In [1]:

```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
import re
import nltk
nltk.download('punkt')
nltk.download('stopwords')
nltk.download('wordnet')
from sklearn.preprocessing import LabelEncoder
from sklearn.model_selection import GridSearchCV
from sklearn.model_selection import train_test_split
```

```
[nltk_data] Downloading package punkt to
[nltk_data]     C:\Users\goyal\AppData\Roaming\nltk_data...
[nltk_data]   Package punkt is already up-to-date!
[nltk_data] Downloading package stopwords to
[nltk_data]     C:\Users\goyal\AppData\Roaming\nltk_data...
[nltk_data]   Package stopwords is already up-to-date!
[nltk_data] Downloading package wordnet to
[nltk_data]     C:\Users\goyal\AppData\Roaming\nltk_data...
[nltk_data]   Package wordnet is already up-to-date!
```

In [2]:

```
file_url = 'bbc-text.csv'
df = pd.read_csv(file_url)
```

In [3]:

```
print(df.columns,df.shape,'\n', df.category.unique(),'\n',df.sample(5))
```

```
Index(['category', 'text'], dtype='object') (2225, 2)
 ['tech' 'business' 'sport' 'entertainment' 'politics']
            category                                               text
426           sport  bortolami predicts dour contest italy skipper ...
2162           tech  who do you think you are  the real danger is n...
277   entertainment  band aid retains number one spot the charity s...
2189           tech  mobile networks seek turbo boost third-generat...
1741           tech  us state acts to stop  spammers  us state texa...
```

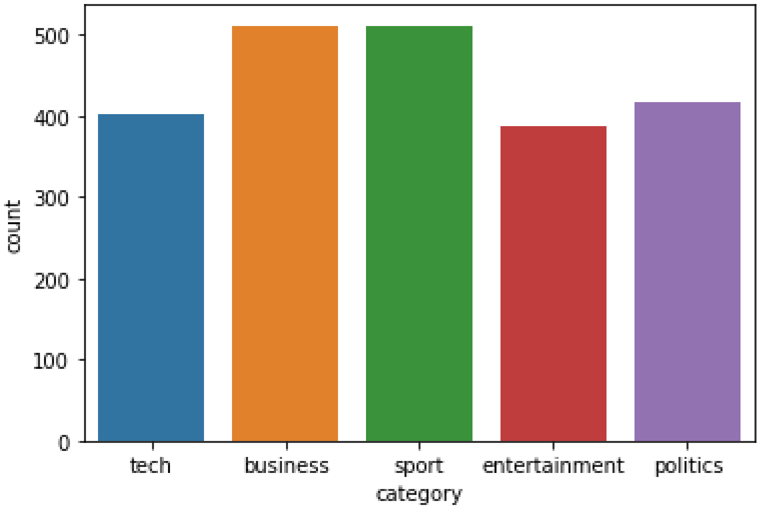
In [4]:

```
sns.countplot(df.category)
```

```
C:\Users\goyal\AppData\Local\Programs\Python\Python310\lib\site-packages\seaborn\_dec
orators.py:36: FutureWarning: Pass the following variable as a keyword arg: x. From v
ersion 0.12, the only valid positional argument will be `data`, and passing other arg
uments without an explicit keyword will result in an error or misinterpretation.
  warnings.warn(
```

Out[4]:

```
<AxesSubplot:xlabel='category', ylabel='count'>
```



In [5]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2225 entries, 0 to 2224
Data columns (total 2 columns):
 #   Column    Non-Null Count  Dtype 
---  ------    --------------  ----- 
 0   category  2225 non-null   object
 1   text      2225 non-null   object
dtypes: object(2)
memory usage: 34.9+ KB
```

In [6]:
```
df.category.value_counts()
```

Out[6]:
```
sport            511
business         510
politics         417
tech             401
entertainment    386
Name: category, dtype: int64
```

In [7]:
```
def getReviewFromIndex(index):
    example = df[df.index == index][['category', 'text']].values[0]
    if len(example) > 0:
        print(example[0])
        print(example[1])
```

In [8]:
```
getReviewFromIndex(12)
```

