AI-Powered Emotion Detection from Text

Emotion is one of the basic instincts of a human being. Emotion detection plays a vital role in the field of textual analysis. At present, people's expressions and emotional states have turned into the leading topic for research works. Emotion Detection and Recognition from texts are recent fields of research that are closely related to Emotion Analysis. Emotion Analysis aims at detecting and recognizing feelings through the expressions from sentences, such as anger, surprise, joy, fear, sadness, love etc.

```
# Basic Libraries
import pandas as pd
import numpy as np

# Visualization libraries
import seaborn as sns
import matplotlib.pyplot as plt

# Text Libraries
import nltk
import string
import re
```

```
# Feature Extraction Libraries
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.feature_extraction.text import TfidfTransformer
from sklearn.model_selection import train_test_split
```

```
from sklearn.linear_model import LogisticRegression
```

```
# Performance Matrix libraries
from sklearn.metrics import accuracy_score
from sklearn.metrics import precision_score
from sklearn.metrics import recall_score
from sklearn.metrics import confusion_matrix
from sklearn.metrics import f1_score
from sklearn.metrics import classification_report
from sklearn.metrics import ConfusionMatrixDisplay
```

```
# other
import warnings
warnings.filterwarnings("ignore")
```

Data Collection

```
df = pd.read_csv('/content/text_emotions.csv')
```

```
print('Dataset size:',df.shape)
print('Columns are:',df.columns)
Y = df['sentiment']
```

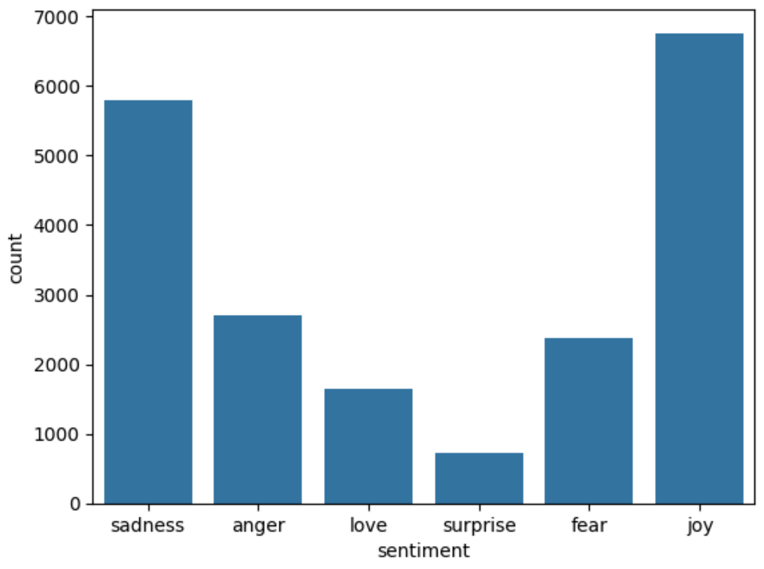
```
Dataset size: (20000, 2)
Columns are: Index(['content', 'sentiment'], dtype='object')
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 20000 entries, 0 to 19999
Data columns (total 2 columns):
 #   Column     Non-Null Count  Dtype
---  ------     --------------  -----
 0   content    20000 non-null  object
 1   sentiment  20000 non-null  object
dtypes: object(2)
memory usage: 312.6+ KB
```

```
sns.countplot(x = 'sentiment', data = df)
```

```
<Axes: xlabel='sentiment', ylabel='count'>
```



