# Project 1 - BBC News Classification

In [49]:

```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
import nltk
import re
from nltk.corpus import stopwords
from nltk.tokenize import word_tokenize
from wordcloud import WordCloud, STOPWORDS
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score, classification_report
from sklearn.tree import DecisionTreeClassifier
from sklearn.ensemble import RandomForestClassifier
from sklearn.neighbors import KNeighborsClassifier
from sklearn.naive_bayes import GaussianNB
```

## Importing Data

In [2]:

```
data = pd.read_csv("D:\Python Data Science\BBC News Classification\BBC News Train.csv")
data
```

Out[2]:

| | ArticleId | Text | Category |
|---|---|---|---|
| **0** | 1833 | worldcom ex-boss launches defence lawyers defe... | business |
| **1** | 154 | german business confidence slides german busin... | business |
| **2** | 1101 | bbc poll indicates economic gloom citizens in ... | business |
| **3** | 1976 | lifestyle governs mobile choice faster bett... | tech |
| **4** | 917 | enron bosses in $168m payout eighteen former e... | business |
| **...** | ... | ... | ... |
| **1485** | 857 | double eviction from big brother model caprice... | entertainment |
| **1486** | 325 | dj double act revamp chart show dj duo jk and ... | entertainment |
| **1487** | 1590 | weak dollar hits reuters revenues at media gro... | business |
| **1488** | 1587 | apple ipod family expands market apple has exp... | tech |
| **1489** | 538 | santy worm makes unwelcome visit thousands of ... | tech |

1490 rows × 3 columns

## Understanding Features & Target Attributes

In [3]:

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1490 entries, 0 to 1489
Data columns (total 3 columns):
 #   Column     Non-Null Count  Dtype 
---  ------     --------------  ----- 
 0   ArticleId  1490 non-null   int64 
 1   Text       1490 non-null   object
 2   Category   1490 non-null   object
dtypes: int64(1), object(2)
memory usage: 35.0+ KB
```

In [4]:

```
data['Category'].value_counts()
```

Out[4]:

```
sport            346
business         336
politics         274
entertainment    273
tech             261
Name: Category, dtype: int64
```

## Checking Any Null Values

In [5]:

```
data.isnull().any()
```

Out[5]:

```
ArticleId    False
Text         False
Category     False
dtype: bool
```

## Countplot of Target Attribute(Category)

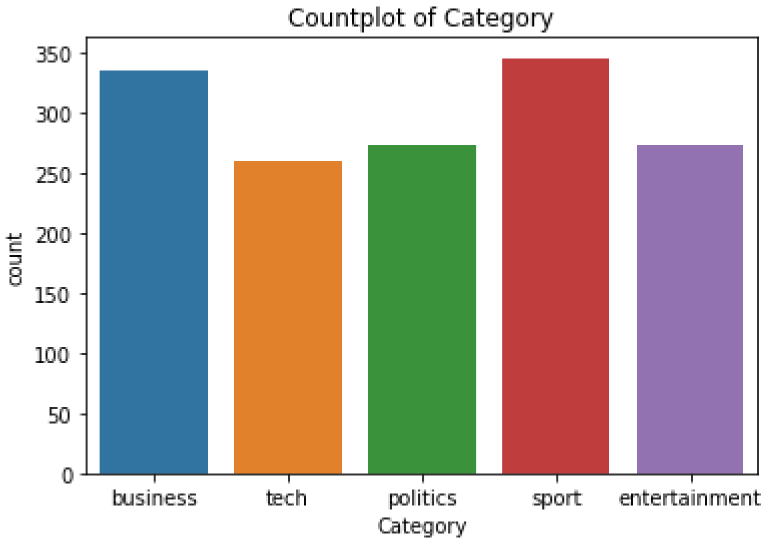
In [6]:

