NLP Project

December 5, 2017

1 Natural Language Processing Project

In this NLP project, I attempted to classify Yelp Reviews into 1 star or 5 star categories based off the text content in the reviews. I used the Yelp Review Data Set from Kaggle.

Each observation in this dataset is a review of a particular business by a particular user.

The "stars" column is the number of stars (1 through 5) assigned by the reviewer to the business. (Higher stars is better.) In other words, it is the rating of the business by the person who wrote the review.

The "cool" column is the number of "cool" votes this review received from other Yelp users.

All reviews start with 0 "cool" votes, and there is no limit to how many "cool" votes a review can receive. In other words, it is a rating of the review itself, not a rating of the business.

The "useful" and "funny" columns are similar to the "cool" column.

1.1 Imports

Import the usual suspects. :)

```
In [18]: import pandas as pd
         import numpy as np
         import matplotlib.pyplot as plt
         import seaborn as sns
         %matplotlib inline
```

1.2 The Data

Read the yelp.csv file and set it as a dataframe called yelp.

```
In [19]: yelp = pd.read_csv('yelp.csv')
```

** Check the head, info , and describe methods on yelp.**

```
In [20]: yelp.head(5)
```

```
Out[20]:              business_id        date               review_id  stars  \
         0  9yKzy9PApeiPPOUJEtnvkg  2011-01-26  fWKvX83p0-ka4JS3dc6E5A      5
         1  ZRJwVLyzEJq1VAihDhYiow  2011-07-27  IjZ33sJrzXqU-0X6U8NwyA      5
         2  6oRAC4uyJCsJl1X0WZpVSA  2012-06-14  IESLBzqUCLdSzSqm0eCSxQ      4
         3  _1QQZuf4zZOyFCvXc0o6Vg  2010-05-27  G-WvGaISbqqaMHlNnByodA      5
```

```
4  6ozycU1RpktNG2-1BroVtw  2012-01-05  1uJFq2r5QfJG_6ExMRCaGw      5

                                                  text    type  \
0  My wife took me here on my birthday for breakf...  review
1  I have no idea why some people give bad review...  review
2  love the gyro plate. Rice is so good and I als...  review
3  Rosie, Dakota, and I LOVE Chaparral Dog Park!!...  review
4  General Manager Scott Petello is a good egg!!!...  review

                  user_id  cool  useful  funny
0  rLtl8ZkDX5vH5nAx9C3q5Q     2       5      0
1  0a2KyEL0d3Yb1V6aivbIuQ     0       0      0
2  0hT2KtfLiobPvh6cDC8JQg     0       1      0
3  uZetl9T0NcROGOyFfughhg     1       2      0
4  vYmM4KTsC8ZfQBg-j5MWkw     0       0      0
```

In [97]:

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to 9999
Data columns (total 10 columns):
business_id    10000 non-null object
date           10000 non-null object
review_id      10000 non-null object
stars          10000 non-null int64
text           10000 non-null object
type           10000 non-null object
user_id        10000 non-null object
cool           10000 non-null int64
useful         10000 non-null int64
funny          10000 non-null int64
dtypes: int64(4), object(6)
memory usage: 781.3+ KB
```

In [99]:
```
yelp.describe()
```

Out[99]:

```
              stars          cool        useful         funny
count  10000.000000  10000.000000  10000.000000  10000.000000
mean       3.777500      0.876800      1.409300      0.701300
std        1.214636      2.067861      2.336647      1.907942
min        1.000000      0.000000      0.000000      0.000000
25%        3.000000      0.000000      0.000000      0.000000
50%        4.000000      0.000000      1.000000      0.000000
75%        5.000000      1.000000      2.000000      1.000000
max        5.000000     77.000000     76.000000     57.000000
```

Created a new column called "text length" which is the number of words in the text column.

In [100]:
```
yelp['text length'] = yelp['text'].apply(len)
```

2 EDA

Let's explore the data

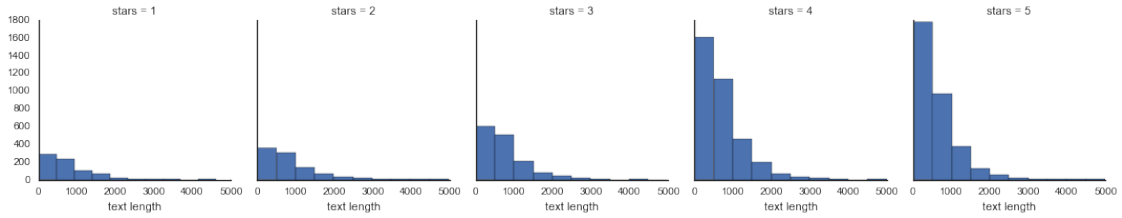
2.1 Imports

```
In [101]: sns.set_style('white')
```

Use FacetGrid from the seaborn library to create a grid of 5 histograms of text length based off of the star ratings.