Text Preprocessing

1. Remove punctuations
2. Tokenization - Converting a sentence into list of words
3. Remove stopwords
4. Lammetization/stemming - Tranforming any form of a word to its root word

```
emojis = pd.read_csv('/content/emojis.txt',sep=',',header=None)
emojis_dict = {i:j for i,j in zip(emojis[0],emojis[1])}
pattern = '|'.join(sorted(re.escape(k) for k in emojis_dict))

def replace_emojis(text):
    text = re.sub(pattern,lambda m: emojis_dict.get(m.group(0)), text, flags=re.IGNORECASE)
    return text

def remove_punct(text):
    text = replace_emojis(text)
    text  = "".join([char for char in text if char not in string.punctuation])
    text = re.sub('[0-9]+', '', text)
    return text

df['Tweet_punct'] = df['content'].apply(lambda x: remove_punct(x))
df.head(10)
```

	content	sentiment	Tweet_punct
0	i didnt feel humiliated	sadness	i didnt feel humiliated
1	i can go from feeling so hopeless to so damned...	sadness	i can go from feeling so hopeless to so damned...
2	im grabbing a minute to post i feel greedy wrong	anger	im grabbing a minute to post i feel greedy wrong
3	i am ever feeling nostalgic about the fireplac...	love	i am ever feeling nostalgic about the fireplac...
4	i am feeling grouchy	anger	i am feeling grouchy
5	ive been feeling a little burdened lately wasn...	sadness	ive been feeling a little burdened lately wasn...
6	ive been taking or milligrams or times recomme...	surprise	ive been taking or milligrams or times recomme...
7	i feel as confused about life as a teenager or...	fear	i feel as confused about life as a teenager or...
8	i have been with petronas for years i feel tha...	joy	i have been with petronas for years i feel tha...
9	i feel romantic too	love	i feel romantic too

Next steps: Generate code with df New interactive sheet

```
def tokenization(text):
    text = text.lower()
    text = re.split('\W+', text)

    return text
```

```
df['Tweet_tokenized'] = df['Tweet_punct'].apply(lambda x: tokenization(x.lower()))
df.head(10)
```

	content	sentiment	Tweet_punct	Tweet_tokenized
0	i didnt feel humiliated	sadness	i didnt feel humiliated	[i, didnt, feel, humiliated]
1	i can go from feeling so hopeless to so damned...	sadness	i can go from feeling so hopeless to so damned...	[i, can, go, from, feeling, so, hopeless, to, ...
2	im grabbing a minute to post i feel greedy wrong	anger	im grabbing a minute to post i feel greedy wrong	[im, grabbing, a, minute, to, post, i, feel, g...
3	i am ever feeling nostalgic about the fireplac...	love	i am ever feeling nostalgic about the fireplac...	[i, am, ever, feeling, nostalgic, about, the, ...
4	i am feeling grouchy	anger	i am feeling grouchy	[i, am, feeling, grouchy]
5	ive been feeling a little burdened lately wasn...	sadness	ive been feeling a little burdened lately wasn...	[ive, been, feeling, a, little, burdened, late...
6	ive been taking or milligrams or times recomme...	surprise	ive been taking or milligrams or times recomme...	[ive, been, taking, or, milligrams, or, times,...

Next steps: Generate code with df New interactive sheet

```
import nltk
nltk.download('stopwords')
stopword = nltk.corpus.stopwords.words('english')
stopword.extend(['yr', 'year', 'woman', 'man', 'girl','boy','one', 'two', 'sixteen', 'yearold', 'fu', 'weeks', 'week',
              'treatment', 'associated', 'patients', 'may','day', 'case','old','u','n','didnt','ive','ate','feel','keep'
                ,'brother','dad','basic','im'])
```

```
[nltk_data] Downloading package stopwords to /root/nltk_data...
[nltk_data]   Package stopwords is already up-to-date!
```

```
def remove_stopwords(text):
    text = [word for word in text if word not in stopword]
    return text

df['Tweet_nonstop'] = df['Tweet_tokenized'].apply(lambda x: remove_stopwords(x))
df.head(10)
```