```
sns.countplot(data.Category).set_title('Countplot of Category')
```

```
C:\Users\Shivam\anaconda3\lib\site-packages\seaborn\_decorators.py:36: Futur
eWarning: Pass the following variable as a keyword arg: x. From version 0.1
2, the only valid positional argument will be `data`, and passing other argu
ments without an explicit keyword will result in an error or misinterpretati
on.
  warnings.warn(
```

Out[6]:

```
Text(0.5, 1.0, 'Countplot of Category')
```



In [8]:

```
data['Text_length'] = data['Text'].str.len()
data
```

Out[8]:

| | ArticleId | Text | Category | Text_length |
|---|---|---|---|---|
| **0** | 1833 | worldcom ex-boss launches defence lawyers defe... | business | 1866 |
| **1** | 154 | german business confidence slides german busin... | business | 2016 |
| **2** | 1101 | bbc poll indicates economic gloom citizens in ... | business | 3104 |
| **3** | 1976 | lifestyle governs mobile choice faster bett... | tech | 3618 |
| **4** | 917 | enron bosses in $168m payout eighteen former e... | business | 2190 |
| **...** | ... | ... | ... | ... |
| **1485** | 857 | double eviction from big brother model caprice... | entertainment | 1266 |
| **1486** | 325 | dj double act revamp chart show dj duo jk and ... | entertainment | 3111 |
| **1487** | 1590 | weak dollar hits reuters revenues at media gro... | business | 1370 |
| **1488** | 1587 | apple ipod family expands market apple has exp... | tech | 3242 |
| **1489** | 538 | santy worm makes unwelcome visit thousands of ... | tech | 1723 |

1490 rows × 4 columns

# Distribution Plot

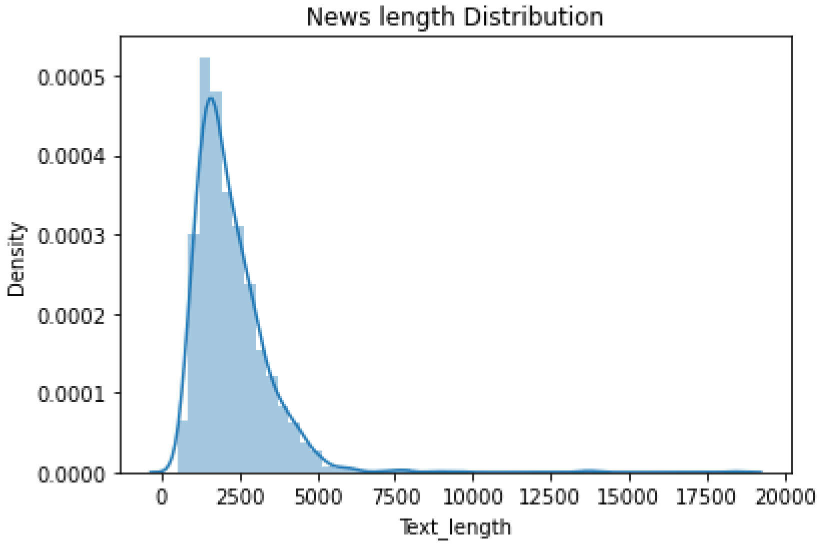
In [9]:

```
sns.distplot(data.Text_length).set_title('News length Distribution')
```

```
C:\Users\Shivam\anaconda3\lib\site-packages\seaborn\distributions.py:2551: F
utureWarning: `distplot` is a deprecated function and will be removed in a f
uture version. Please adapt your code to use either `displot` (a figure-leve
l function with similar flexibility) or `histplot` (an axes-level function f
or histograms).
  warnings.warn(msg, FutureWarning)
```

Out[9]:

```
Text(0.5, 1.0, 'News length Distribution')
```



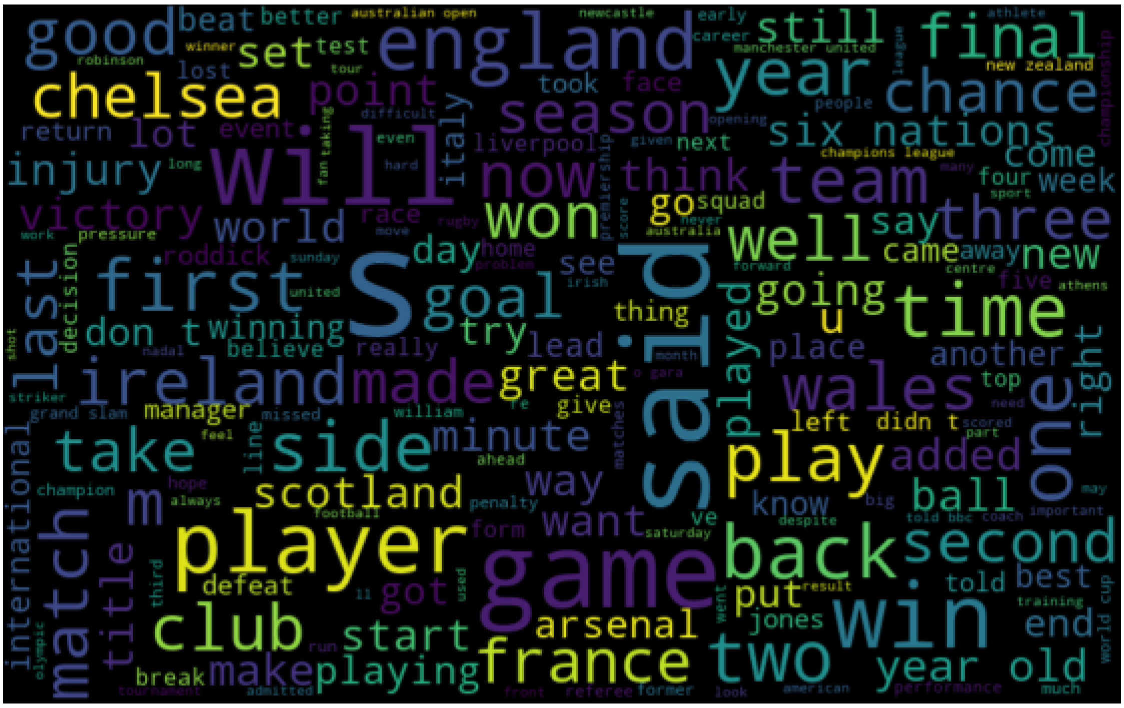
# Constructing Wordcloud

In [10]:

```
def text_wordcloud(words):
    wc = WordCloud(width=800, height=500, max_font_size=110).generate(words)
    plt.figure(figsize=(10, 7))
    plt.axis('off')
    plt.imshow(wc, interpolation="bilinear")
```

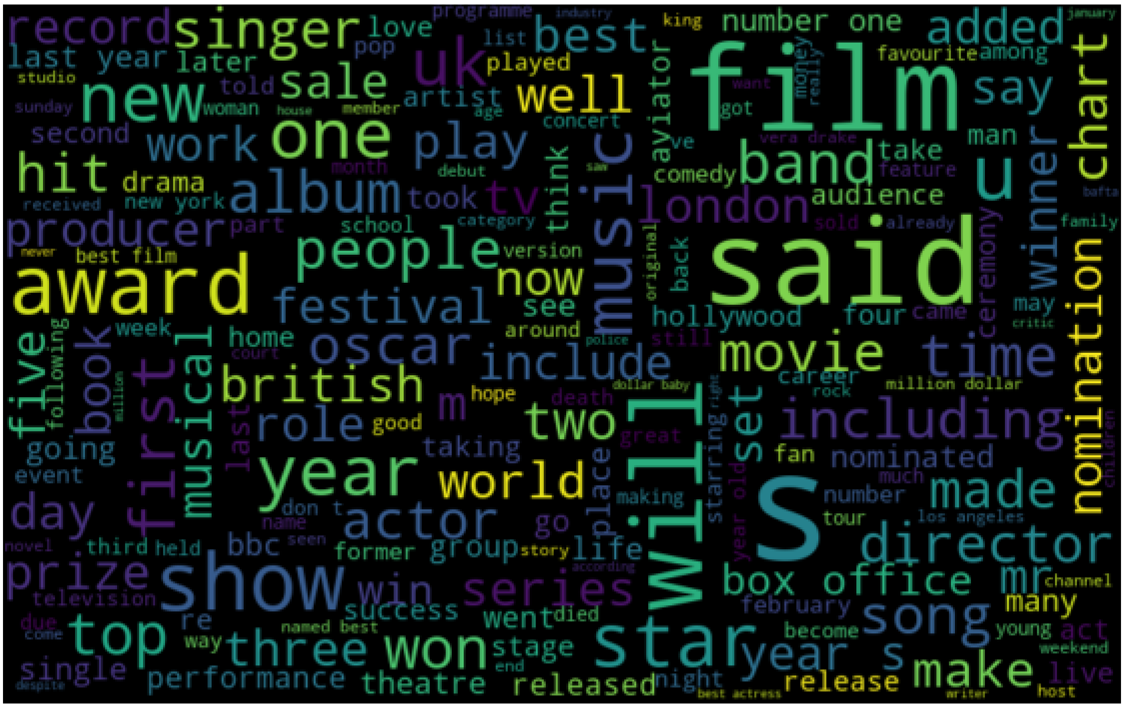
In [11]:

```
temp_sport = data[data['Category'] == "sport"]
sport_sentences = temp_sport['Text'].tolist()
text = " ".join(sport_sentences)

text_wordcloud(text)
```



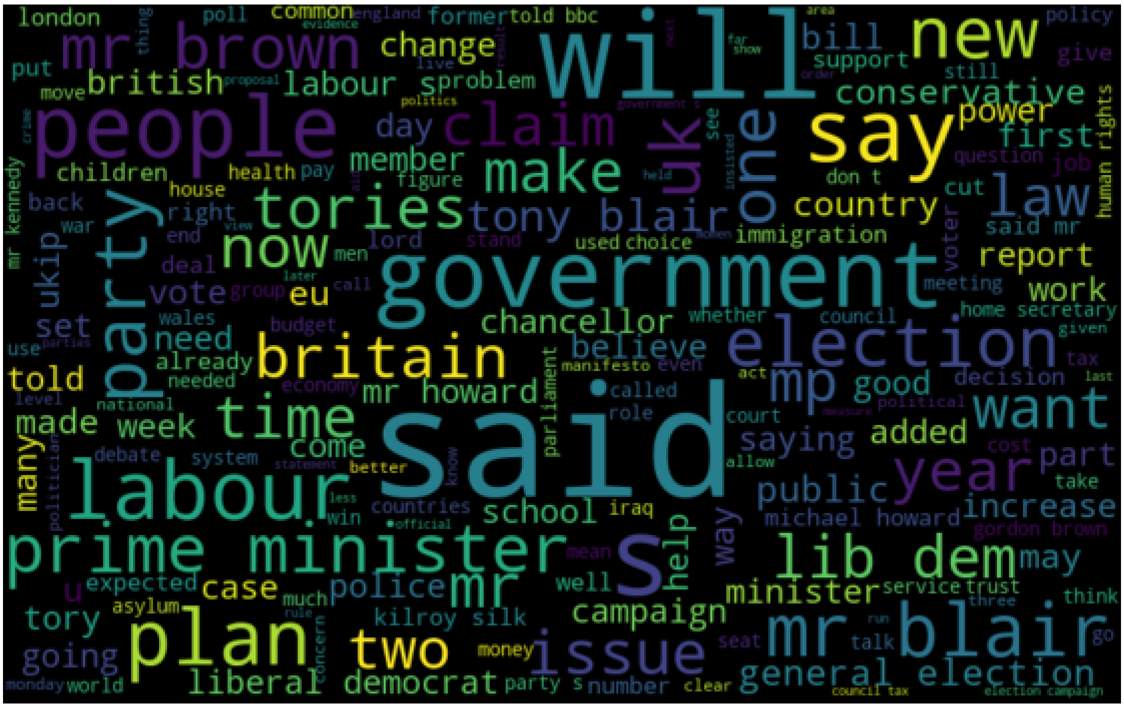
In [12]:

```
temp_sport = data[data['Category'] == "entertainment"]
entertainment_sentences = temp_sport['Text'].tolist()
text = " ".join(entertainment_sentences)

text_wordcloud(text)
```



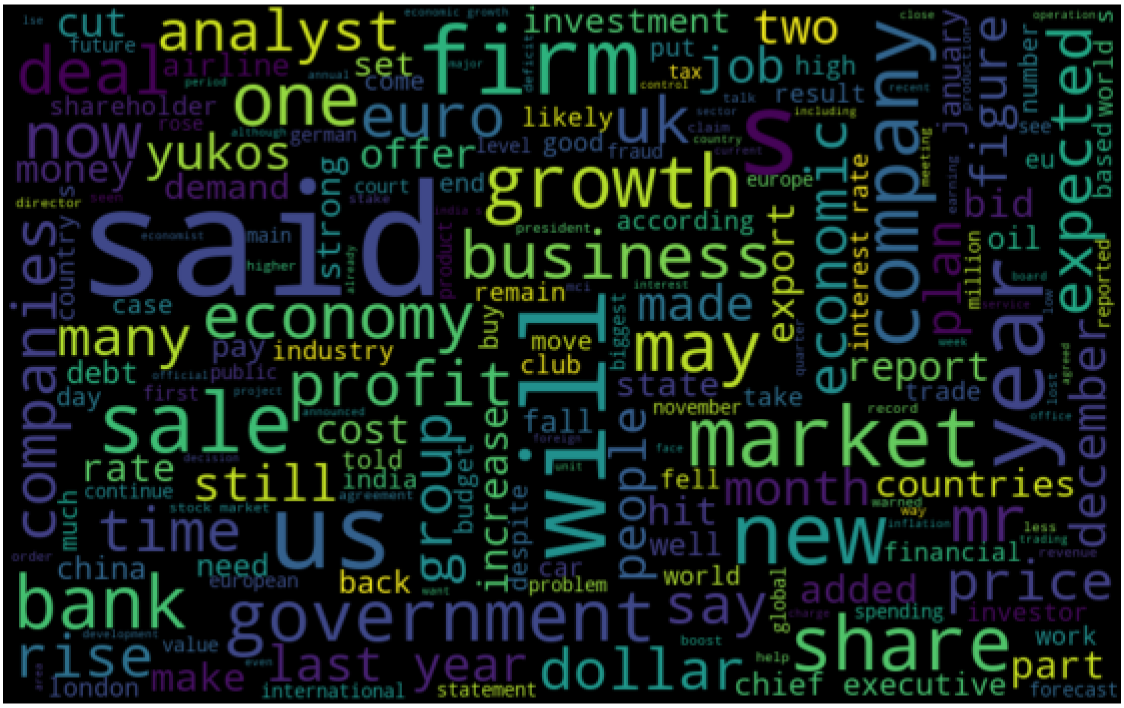
In [13]:

```
temp_sport = data[data['Category'] == "politics"]
politics_sentences = temp_sport['Text'].tolist()
text = " ".join(politics_sentences)