```
In [102]: g = sns.FacetGrid(yelp,col='stars')
          g.map(plt.hist,'text length',bins=50)
```

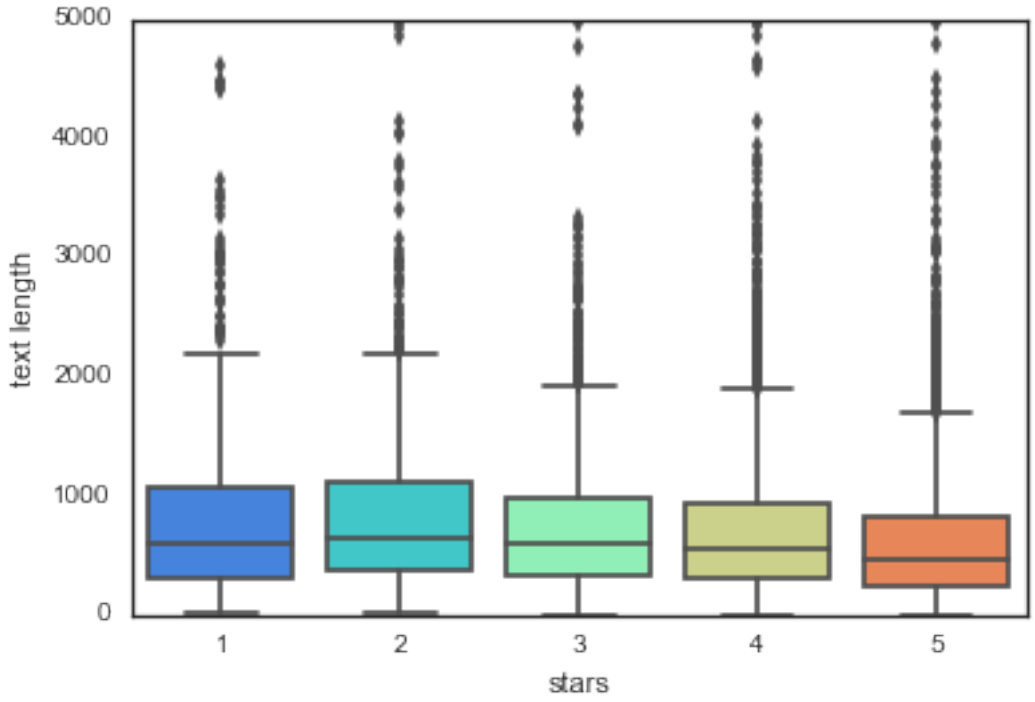
```
Out[102]: <seaborn.axisgrid.FacetGrid at 0x121e705f8>
```



Created a boxplot of text length for each star category.

```
In [103]: sns.boxplot(x='stars',y='text length', data=yelp, palette='rainbow')
```

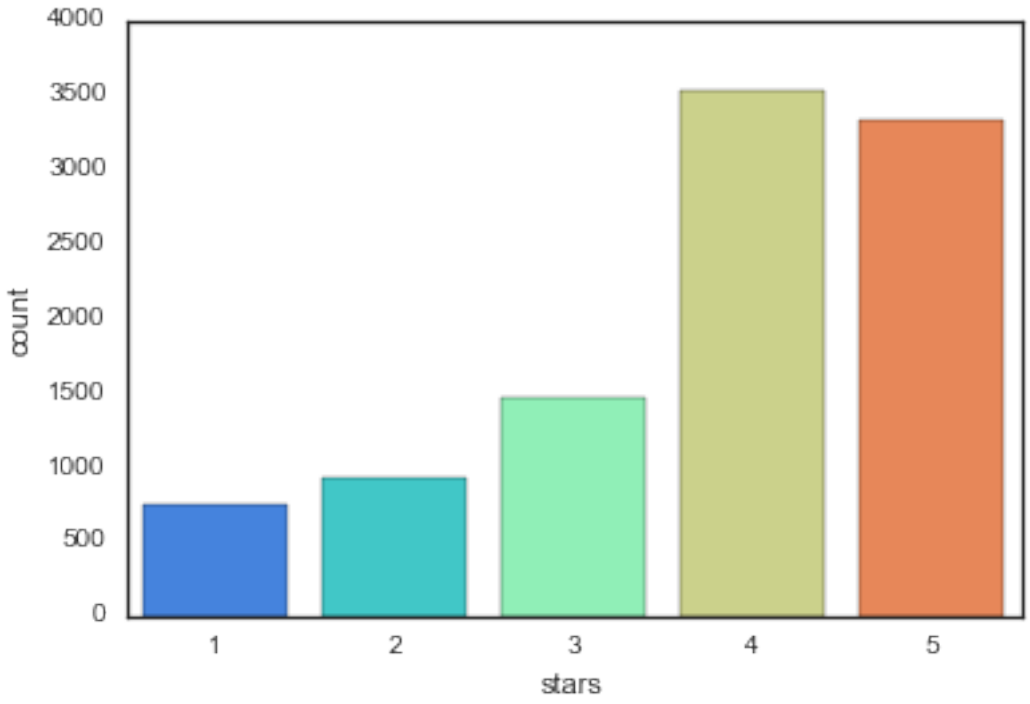
```
Out[103]: <matplotlib.axes._subplots.AxesSubplot at 0x121283470>
```



Created a countplot of the number of occurrences for each type of star rating.