	content	sentiment	Tweet_punct	Tweet_tokenized	Tweet_nonstop
0	i didnt feel humiliated	sadness	i didnt feel humiliated	[i, didnt, feel, humiliated]	[humiliated]
1	i can go from feeling so hopeless to so damned...	sadness	i can go from feeling so hopeless to so damned...	[i, can, go, from, feeling, so, hopeless, to, ...	[go, feeling, hopeless, damned, hopeful, aroun...
2	im grabbing a minute to post i feel greedy wrong	anger	im grabbing a minute to post i feel greedy wrong	[im, grabbing, a, minute, to, post, i, feel, g...	[grabbing, minute, post, greedy, wrong]
3	i am ever feeling nostalgic about the fireplac...	love	i am ever feeling nostalgic about the fireplac...	[i, am, ever, feeling, nostalgic, about, the, ...	[ever, feeling, nostalgic, fireplace, know, st...
4	i am feeling grouchy	anger	i am feeling grouchy	[i, am, feeling, grouchy]	[feeling, grouchy]
5	ive been feeling a little burdened lately wasn...	sadness	ive been feeling a little burdened lately wasn...	[ive, been, feeling, a, little, burdened, late...	[feeling, little, burdened, lately, wasnt, sure]
6	ive been taking or milligrams or times recomme...	surprise	ive been taking or milligrams or times recomme...	[ive, been, taking, or, milligrams, or, times,...	[taking, milligrams, times, recommended, amoun...

Next steps: Generate code with df New interactive sheet

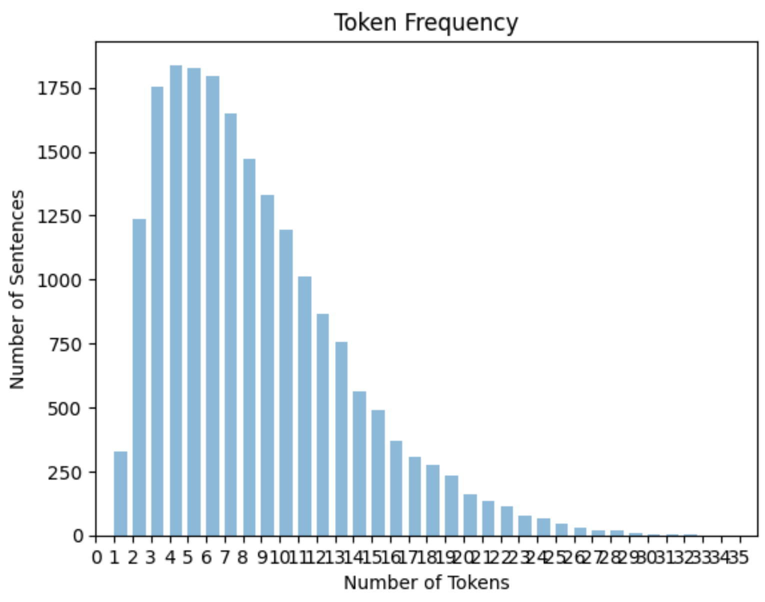
```
nltk.download('wordnet')
wn = nltk.WordNetLemmatizer()

def lemmatizer(text):
    text = [wn.lemmatize(word) for word in text]
    return text

df['Tweet_lemmatized'] = df['Tweet_nonstop'].apply(lambda x: lemmatizer(x))
df.head()
```

```
[nltk_data] Downloading package wordnet to /root/nltk_data...
[nltk_data]   Package wordnet is already up-to-date!
```

	content	sentiment	Tweet_punct	Tweet_tokenized	Tweet_nonstop	Tweet_lemmatized
0	i didnt feel humiliated	sadness	i didnt feel humiliated	[i, didnt, feel, humiliated]	[humiliated]	[humiliated]
1	i can go from feeling so hopeless to so damned...	sadness	i can go from feeling so hopeless to so damned...	[i, can, go, from, feeling, so, hopeless, to, ...	[go, feeling, hopeless, damned, hopeful, aroun...	[go, feeling, hopeless, damned, hopeful, aroun...
2	im grabbing a minute to post i feel greedy wrong	anger	im grabbing a minute to post i feel greedy wrong	[im, grabbing, a, minute, to, post, i, feel, g...	[grabbing, minute, post, greedy, wrong]	[grabbing, minute, post, greedy, wrong]
	i am ever feeling		i am ever feeling	[i, am, ever, feeling	[ever, feeling, nostalgic	[ever, feeling, nostalgic

Next steps: Generate code with df New interactive sheet

```
token_lengths = [len(t) for t in df['Tweet_lemmatized']]
plt.hist(token_lengths,bins=33,width = 0.7, fc="green",alpha=0.5)
plt.xlabel('Number of Tokens')
plt.ylabel('Number of Sentences')
plt.title('Token Frequency')
x_Values = [i for i in range(36)]
plt.xticks(x_Values)
plt.xlim(0,36)
plt.rcParams["figure.figsize"] = (10,5)
plt.show()
```



```
def clean_text(text):
    text = remove_punct(text)
    text = tokenization(text)
    text = remove_stopwords(text)
    text = lemmatizer(text)
    return text
```

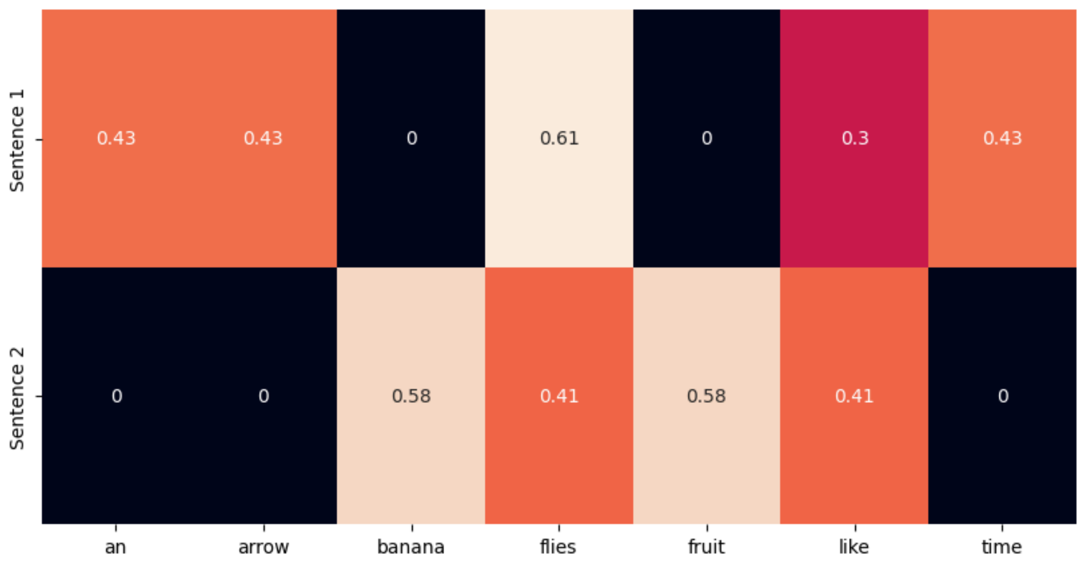
Feature Extraction

○ TF-IDF

```
from sklearn.feature_extraction.text import TfidfVectorizer

document = ['Time flies flies like an arrow.',
            'Fruit flies like a banana.']

tfidf_vectorizer = TfidfVectorizer()
tfidf = tfidf_vectorizer.fit_transform(document).toarray()

print (tfidf)

print (tfidf_vectorizer.vocabulary_)

dictionary = sorted(tfidf_vectorizer.vocabulary_)
```

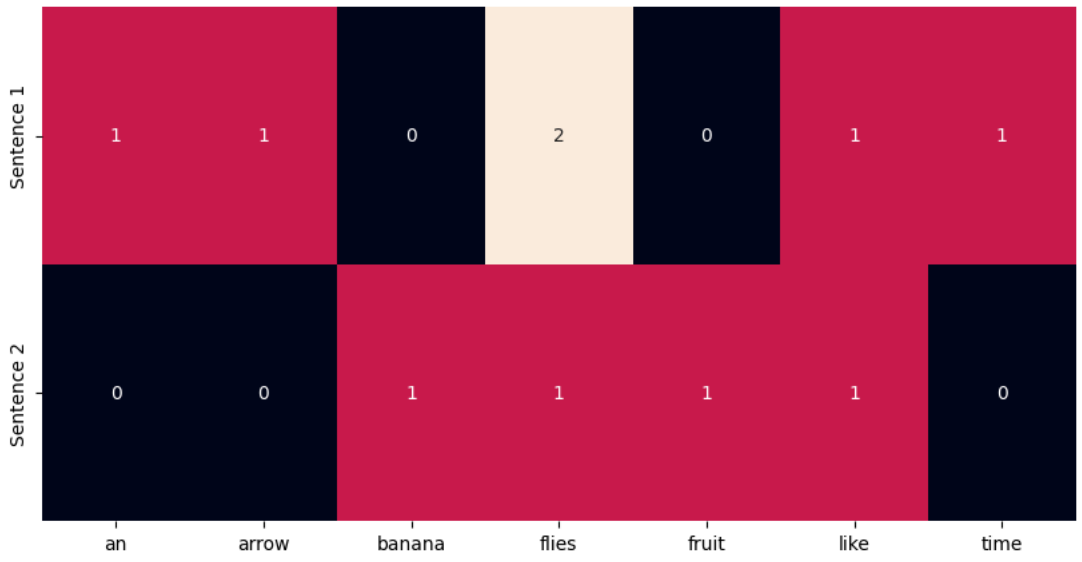
```
print(dictionary)

sns.heatmap(tfidf, annot=True, cbar=False, xticklabels=dictionary,
                                           yticklabels=['Sentence 1','Sentence 2'])
```

```
[[0.42519636 0.42519636 0.         0.60506143 0.         0.30253071
  0.42519636]
 [0.         0.         0.57615236 0.40993715 0.57615236 0.40993715
  0.        ]]
{'time': 6, 'flies': 3, 'like': 5, 'an': 0, 'arrow': 1, 'fruit': 4, 'banana': 2}
['an', 'arrow', 'banana', 'flies', 'fruit', 'like', 'time']
<Axes: >
```