text_wordcloud(text)
```



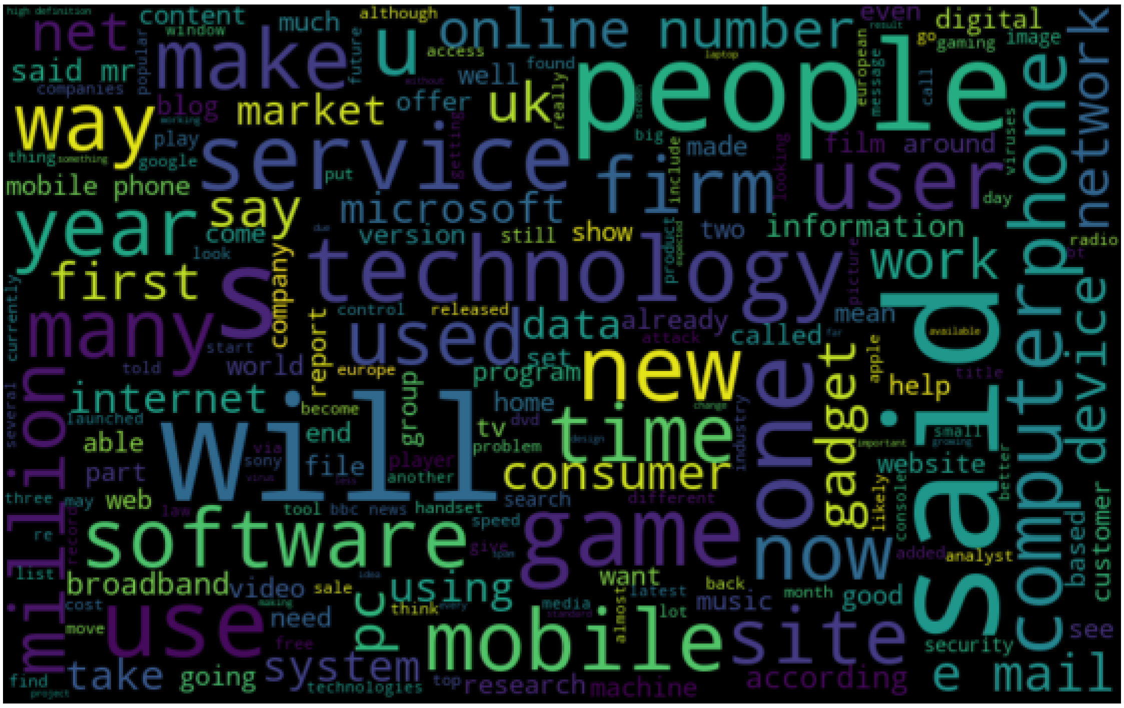
In [14]:

```
temp_sport = data[data['Category'] == "business"]
business_sentences = temp_sport['Text'].tolist()
text = " ".join(business_sentences)

text_wordcloud(text)
```



In [15]:

```
temp_sport = data[data['Category'] == "tech"]
tech_sentences = temp_sport['Text'].tolist()
text = " ".join(tech_sentences)

text_wordcloud(text)
```



# Data Preprocessing

Removing special characters

- \r
- \n

Removing Punctuations & Stopwords

In [16]:

```
def preprocess_text(text):
    text = text.lower().replace('\n',' ').replace('\r','').strip()
    text = re.sub(' +', ' ',text)
    text = re.sub(r'[^\w\s]','',text)

    mystopwords = set(stopwords.words('english'))
    word_tokenize_output = word_tokenize(text)

    temp_word_list = []
    for each_word in word_tokenize_output:
        if each_word not in mystopwords:
            temp_word_list.append(each_word)
    temp_word_list = " ".join(temp_word_list)

    return temp_word_list
```

In [17]:

```
data['Cleaned_text'] = data['Text'].apply(preprocess_text)
data['Cleaned_text_length'] = data['Cleaned_text'].str.len()
data
```

Out[17]:

| | ArticleId | Text | Category | Text_length | Cleaned_text | Cleaned_text_length |
|---|---|---|---|---|---|---|
| **0** | 1833 | worldcom ex-boss launches defence lawyers defe... | business | 1866 | worldcom exboss launches defence lawyers defen... | 1423 |
| **1** | 154 | german business confidence slides german busin... | business | 2016 | german business confidence slides german busin... | 1508 |
| **2** | 1101 | bbc poll indicates economic gloom citizens in ... | business | 3104 | bbc poll indicates economic gloom citizens maj... | 2145 |
| **3** | 1976 | lifestyle governs mobile choice faster bett... | tech | 3618 | lifestyle governs mobile choice faster better ... | 2412 |
| **4** | 917 | enron bosses in $168m payout eighteen former e... | business | 2190 | enron bosses 168m payout eighteen former enron... | 1581 |
| **...** | ... | ... | ... | ... | ... | ... |
| **1485** | 857 | double eviction from big brother model caprice... | entertainment | 1266 | double eviction big brother model caprice holb... | 869 |
| **1486** | 325 | dj double act revamp chart show dj duo jk and ... | entertainment | 3111 | dj double act revamp chart show dj duo jk joel... | 2080 |
| **1487** | 1590 | weak dollar hits reuters revenues at media gro... | business | 1370 | weak dollar hits reuters revenues media group ... | 990 |
| **1488** | 1587 | apple ipod family expands market apple has exp... | tech | 3242 | apple ipod family expands market apple expande... | 2273 |
| **1489** | 538 | santy worm makes unwelcome visit thousands of ... | tech | 1723 | santy worm makes unwelcome visit thousands web... | 1225 |

1490 rows × 6 columns

# Label Encoding

In [18]:

```
from sklearn import preprocessing
label_encoder = preprocessing.LabelEncoder()
data['Category_target'] = label_encoder.fit_transform(data['Category'])
```

In [19]:

```
data
```

Out[19]:

| | ArticleId | Text | Category | Text_length | Cleaned_text | Cleaned_text_length | Categ |
|---|---|---|---|---|---|---|---|
| **0** | 1833 | worldcom ex-boss launches defence lawyers defe... | business | 1866 | worldcom exboss launches defence lawyers defen... | 1423 | |
| **1** | 154 | german business confidence slides german busin... | business | 2016 | german business confidence slides german busin... | 1508 | |
| **2** | 1101 | bbc poll indicates economic gloom citizens in ... | business | 3104 | bbc poll indicates economic gloom citizens maj... | 2145 | |
| **3** | 1976 | lifestyle governs mobile choice faster bett... | tech | 3618 | lifestyle governs mobile choice faster better ... | 2412 | |
| **4** | 917 | enron bosses in $168m payout eighteen former e... | business | 2190 | enron bosses 168m payout eighteen former enron... | 1581 | |
| **...** | ... | ... | ... | ... | ... | ... | |
| **1485** | 857 | double eviction from big brother model caprice... | entertainment | 1266 | double eviction big brother model caprice holb... | 869 | |
| **1486** | 325 | dj double act revamp chart show dj duo jk and ... | entertainment | 3111 | dj double act revamp chart show dj duo jk joel... | 2080 | |
| **1487** | 1590 | weak dollar hits reuters revenues at media gro... | business | 1370 | weak dollar hits reuters revenues media group ... | 990 | |
| **1488** | 1587 | apple ipod family expands market apple has exp... | tech | 3242 | apple ipod family expands market apple expande... | 2273 | |

| | ArticleId | Text | Category | Text_length | Cleaned_text | Cleaned_text_length | Catego |
|---|---|---|---|---|---|---|---|
| **1489** | 538 | santy worm makes unwelcome visit thousands of ... | tech | 1723 | santy worm makes unwelcome visit thousands web... | 1225 | |

1490 rows × 7 columns

## Splitting Data in Training Set and Testing Set

In [20]:

```
x_train,x_test,y_train,y_test = train_test_split(data['Cleaned_text'], data['Category_targe
```

In [21]:

```
print(x_train.shape)
print(y_train.shape)
print(x_test.shape)
print(y_test.shape)
```

```
(1117,)
(1117,)
(373,)
(373,)
```

In [28]:

```
tfidf = TfidfVectorizer(encoding = 'utf-8',
                        ngram_range = (1,2),
                        max_df = 1.,
                        min_df = 10,
                        max_features = 300,
                        )

features_train = tfidf.fit_transform(x_train).toarray()
labels_train = y_train
print(features_train.shape)

features_test = tfidf.transform(x_test).toarray()
labels_test = y_test
print(features_test.shape)
```