```
In [104]: sns.countplot(x='stars', data=yelp, palette='rainbow')

Out[104]: <matplotlib.axes._subplots.AxesSubplot at 0x12578fc88>
```



** Used groupby to get the mean values of the numerical columns, I should be able to create this dataframe with the operation:**

```
In [105]: stars = yelp.groupby('stars').mean()

Out[105]:            cool    useful     funny  text length
          stars
          1      0.576769  1.604806  1.056075   826.515354
          2      0.719525  1.563107  0.875944   842.256742
          3      0.788501  1.306639  0.694730   758.498289
          4      0.954623  1.395916  0.670448   712.923142
          5      0.944261  1.381780  0.608631   624.999101
```

Used the corr() method on that groupby dataframe to produce this dataframe:

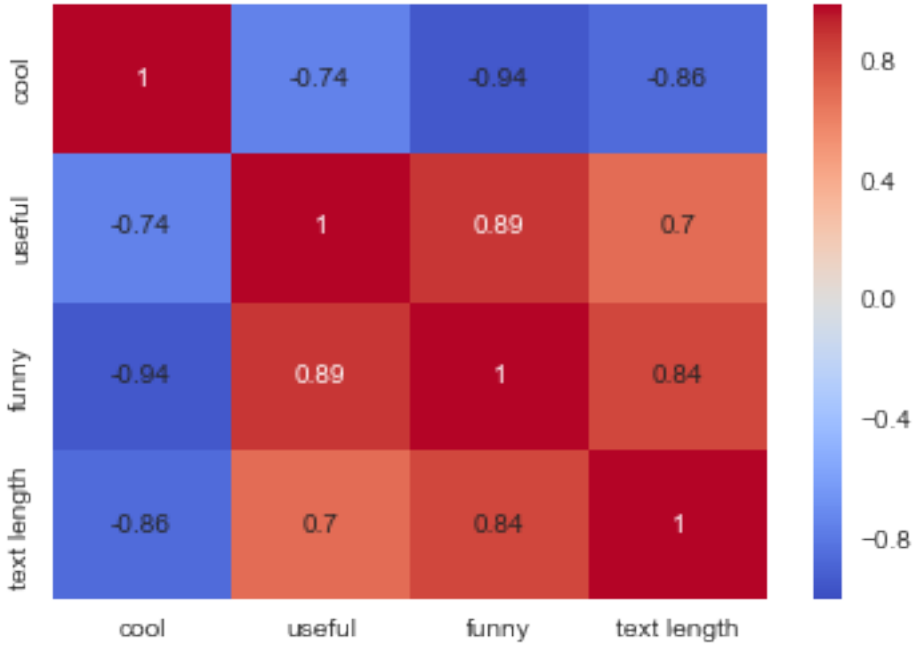
```
In [106]: stars.corr()
```

```
Out[106]:                 cool    useful     funny  text length
          cool         1.000000 -0.743329 -0.944939    -0.857664
          useful      -0.743329  1.000000  0.894506     0.699881
          funny       -0.944939  0.894506  1.000000     0.843461
          text length -0.857664  0.699881  0.843461     1.000000
```

Then I used seaborn to create a heatmap based off that .corr() dataframe:

```
In [38]: sns.heatmap(stars.corr(),cmap='coolwarm',annot=True)

Out[38]: <matplotlib.axes._subplots.AxesSubplot at 0x120edb828>
```



2.2 NLP Classification Task

Grabbed reviews that were either 1 star or 5 stars.

Created a dataframe called yelp_class that contains the columns of yelp dataframe but for only the 1 or 5 star reviews.