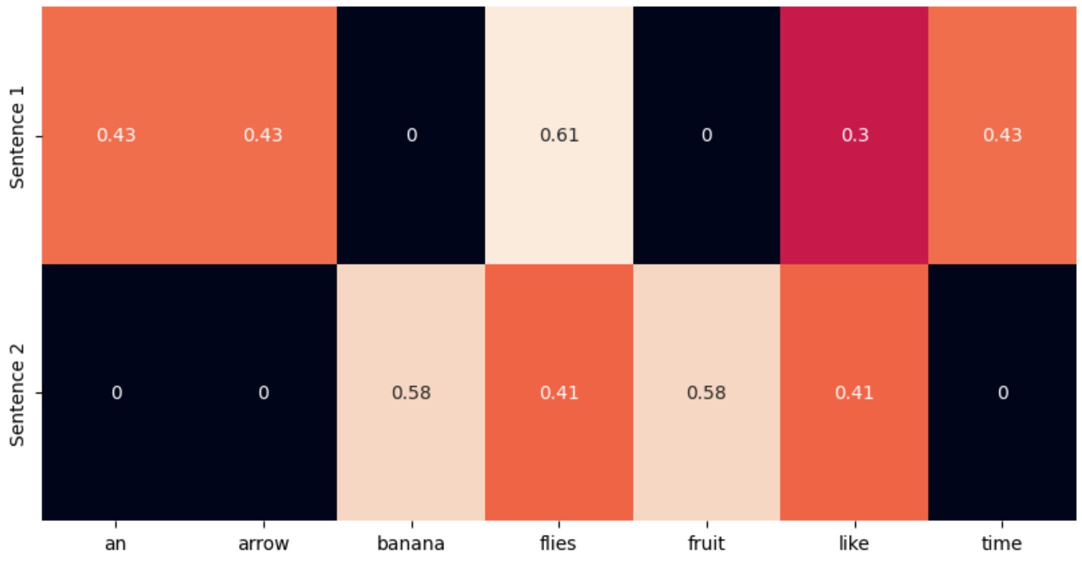
```
document = ["Time flies flies like an arrow",
            "Fruit flies like a banana"]

# Create a Vectorizer Object
vectorizer = CountVectorizer()

vectorizer.fit(document)

# Printing the identified Unique words along with their indices
print("Vocabulary: ", vectorizer.vocabulary_)

# Encode the Document
vector = vectorizer.transform(document)

# Summarizing the Encoded Texts
print("Encoded Document is:")
print(vector.toarray())

dictionary = sorted(vectorizer.vocabulary_)

print(dictionary)

sns.heatmap(vector.toarray(), annot=True, cbar=False, xticklabels=dictionary,
                                             yticklabels=['Sentence 1','Sentence 2'])
```

```
Vocabulary:  {'time': 6, 'flies': 3, 'like': 5, 'an': 0, 'arrow': 1, 'fruit': 4, 'banana': 2}
Encoded Document is:
[[1 1 0 2 0 1 1]
 [0 0 1 1 1 1 0]]
['an', 'arrow', 'banana', 'flies', 'fruit', 'like', 'time']
<Axes: >
```



```
from sklearn.feature_extraction.text import TfidfVectorizer

document = ['Time flies flies like an arrow.',
          'Fruit flies like a banana.']

tfidf_vectorizer = TfidfVectorizer()
tfidf = tfidf_vectorizer.fit_transform(document).toarray()

print (tfidf)

print (tfidf_vectorizer.vocabulary_)

dictionary = sorted(tfidf_vectorizer.vocabulary_)

print(dictionary)

sns.heatmap(tfidf, annot=True, cbar=False, xticklabels=dictionary,
                                           yticklabels=['Sentence 1','Sentence 2'])
```

```
[[0.42519636 0.42519636 0.         0.60506143 0.         0.30253071
  0.42519636]
 [0.         0.         0.57615236 0.40993715 0.57615236 0.40993715
  0.        ]]
{'time': 6, 'flies': 3, 'like': 5, 'an': 0, 'arrow': 1, 'fruit': 4, 'banana': 2}
['an', 'arrow', 'banana', 'flies', 'fruit', 'like', 'time']
<Axes: >
```



```
X_train, X_test, y_train, y_test = train_test_split(df['content'], df['sentiment'],test_size=0.3, random_state = 0)
```

```
countVectorizer1 = CountVectorizer(analyzer=clean_text)
countVector1 = countVectorizer1.fit_transform(X_train)

countVector2 = countVectorizer1.transform(X_test)

tfidf_transformer_xtrain = TfidfTransformer()
x_train = tfidf_transformer_xtrain.fit_transform(countVector1)

tfidf_transformer_xtest = TfidfTransformer()
x_test = tfidf_transformer_xtest.fit_transform(countVector2)
```