```
(1117, 300)
(373, 300)
```

## Building a Model

## Logistic Regression

In [34]:

```
lc_model = LogisticRegression()
lc_model.fit(features_train,labels_train)
lc_model_predictions = lc_model.predict(features_test)

print("Accuracy ->", accuracy_score(labels_test,lc_model_predictions))
print(classification_report(labels_test,lc_model_predictions))
```

```
Accuracy -> 0.9544235924932976
              precision    recall  f1-score   support

           0       0.95      0.94      0.95        86
           1       0.97      0.97      0.97        62
           2       0.96      0.96      0.96        75
           3       0.97      0.97      0.97        79
           4       0.92      0.93      0.92        71

    accuracy                           0.95       373
   macro avg       0.95      0.95      0.95       373
weighted avg       0.95      0.95      0.95       373
```

# Decision Tree

In [38]:

```
dc_model = DecisionTreeClassifier()
dc_model.fit(features_train,labels_train)
dc_model_predictions = dc_model.predict(features_test)

print("Accuracy ->", accuracy_score(labels_test,dc_model_predictions))
print(classification_report(labels_test,dc_model_predictions))
```

```
Accuracy -> 0.7855227882037533
              precision    recall  f1-score   support

           0       0.71      0.76      0.73        86
           1       0.85      0.74      0.79        62
           2       0.74      0.77      0.76        75
           3       0.78      0.92      0.84        79
           4       0.91      0.72      0.80        71

    accuracy                           0.79       373
   macro avg       0.80      0.78      0.79       373
weighted avg       0.79      0.79      0.79       373
```

# Random Forest

In [40]:

```
rf_model = RandomForestClassifier()
rf_model.fit(features_train,labels_train)
rf_model_predictions = rf_model.predict(features_test)

print("Accuracy ->", accuracy_score(labels_test,rf_model_predictions))
print(classification_report(labels_test,rf_model_predictions))
```

```
Accuracy -> 0.9302949061662198
              precision    recall  f1-score   support

           0       0.95      0.91      0.93        86
           1       0.90      0.90      0.90        62
           2       0.93      0.95      0.94        75
           3       0.92      0.97      0.94        79
           4       0.94      0.92      0.93        71

    accuracy                           0.93       373
   macro avg       0.93      0.93      0.93       373
weighted avg       0.93      0.93      0.93       373
```

## KNeighborsClassifier

In [44]:

```
kn_model = KNeighborsClassifier()
kn_model.fit(features_train,labels_train)
kn_model_predictions = kn_model.predict(features_test)

print("Accuracy ->", accuracy_score(labels_test,kn_model_predictions))
print(classification_report(labels_test,kn_model_predictions))
```

```
Accuracy -> 0.900804289544236
              precision    recall  f1-score   support

           0       0.87      0.87      0.87        86
           1       0.95      0.84      0.89        62
           2       0.84      0.92      0.88        75
           3       0.97      0.95      0.96        79
           4       0.89      0.92      0.90        71

    accuracy                           0.90       373
   macro avg       0.90      0.90      0.90       373
weighted avg       0.90      0.90      0.90       373
```

## Naive Bayes

In [47]:

```
nb_model = GaussianNB()
nb_model.fit(features_train,labels_train)
nb_model_predictions = nb_model.predict(features_test)

print("Accuracy ->", accuracy_score(labels_test,nb_model_predictions))
print(classification_report(labels_test,nb_model_predictions))
```

```
Accuracy -> 0.9088471849865952
              precision    recall  f1-score   support

           0       0.90      0.86      0.88        86
           1       0.87      0.87      0.87        62
           2       0.92      0.93      0.93        75
           3       0.96      0.97      0.97        79
           4       0.88      0.90      0.89        71

    accuracy                           0.91       373
   macro avg       0.91      0.91      0.91       373
weighted avg       0.91      0.91      0.91       373
```

In [ ]: