📊 Sentiment Analysis of YouTube Comments using NLP

An NLP-based project to analyze audience opinions and classify YouTube comments into **Positive**, **Negative**, and **Neutral** sentiments.

1] Import Required Libraries.

In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

2] Load Dataset.

In [2]:
```
df=pd.read_csv('YoutubeCommentsDataSet.csv')
df
```

Out[2]:

	Comment	Sentiment
0	lets not forget that apple pay in 2014 require...	neutral
1	here in nz 50 of retailers don’t even have con...	negative
2	i will forever acknowledge this channel with t...	positive
3	whenever i go to a place that doesn’t take app...	negative
4	apple pay is so convenient secure and easy to ...	positive
...	...	...
18403	i really like the point about engineering tool...	positive
18404	i’ve just started exploring this field and thi...	positive
18405	excelente video con una pregunta filosófica pr...	neutral
18406	hey daniel just discovered your channel a coup...	positive
18407	this is great focus is key a playful approach ...	positive

18408 rows × 2 columns

3] Data Cleaning (Handling Missing Data).

In [3]:
```
# Dataset size before cleaning.
df.shape
```
Out[3]:
```
(18408, 2)
```
In [4]:
```
# Check missing values.
df.isnull().sum()
```
Out[4]:
```
Comment      44
Sentiment     0
dtype: int64
```
In [5]:
```
# Remove missing comments
df.dropna(subset=['Comment'],inplace=True)    # Removes rows where comment value
```
In [6]:
```
# Remove empty comments
df = df[df['Comment'].str.strip() != ""]    # Deletes rows where comment is empt
```
In [7]:
```
# Dataset size after cleaning
print("After cleaning:",df.shape)
```
```
After cleaning: (18364, 2)
```
In [8]:
```
# Verify missing values
print(df.isnull().sum())
```
```
Comment      0
Sentiment    0
dtype: int64
```

4] Text Preprocessing.

In [9]:
```
# Import Required Libraries for Text Cleaning.

import re                                        # For regex (removing URLs, punctua
import nltk                                      # NLP library
from nltk.corpus import stopwords                # Stopword list
from nltk.tokenize import word_tokenize          # Tokenizer to split text
from nltk.stem import WordNetLemmatizer          # Lemmatizer
```
In [10]:
```
stop_words = set(stopwords.words('english'))     # set() makes lookups faster.
lemmatizer = WordNetLemmatizer()                 # Converts words to their base

def preprocess_text(text):
    text = text.lower()                              # Lowercase
    text = re.sub(r"http\S+|www\S+", "", text)       # Remove URLs
    text = re.sub(r"[^a-z\s]", "", text)             # Remove punctuation/number
    tokens = word_tokenize(text)                     # Tokenization(Splits text
    tokens = [lemmatizer.lemmatize(word)             # Lemmatization
              for word in tokens if word not in stop_words]
    return " ".join(tokens)                          # Combines the cleaned toke
```
In [11]:
```
# Apply cleaning to all comments.
df['clean_comment'] = df['Comment'].apply(preprocess_text)
df.head()
```

Out[11]:

	Comment	Sentiment	clean_comment
0	lets not forget that apple pay in 2014 require...	neutral	let forget apple pay required brand new iphone...
1	here in nz 50 of retailers don’t even have con...	negative	nz retailer dont even contactless credit card ...
2	i will forever acknowledge this channel with t...	positive	forever acknowledge channel help lesson idea e...
3	whenever i go to a place that doesn’t take app...	negative	whenever go place doesnt take apple pay doesnt...
4	apple pay is so convenient secure and easy to ...	positive	apple pay convenient secure easy use used kore...

5] Create Sentiment Labels

In [12]:
```
from textblob import TextBlob

def get_sentiment(text):
    polarity = TextBlob(text).sentiment.polarity    # It tells us how positive o
    if polarity > 0:
        return "positive"
    elif polarity < 0:
        return "negative"
    else:
        return "neutral"

df['sentiment'] = df['clean_comment'].apply(get_sentiment)
df.head()
```

Out[12]:

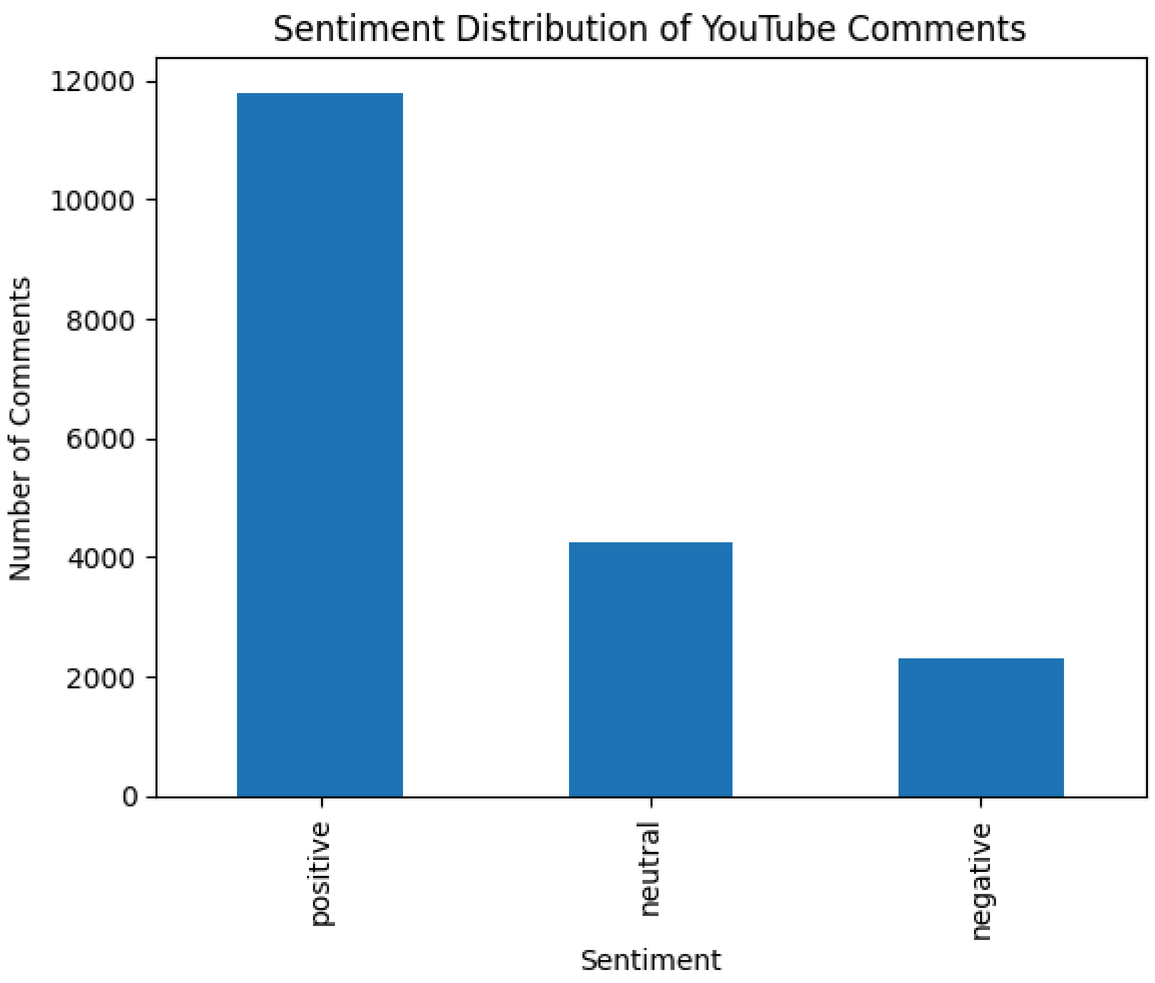
	Comment	Sentiment	clean_comment	sentiment
0	lets not forget that apple pay in 2014 require...	neutral	let forget apple pay required brand new iphone...	positive
1	here in nz 50 of retailers don’t even have con...	negative	nz retailer dont even contactless credit card ...	positive
2	i will forever acknowledge this channel with t...	positive	forever acknowledge channel help lesson idea e...	neutral
3	whenever i go to a place that doesn’t take app...	negative	whenever go place doesnt take apple pay doesnt...	negative
4	apple pay is so convenient secure and easy to ...	positive	apple pay convenient secure easy use used kore...	positive