Models

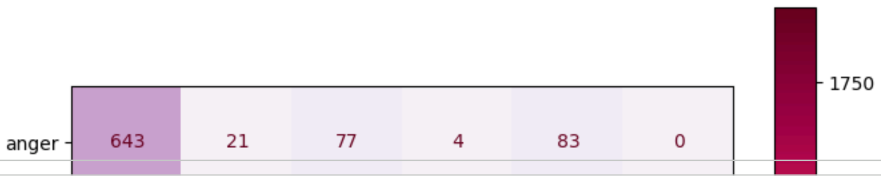
Logistic Regression

```
logisticRegr = LogisticRegression()

logisticRegr.fit(x_train, y_train)

y_pred = logisticRegr.predict(x_test)

lr_acc = accuracy_score(y_pred, y_test)
lr_prec = precision_score(y_test, y_pred, average='macro')
lr_recal = recall_score(y_test, y_pred, average='macro')
lr_cm = confusion_matrix(y_test,y_pred)
lr_f1 = f1_score(y_test, y_pred, average='macro')

print('Accuracy:', '{0:.3f}'.format(lr_acc*100))
print('Precision:', '{0:.3f}'.format(lr_prec*100))
print('Recall:', '{0:.3f}'.format(lr_recal*100))
print('F1-score:', '{0:.3f}'.format(lr_f1*100))
print(classification_report(y_test,y_pred))
```

```
Accuracy: 86.200
Precision: 87.959
Recall: 76.543
F1-score: 80.762
              precision    recall  f1-score   support

       anger       0.91      0.78      0.84       828
        fear       0.87      0.77      0.82       741
         joy       0.82      0.95      0.88      2019
        love       0.87      0.64      0.73       484
     sadness       0.88      0.94      0.91      1715
    surprise       0.92      0.52      0.66       213

    accuracy                           0.86      6000
   macro avg       0.88      0.77      0.81      6000
weighted avg       0.87      0.86      0.86      6000
```

```
cm_display_lr = ConfusionMatrixDisplay(lr_cm, display_labels=logisticRegr.classes_)
fig, ax = plt.subplots(figsize=(8,8)) # adjust the size
cm_display_lr.plot(ax=ax,cmap='PuRd')
```

```
<sklearn.metrics._plot.confusion_matrix.ConfusionMatrixDisplay at 0x7f05957d4440>
```



```
# 1. Preprocess X_train and X_test consistently
X_train_cleaned_str = X_train.apply(clean_text).apply(lambda x: ' '.join(x))
X_test_cleaned_str = X_test.apply(clean_text).apply(lambda x: ' '.join(x))

# 2. Initialize and fit CountVectorizer on the preprocessed training data
# We remove max_features here to allow the CountVectorizer to learn the full vocabulary present in X_train_cleaned_str
# This will determine the actual number of features the model will be trained on.
count_vectorizer_pipeline = CountVectorizer()
X_train_counts = count_vectorizer_pipeline.fit_transform(X_train_cleaned_str)
X_test_counts = count_vectorizer_pipeline.transform(X_test_cleaned_str) # Transform test data using fitted vectorizer

# 3. Initialize and fit TfidfTransformer on the training count vectors
tfidf_transformer_pipeline = TfidfTransformer()
x_train_transformed = tfidf_transformer_pipeline.fit_transform(X_train_counts)
x_test_transformed = tfidf_transformer_pipeline.transform(X_test_counts) # Transform test data using fitted transformer

# 4. Re-initialize and re-train the Logistic Regression model with the consistent features
logisticRegr = LogisticRegression()
logisticRegr.fit(x_train_transformed, y_train)

# 5. Re-evaluate performance metrics with the newly trained model and consistent test features
y_pred = logisticRegr.predict(x_test_transformed)

lr_acc = accuracy_score(y_pred, y_test)
lr_prec = precision_score(y_test, y_pred, average='macro')
lr_recal = recall_score(y_test, y_pred, average='macro')
lr_cm = confusion_matrix(y_test,y_pred)
lr_f1 = f1_score(y_test, y_pred, average='macro')

print('Accuracy:', '{0:.3f}'.format(lr_acc*100))
print('Precision:', '{0:.3f}'.format(lr_prec*100))
print('Recall:', '{0:.3f}'.format(lr_recal*100))
print('F1-score:', '{0:.3f}'.format(lr_f1*100))
print(classification_report(y_test,y_pred))

# 6. Prediction loop using the consistently fitted pipeline
while True:
    input_str = input("What's in your mind: ")
    if input_str == 'nothing':
        break

    # Preprocess the input string
    cleaned_input_tokens = clean_text(input_str)
    cleaned_input_str = ' '.join(cleaned_input_tokens)

    # Transform the cleaned input string using the *fitted* CountVectorizer and TfidfTransformer
    input_counts = count_vectorizer_pipeline.transform([cleaned_input_str])
    processed_text = tfidf_transformer_pipeline.transform(input_counts)

    print('Emotion using Logistic Regression: ',end = '')
    print(logisticRegr.predict(processed_text))
```

```
Accuracy: 86.267
Precision: 88.309
Recall: 76.184
F1-score: 80.543
              precision    recall  f1-score   support
```