```
In [21]: yelp_class = yelp[(yelp['stars']==1) | (yelp['stars']==5)]

In [22]: yelp_class.info()

<class 'pandas.core.frame.DataFrame'>
Int64Index: 4086 entries, 0 to 9999
Data columns (total 10 columns):
business_id    4086 non-null object
```

```
date            4086 non-null object
review_id       4086 non-null object
stars           4086 non-null int64
text            4086 non-null object
type            4086 non-null object
user_id         4086 non-null object
cool            4086 non-null int64
useful          4086 non-null int64
funny           4086 non-null int64
dtypes: int64(4), object(6)
memory usage: 351.1+ KB
```

** Created two objects X and y. X will be the 'text' column of yelp_class and y will be the 'stars' column of yelp_class. **

```
In [26]: X = yelp_class['text']
         y = yelp_class['stars']
```

Import CountVectorizer and create a CountVectorizer object.

```
In [27]: from sklearn.feature_extraction.text import CountVectorizer
         cv = CountVectorizer
```

** Used the fit_transform method on the CountVectorizer object and pass in X (the 'text' column). Save this result by overwriting X.**

```
In [ ]: X = cv.fit_transform(X)
```

2.3 Train Test Split

Split the data into training and testing data.

```
In [120]: from sklearn.cross_validation import train_test_split
```

```
In [121]: X_train, X_test, y_train, y_test = train_test_split(X,y, test_size=0.3, random_state=
```

2.4 Training a Model

Time to train a model!

** Import MultinomialNB and create an instance of the estimator and call is nb **

```
In [122]: from sklearn.naive_bayes import MultinomialNB
          nb = MultinomialNB()
```

Now fit nb using the training data.

```
In [123]: nb.fit(X_train,y_train)
```

```
Out[123]: MultinomialNB(alpha=1.0, class_prior=None, fit_prior=True)
```

2.5 Predictions and Evaluations

Time to see how the model did!

Used the predict method off of nb to predict labels from X_test.

```
In [124]: predictions = nb.predict(X_test)
```

** Created a confusion matrix and classification report using these predictions and y_test **

```
In [82]: from sklearn.metrics import confusion_matrix, classification_report
```

```
In [125]: print(confusion_matrix(y_test,predictions))
          print('\n')
          print(classification_report(y_test,predictions))
```

```
[[159  69]
 [ 22 976]]


             precision    recall  f1-score   support

          1       0.88      0.70      0.78       228
          5       0.93      0.98      0.96       998

avg / total       0.92      0.93      0.92      1226
```

Let's see what happens if I try to include TF-IDF to this process using a pipeline.

3 Using Text Processing

** Import TfidfTransformer/Pipeline from sklearn. **

```
In [155]: from sklearn.feature_extraction.text import TfidfTransformer
```

```
In [156]: from sklearn.pipeline import Pipeline
```

** Now create a pipeline with the following steps:CountVectorizer(), TfidfTransformer(),MultinomialNB()**

```
In [157]: pipe = Pipeline([('bow', CountVectorizer()),
                           ('tfidf',TfidfTransformer()),
                          ('model',MultinomialNB())])
```

3.1 Using the Pipeline

Time to use the pipeline! This pipeline has all your pre-process steps in it already, meaning I'll need to re-split the original data (I overwrote X as the CountVectorized version. What I need is just the text

3.1.1 Train Test Split

Redid the train test split on the yelp_class object.

```
In [158]: X = yelp_class['text']
          y = yelp_class['stars']
          X_train, X_test, y_train, y_test = train_test_split(X,y, test_size=0.3, random_state=
```

I fit the pipeline to the training data. Since I can't use the same training data as last time because that data has already been vectorized, I need to pass in just text & labels.

```
In [159]: pipe.fit(X_train,y_train)
```

```
Out[159]: Pipeline(steps=[('bow', CountVectorizer(analyzer='word', binary=False, decode_error=
                  dtype=<class 'numpy.int64'>, encoding='utf-8', input='content',
                  lowercase=True, max_df=1.0, max_features=None, min_df=1,
                  ngram_range=(1, 1), preprocessor=None, stop_words=None,
                  strip_...f=False, use_idf=True)), ('classifier', MultinomialNB(alpha=1.0, cla
```

3.1.2 Predictions and Evaluation

** Used the pipeline to predict from the X_test and create a classification report and confusion matrix. I noticed strange results.**

```
In [153]: predictions = pipe.predict(X_test)
```

```
In [154]: print(confusion_matrix(y_test, predictions))
          print('\n')
          print(classification_report(y_test, predictions))
```

```
[[  0 228]
 [  0 998]]
             precision    recall  f1-score   support

          1       0.00      0.00      0.00       228
          5       0.81      1.00      0.90       998

avg / total       0.66      0.81      0.73      1226
```

```
/Users/marci/anaconda/lib/python3.5/site-packages/sklearn/metrics/classification.py:1074: Undef
  'precision', 'predicted', average, warn_for)
```

Looks like Tf-Idf actually made things worse! That is it for this project.