```
business
crude oil prices back above $50 cold weather across parts of the united states and mu
ch of europe has pushed us crude oil prices above $50 a barrel for the first time in
almost three months.  freezing temperatures and heavy snowfall have increased demand
for heating fuel in the us  where stocks are low. fresh falls in the value of the dol
lar helped carry prices above the $50 mark for the first time since november. a barre
l of us crude oil closed up $2.80 to $51.15 in new york on tuesday. opec members said
on tuesday that it saw no reason to cut its output.  although below last year s peak
of $55.67 a barrel  which was reached in october  prices are now well above 2004 s av
erage of $41.48.  brent crude also rose in london trading  adding $1.89 to $48.62 at
the close. much of western europe and the north east of america has been shivering un
der unseasonably low temperatures in recent days. the decline in the us dollar to a f
ive-week low against the euro has also served to inflate prices.  the dollar moved sh
arply overnight and oil is following it   said chris furness  senior market strategis
t at 4cast.  if the dollar continues to weaken  oil will be obviously higher.   sever
al opec members said a cut in production was unlikely  citing rising prices and stron
g demand for oil from asia.  i agree that we do not need to cut supply if the prices
are as much as this   fathi bin shatwan  libya s oil minister  told reuters.  i do no
t think we need to cut unless the prices are falling below $35 a barrel   he added. o
pec closely watches global stocks to ensure that there is not an excessive supply in
the market. the arrival of spring in the northern hemisphere will focus attention on
stockpiles of us crude and gasoline  which are up to 9% higher than at this time last
year. heavy stockpiles could help force prices lower when demand eases.
```

In [9]:

```python
import keras
from keras.preprocessing.text import Tokenizer
from keras_preprocessing.sequence import pad_sequences
from keras.models import Sequential
from keras.layers import Dense, Embedding, LSTM, SpatialDropout1D
from sklearn.model_selection import train_test_split
from keras.utils.np_utils import to_categorical
from keras.callbacks import EarlyStopping
from keras.layers import Dropout
import re
```

In [10]:

```python
import nltk
```

In [11]:

```python
from nltk.corpus import stopwords
from nltk import word_tokenize
STOPWORDS = set(stopwords.words('english'))
```

In [12]:

```python
#cleaning the text
REPLACE_BY_SPACE_RE = re.compile('[/(){}\[\]\|@,;]')
BAD_SYMBOLS_RE = re.compile('[^0-9a-z #+_]')
STOPWORDS = set(stopwords.words('english'))

def clean_text(text):

    text = text.lower() # lowercase text
    text = REPLACE_BY_SPACE_RE.sub(' ', text) # replace REPLACE_BY_SPACE_RE symbols by
    text = BAD_SYMBOLS_RE.sub('', text) # remove symbols which are in BAD_SYMBOLS_RE f
    text = text.replace('x', '')
    text = ' '.join(word for word in text.split() if word not in STOPWORDS) # remove s
    return text
df['text'] = df['text'].apply(clean_text)
```

In [13]:

```python
getReviewFromIndex(1000)
```

```
politics
parties warned grey vote political parties cannot afford take older uk voters granted
coming election says age concern survey charity suggests 69 over55s say always vote g
eneral election compared 17 18 24 year olds charity boss gordon lishman said decisive
blow struck election would older voters could relied turn total 3 028 adults aged 18
interviewed study mr lishman urged net government boost state pension also called mea
sures combat ageism build effective public services support us ageing society older p
eople want see manifesto commitments make difference lives mr lishman said political
parties must wake fact unless address demands concerns older people keep attract vote
survey carried icm research 14 people aged 18 34 said never voted general elections a
mong over65s 70 said would certain vote immediate election compared 39 people 55 age
concern says over55s united around key areas policy want government focus 57 pensions
nhs key issues economy important third ta crucial area 25
```

In [14]:

```python
max_words=50000
max_text_len=200
embedding_dim=100
tokenizer = Tokenizer(num_words=max_words, filters='!"#$%&()*+,-./:;<=>?@[\]^_`{|}~',
tokenizer.fit_on_texts(df['text'].values)
word_index = tokenizer.word_index
print('Found %s unique tokens.' % len(word_index))
```

```
Found 32485 unique tokens.
```

In [15]:

```python
X = tokenizer.texts_to_sequences(df['text'].values)
X = pad_sequences(X, maxlen=max_text_len)
print('Shape of data tensor is', X.shape)
```

```
Shape of data tensor is (2225, 200)
```

In [ ]:

```python
tokenizer.get_config()
```

In [26]:

```python
Y = pd.get_dummies(df['category']).values
print('Shape of label tensor:', Y.shape)
#splitting data
X_train, X_test, Y_train, Y_test = train_test_split(X,Y, test_size = 0.10, random_stat
print(X_train.shape,Y_train.shape)
print(X_test.shape,Y_test.shape)
```

```
Shape of label tensor: (2225, 5)
(2002, 200) (2002, 5)
(223, 200) (223, 5)
```

In [34]:

```python
model = Sequential()
model.add(Embedding(max_words, embedding_dim, input_length=X.shape[1]))
model.add(SpatialDropout1D(0.2))
model.add(LSTM(100, dropout=0.2, recurrent_dropout=0.15))
model.add(Dense(5, activation='sigmoid'))
model.compile(loss='categorical_crossentropy', optimizer='adam', metrics=['accuracy'])
print(model.summary())
```

```
Model: "sequential_3"
_________________________________________________________________
 Layer (type)                Output Shape              Param #   
=================================================================
 embedding_3 (Embedding)     (None, 200, 100)          5000000   
                                                                 
 spatial_dropout1d_3 (Spatia  (None, 200, 100)         0         
 lDropout1D)                                                     
                                                                 
 lstm_3 (LSTM)               (None, 100)               80400     
                                                                 
 dense_3 (Dense)             (None, 5)                 505       
                                                                 
=================================================================
Total params: 5,080,905
Trainable params: 5,080,905
Non-trainable params: 0
_________________________________________________________________
None
```

In [35]:

```
epochs=10
batch_size=128
history = model.fit(X_train, Y_train, epochs=epochs, batch_size=batch_size,validation_
```

```
Epoch 1/10
15/15 [==============================] - 10s 588ms/step - loss: 1.6006 - accuracy: 0.
2737 - val_loss: 1.5675 - val_accuracy: 0.3781
Epoch 2/10
15/15 [==============================] - 8s 564ms/step - loss: 1.3726 - accuracy: 0.4
092 - val_loss: 1.1198 - val_accuracy: 0.4925
Epoch 3/10
15/15 [==============================] - 9s 593ms/step - loss: 0.9154 - accuracy: 0.6
135 - val_loss: 0.8531 - val_accuracy: 0.6418
Epoch 4/10
15/15 [==============================] - 9s 616ms/step - loss: 0.7549 - accuracy: 0.6
818 - val_loss: 0.7985 - val_accuracy: 0.6866
Epoch 5/10
15/15 [==============================] - 9s 632ms/step - loss: 0.6207 - accuracy: 0.7
973 - val_loss: 0.7147 - val_accuracy: 0.8358
Epoch 6/10
15/15 [==============================] - 10s 655ms/step - loss: 0.4112 - accuracy: 0.
8923 - val_loss: 0.3960 - val_accuracy: 0.9254
Epoch 7/10
15/15 [==============================] - 10s 679ms/step - loss: 0.1752 - accuracy: 0.
9789 - val_loss: 0.2027 - val_accuracy: 0.9502
Epoch 8/10
15/15 [==============================] - 10s 654ms/step - loss: 0.1263 - accuracy: 0.
9722 - val_loss: 0.2699 - val_accuracy: 0.9204
Epoch 9/10
15/15 [==============================] - 10s 685ms/step - loss: 0.0855 - accuracy: 0.
9878 - val_loss: 0.2831 - val_accuracy: 0.9254
Epoch 10/10
15/15 [==============================] - 10s 644ms/step - loss: 0.0883 - accuracy: 0.
9800 - val_loss: 0.2460 - val_accuracy: 0.9552
```

In [37]:

```
accr = model.evaluate(X_test,Y_test)
print('Test set\n  Loss: {:0.3f}\n  Accuracy: {:0.3f}'.format(accr[0],accr[1]))
```

```
7/7 [==============================] - 0s 22ms/step - loss: 0.2273 - accuracy: 0.9417
Test set
  Loss: 0.227
  Accuracy: 0.942
```

```
In [ ]:
```