),
(-10.794984555596727, 'broadway'),
(-10.794984555596727, 'bronx'),
(-10.794984555596727, 'brooklyn'),
(-10.794984555596727, 'brooklyn new'),
(-10.794984555596727, 'brooklyn new york'),
(-10.794984555596727, 'bureaucrat'),
(-10.794984555596727, 'caitlyn'),
(-10.794984555596727, 'caitlyn jenner'),
(-10.794984555596727, 'cal'),
(-10.794984555596727, 'california today'),
(-10.794984555596727, 'calm'),
(-10.794984555596727, 'campaign breitbart'),
(-10.794984555596727, 'campaign new'),
(-10.794984555596727, 'campaign new york'),
(-10.794984555596727, 'campu breitbart'),
(-10.794984555596727, 'cann'),
(-10.794984555596727, 'car new'),
(-10.794984555596727, 'car new york'),
(-10.794984555596727, 'care act'),
(-10.794984555596727, 'care act new'),
(-10.794984555596727, 'care bill'),
(-10.794984555596727, 'care breitbart'),
(-10.794984555596727, 'carri fisher'),
(-10.794984555596727, 'carson'),
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