To be, or to be not

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1.0.1 1. INDUSTRY

Literature industry is assigned.

1.0.2 2. DATA SETS

2.1. SOURCE: The dataset is from Kaggle in this link.

DESCRIPTION: The dataset contains about one hundred thousand data with attributes related to shakespeare's plays. The following attributes from the dataset will be used for analysis.

Attribute	Datatype
Play	object
PlayerLinenumber	float64
ActSceneLine	object
Player	object
PlayerLine	object

1.0.3 3. IDEAS

3.1. To predict the player for a given player line using top three words from all lines and word used maximum in that line.

3.2. To predict the player for a given player line from top three words from all lines and number of words in that line.

1.0.4 4. LOADING THE DATASETS

Load the libraries

[1]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

Import the csv file of dataset

[2]:
```
shake_data=pd.read_csv("Shakespeare_data.csv")
shake_data.head()
```

[2]:
```
   Dataline      Play  PlayerLinenumber ActSceneLine         Player  \
0         1  Henry IV               NaN          NaN            NaN
1         2  Henry IV               NaN          NaN            NaN
2         3  Henry IV               NaN          NaN            NaN
3         4  Henry IV               1.0        1.1.1  KING HENRY IV
4         5  Henry IV               1.0        1.1.2  KING HENRY IV

                                           PlayerLine
0                                               ACT I
1                        SCENE I. London. The palace.
2  Enter KING HENRY, LORD JOHN OF LANCASTER, the …
3              So shaken as we are, so wan with care,
4          Find we a time for frighted peace to pant,
```

1.0.5 5. DATA PREPARATION

5.1 DATA CLEANING

Drop the NaN rows

[3]:
```
shake_data=shake_data.dropna()
shake_data.head()
```

[3]:
```
   Dataline      Play  PlayerLinenumber ActSceneLine         Player  \
3         4  Henry IV               1.0        1.1.1  KING HENRY IV
4         5  Henry IV               1.0        1.1.2  KING HENRY IV
5         6  Henry IV               1.0        1.1.3  KING HENRY IV
6         7  Henry IV               1.0        1.1.4  KING HENRY IV
7         8  Henry IV               1.0        1.1.5  KING HENRY IV

                                       PlayerLine
3          So shaken as we are, so wan with care,
4      Find we a time for frighted peace to pant,
5  And breathe short-winded accents of new broils
6         To be commenced in strands afar remote.
7       No more the thirsty entrance of this soil
```

Reset the index and drop the old index column

[4]:
```
shake_data=shake_data.reset_index()
del shake_data['index']
shake_data.head()
```

[4]:
```
   Dataline      Play  PlayerLinenumber ActSceneLine         Player  \
0         4  Henry IV               1.0        1.1.1  KING HENRY IV
```

```
1          5  Henry IV                 1.0        1.1.2  KING HENRY IV
2          6  Henry IV                 1.0        1.1.3  KING HENRY IV
3          7  Henry IV                 1.0        1.1.4  KING HENRY IV
4          8  Henry IV                 1.0        1.1.5  KING HENRY IV

                                         PlayerLine
0          So shaken as we are, so wan with care,
1      Find we a time for frighted peace to pant,
2  And breathe short-winded accents of new broils
3         To be commenced in strands afar remote.
4       No more the thirsty entrance of this soil
```

Printing the dimension of the dataset

```
[5]: print(shake_data.shape)
```

```
(105152, 6)
```

Deleting the dataline and actsceneline column

```
[6]: del shake_data['Dataline']
     del shake_data['ActSceneLine']
     shake_data.head()
```

```
[6]:       Play  PlayerLinenumber         Player  \
     0  Henry IV               1.0  KING HENRY IV
     1  Henry IV               1.0  KING HENRY IV
     2  Henry IV               1.0  KING HENRY IV
     3  Henry IV               1.0  KING HENRY IV
     4  Henry IV               1.0  KING HENRY IV

                                              PlayerLine
     0          So shaken as we are, so wan with care,
     1      Find we a time for frighted peace to pant,
     2  And breathe short-winded accents of new broils
     3         To be commenced in strands afar remote.
     4       No more the thirsty entrance of this soil
```

Printing the dimension of the dataset

```
[7]: print(shake_data.shape)
```

```
(105152, 4)
```

5.2 FORMATTING

Attributes and datatypes of the dataset

```
[8]: for column in shake_data.columns:
         print(column, " is ", shake_data[column].dtype.name)
```

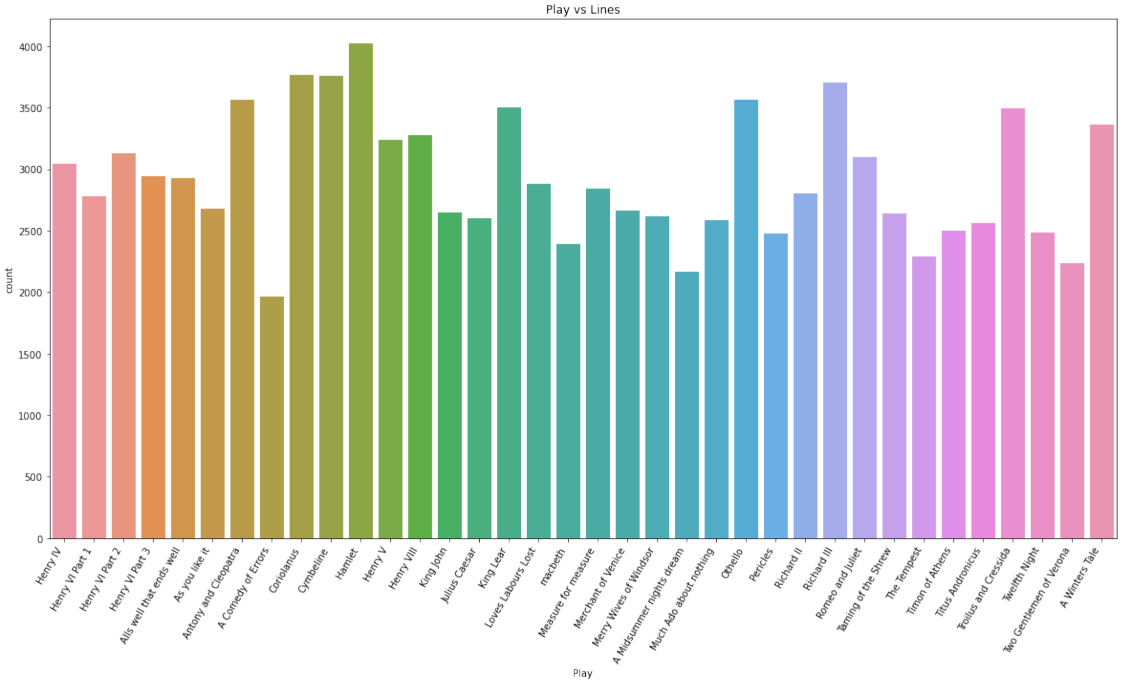
```
Play  is  object
PlayerLinenumber  is  float64
Player  is  object
PlayerLine  is  object
```

5.3 VISUALIZATION

Barplot for number of lines in each play

[9]:

```
shake_data.Play.value_counts()
plt.figure(figsize=(20,10))
g = sns.countplot(x=shake_data['Play'], data=shake_data)
g.set_xticklabels(g.get_xticklabels(), rotation=60, ha="right");
g.set_title('Play vs Lines');
```



Barplot for Player vs number of lines for each play

[10]:

```
play_data=shake_data.Play.unique()
list1 = []
list2 =[]
for i in play_data:
    i_bar=shake_data.groupby(['Play']).get_group(i)
    player_data=i_bar.Player.unique()
    for j in player_data:
        j_bar=i_bar.groupby(['Player']).get_group(j)
        list1.append(j_bar.Player.unique()[0])
        list2.append(j_bar.PlayerLinenumber.max())
    df2 = pd.DataFrame(list(zip(list1, list2)), columns=['Player', 'Lines'])
    plt.figure(figsize=(20,5))
    i = sns.barplot(x=df2.Player, y=df2.Lines, data=df2)
    i.set_xticklabels(i.get_xticklabels(), rotation=60, ha="right");
    i.set_title(str(i_bar.Play.unique()[0])+" Players vs Lines");
    plt.savefig(str(i_bar.Play.unique()[0])+".png",dpi=250)
    plt.close()
    list1.clear()
    list2.clear()
    df2=df2.sort_values(['Lines'], ascending=[False])
    df2 = df2[df2['Lines'] <= (df2['Lines'].max()/4)]
    df2=df2.reset_index()
    df2.drop(['index'], inplace=True, axis=1)
    for k in range(len(df2)):
        shake_data.drop(shake_data.
 ↪Player[shake_data['Player']==str(df2['Player'][k])].index, inplace=True)
```

In all the plays, the players with less than one-fourth of the player with maximum number of lines for each play is removed from the original dataset.

Deleting PlayerLinernumber to release memory

[11]:
```
del shake_data['PlayerLinenumber']
print(shake_data.shape)
```

```
(85171, 3)
```

5.4 FEATURE ENGINEERING

Three highly used words for each player

[12]:
```
# list for storing the player
player_count = []
# list for storing three most used words
words_used =[]
# new column for storing three most used words
shake_data['Words Count'] = ''
# assigning three most words in word count column for each row with respect to␣
 ↪the player
for i in play_data:
    i_bar=shake_data.groupby(['Play']).get_group(i)
    player_data=i_bar.Player.unique()
    for j in player_data:
        j_bar=i_bar.groupby(['Player']).get_group(j)
        player_count.append(j_bar.Player.unique()[0])
        j_bar=j_bar.PlayerLine.str.split(expand=True).stack().value_counts().
 ↪to_frame()
        j_bar=j_bar.reset_index()
        j_bar.drop(j_bar.index[0])
        j_bar=j_bar.reset_index()
        j_bar.drop(['level_0'], inplace=True, axis=1)
        j_bar.rename(columns={0: "Counts", "index": "Words"}, inplace=True)
        words_array=str(j_bar.Words.iloc[:3].values)[1:-1]
        words_array=words_array.replace("'","")
        words_used.append(words_array)
        j_bar = pd.DataFrame(list(zip(player_count, words_used)),␣
 ↪columns=['Player', 'Lines'])
        shake_data.loc[(shake_data['Player'] == j) & (shake_data['Play']==i),␣
 ↪['Words Count']] = words_array
shake_data.head()
```

[12]:

```
        Play    Player                                   PlayerLine  \
108  Henry IV  FALSTAFF             Now, Hal, what time of day is it, lad?
120  Henry IV  FALSTAFF  Indeed, you come near me now, Hal, for we that…
121  Henry IV  FALSTAFF  purses go by the moon and the seven stars, and…
122  Henry IV  FALSTAFF  by Phoebus, he,'that wandering knight so fair…
123  Henry IV  FALSTAFF  I prithee, sweet wag, when thou art king, as, God

    Words Count
108     I the a
120     I the a
121     I the a
122     I the a
123     I the a
```

Counting number of words for each player from the respective playerline

[13]:

```
# create number column to count number of words in playerline for all rows
shake_data['Number'] = ''
# assinging number of words in playerline in number column
for i in range(len(shake_data)):
            x=shake_data.iloc[i].PlayerLine.lower()
            words = len(x.split())
            shake_data.loc[(shake_data['PlayerLine'] == shake_data.iloc[i].
 ↪PlayerLine), ['Number']] = words
shake_data.head()
```

[13]:

```
        Play    Player                                   PlayerLine  \
108  Henry IV  FALSTAFF             Now, Hal, what time of day is it, lad?
120  Henry IV  FALSTAFF  Indeed, you come near me now, Hal, for we that…
121  Henry IV  FALSTAFF  purses go by the moon and the seven stars, and…
122  Henry IV  FALSTAFF  by Phoebus, he,'that wandering knight so fair…
123  Henry IV  FALSTAFF  I prithee, sweet wag, when thou art king, as, God

    Words Count Number
108     I the a      9
```

```
120     I the a     11
121     I the a     11
122     I the a      8
123     I the a     10
```

Finding the highest repeated word of a player speaks for each line of the player

[14]:

```
# create maxword column to count number of words in playerline for that rows
shake_data['Maxword'] = ''
# assigning maximum used word of a playline in the row
for i in range(len(shake_data)):
            x=shake_data.iloc[i].PlayerLine.lower()
            word_list=[]
            count_list=[]
            def word_count(str):
                counts = dict()
                words = str.split()
                for word in words:
                    word_list.append(word)
                    if word in counts:
                        counts[word] += 1
                    else:
                        counts[word] = 1
                    count_list.append(counts[word])
                return counts
            word_count(x)
            words_bar = pd.DataFrame(list(zip(word_list, count_list)),␣
 ↪columns=['Word', 'Count'])
            words_bar=words_bar.sort_values(['Count', 'Word'],␣
 ↪ascending=[False, True])
            words_bar=words_bar.reset_index()
            words_bar.drop(['index'], inplace=True, axis=1)
            words_bar=str(words_bar['Word'][0])
            shake_data.loc[(shake_data['PlayerLine'] == shake_data.iloc[i].
 ↪PlayerLine), ['Maxword']] = str(words_bar)
shake_data.head()
```

[14]:

```
          Play    Player                                       PlayerLine  \
108  Henry IV  FALSTAFF             Now, Hal, what time of day is it, lad?
120  Henry IV  FALSTAFF  Indeed, you come near me now, Hal, for we that…
121  Henry IV  FALSTAFF  purses go by the moon and the seven stars, and…
122  Henry IV  FALSTAFF  by Phoebus, he,'that wandering knight so fair…
123  Henry IV  FALSTAFF  I prithee, sweet wag, when thou art king, as, God

    Words Count Number Maxword
108     I the a       9     day
120     I the a      11    come
```

```
121     I the a     11     and
122     I the a      8    and,
123     I the a     10     art
```

Dropping columns play and playerline to free memory

[15]:
```
del shake_data['Play']
del shake_data['PlayerLine']
shake_data.head()
```

[15]:
```
          Player Words Count Number Maxword
108   FALSTAFF      I the a      9     day
120   FALSTAFF      I the a     11    come
121   FALSTAFF      I the a     11     and
122   FALSTAFF      I the a      8    and,
123   FALSTAFF      I the a     10     art
```

5.5 CLASSIFICATION

5.5.1 To predict the player for a given player line using top three words from all lines and word used maximum in that line.

Train, test and validation dataset for finding players from overall top three words and top word of each line

[30]:
```
from numpy import mean
from numpy import std
from pandas import read_csv
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn.preprocessing import OneHotEncoder
from sklearn.preprocessing import LabelEncoder
from sklearn.preprocessing import OrdinalEncoder
from sklearn.metrics import accuracy_score
from sklearn.model_selection import train_test_split
train_ratio = 0.8
validation_ratio = 0.1
test_ratio = 0.1
# define one hot encoding for the categorical independent variables
encoder = OneHotEncoder(sparse=False)
# transform data
x = encoder.fit_transform(shaken_data[['Words Count','Maxword']])

label_encoder = LabelEncoder()
y = label_encoder.fit_transform(shaken_data['Player'])

x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=1 -␣
 ↪train_ratio)
```

```
# test = 10% of the initial data set
# validation = 10% of the initial data set
x_val, x_test, y_val, y_test = train_test_split(x_test, y_test,␣
 ↪test_size=test_ratio/(test_ratio + validation_ratio))
```

Logistic regression for finding the player from overall top three words and top word of each line

[31]:

```
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score
clf = LogisticRegression(max_iter=61000).fit(x_train, y_train)
y_pred=clf.predict(x_test)
# Model Accuracy for test dataset
print("Testing Accuracy:",accuracy_score(y_test, y_pred)*100)

y_pred = clf.predict(x_val)
# Model Accuracy for validation dataset
print("Validation Accuracy:",accuracy_score(y_val, y_pred)*100)
```

```
Testing Accuracy: 87.1
Validation Accuracy: 86.4
```

Decision tree classifier for finding the player from overall top three words and top word of each line

[32]:

```
from sklearn import tree
from sklearn.datasets import load_iris
clf = tree.DecisionTreeClassifier()
clf = clf.fit(x_train, y_train)
y_pred = clf.predict(x_test)
# Model Accuracy for test dataset
print("Testing Accuracy:",accuracy_score(y_test, y_pred)*100)

y_pred = clf.predict(x_val)
# Model Accuracy for validation dataset
print("Validation Accuracy:",accuracy_score(y_val, y_pred)*100)
```

```
Testing Accuracy: 87.0
Validation Accuracy: 86.2
```

The player predicted using the overall top three words and top word of each line has higher accuracy in logistic regression than in decision tree.

5.5.2 To predict the player for a given player line from top three words from all lines and number of words in that line.

Train, test and validation dataset for finding players from overall top three words and number of words in each line

[33]:

```
train_ratio = 0.8
validation_ratio = 0.1
test_ratio = 0.1

# define one hot encoding and transformation
encoder = OneHotEncoder(sparse=False)
x = encoder.fit_transform(shake_data[['Number','Words Count']])

# define label encoding and transformation
label_encoder = LabelEncoder()
y = label_encoder.fit_transform(shake_data['Player'])

# train = 80% of the entire data set
x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=1 -␣
 ↪train_ratio)

# test = 10% of the initial data set
# validation = 10% of the initial data set
x_val, x_test, y_val, y_test = train_test_split(x_test, y_test,␣
 ↪test_size=test_ratio/(test_ratio + validation_ratio))
```

Logistic regression for finding the player from overall top three words and number of words in each line

[37]:

```
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score
clf = LogisticRegression(max_iter=61000).fit(x_train, y_train)
y_pred=clf.predict(x_test)
# Model Accuracy for test dataset
print("Testing Accuracy:",accuracy_score(y_test, y_pred)*100)

y_pred = clf.predict(x_val)
# Model Accuracy for validation dataset
print("Validation Accuracy:",accuracy_score(y_val, y_pred)*100)
```

```
Testing Accuracy: 46.47804648978634
Validation Accuracy: 46.44827991076671
```

Decision trees classifier for finding the player from overall top three words and number of words in each line

[40]:

```
from sklearn import tree
from sklearn.datasets import load_iris
clf_d = tree.DecisionTreeClassifier()
clf_d= clf_d.fit(x_train, y_train)
y_pred = clf_d.predict(x_test)
# Model Accuracy for test set
print("Testing Accuracy:",accuracy_score(y_test, y_pred)*100)
```

```
y_pred = clf.predict(x_val)
# Model Accuracy for validation set
print("Validation Accuracy:",accuracy_score(y_val, y_pred)*100)
```

```
Testing Accuracy: 46.43108710965016
Validation Accuracy: 46.43653868733122
```

The player predicted using the overall top three words and top word of each line has higher accuracy in logistic regression than in decision tree.

6. Results

Predicting the player using overall top three words and most used word in each line gives more accuracy than predicting using overall top three words and number of words in each line.