Data Balance vs Imbalance

In [13]:
```
# Sentiment distribution
df['sentiment'].value_counts()
```

```
Out[13]: sentiment
         positive    11797
         neutral      4255
         negative     2312
         Name: count, dtype: int64
```

```
In [14]: # Sentiment Distribution Visualization
         df['sentiment'].value_counts().plot(kind='bar')
         plt.title("Sentiment Distribution of YouTube Comments")
         plt.xlabel("Sentiment")
         plt.ylabel("Number of Comments")
         plt.show()
```



⚖️ **Class Imbalance Handling**

Since the dataset is imbalanced, class weights were applied in Logistic Regression after TF-IDF vectorization to give equal importance to all sentiment classes without modifying the data distribution.

6] Split Data (Train & Test)

```
In [15]: X = df['clean_comment']
         y = df['sentiment']
```

In [16]:
```
X
```

Out[16]:
```
0        let forget apple pay required brand new iphone...
1        nz retailer dont even contactless credit card ...
2        forever acknowledge channel help lesson idea e...
3        whenever go place doesnt take apple pay doesnt...
4        apple pay convenient secure easy use used kore...
                               ...                        
18403    really like point engineering toolbox think th...
18404    ive started exploring field really good remind...
18405    excelente video con una pregunta filosfica pro...
18406    hey daniel discovered channel couple day ago i...
18407    great focus key playful approach also speed th...
Name: clean_comment, Length: 18364, dtype: object
```

In [17]:
```
y
```

Out[17]:
```
0        positive
1        positive
2         neutral
3        negative
4        positive
           ...   
18403    positive
18404    positive
18405    negative
18406     neutral
18407    positive
Name: sentiment, Length: 18364, dtype: object
```

In [18]:
```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_
print(X_train.shape,y_train.shape)
```

```
(14691,) (14691,)
```

7] Feature Extraction.

In [19]:
```
from sklearn.feature_extraction.text import TfidfVectorizer

vectorizer = TfidfVectorizer(max_features=5000)
X_train_tfidf = vectorizer.fit_transform(X_train)
X_test_tfidf = vectorizer.transform(X_test)

# Bag of Words(alternative).
#vectorizer = CountVectorizer()
#X_train_vec = vectorizer.fit_transform(X_train)
#X_test_vec = vectorizer.transform(X_test)
```

8] Train ML Model (Logistic Regression)

In [20]:
```
from sklearn.linear_model import LogisticRegression
model = LogisticRegression(class_weight='balanced', max_iter=1000)
model.fit(X_train_tfidf, y_train)
```

Out[20]:

```
▾ LogisticRegression
▶ Parameters
```

9] Predictions.

In [21]:

```
y_pred = model.predict(X_test_tfidf)
y_pred
```

Out[21]:

```
array(['neutral', 'positive', 'positive', ..., 'negative', 'positive',
       'positive'], shape=(3673,), dtype=object)
```

10] Model Evaluation

In [22]:

```
from sklearn.metrics import accuracy_score, classification_report, confusion_mat
print("Accuracy:", accuracy_score(y_test, y_pred))
print("\nClassification Report:\n", classification_report(y_test, y_pred))
```

```
Accuracy: 0.848625102096379

Classification Report:
               precision    recall  f1-score   support

    negative       0.59      0.74      0.65       425
     neutral       0.74      0.92      0.82       798
    positive       0.96      0.85      0.90      2450

    accuracy                           0.85      3673
   macro avg       0.76      0.83      0.79      3673
weighted avg       0.87      0.85      0.85      3673
```

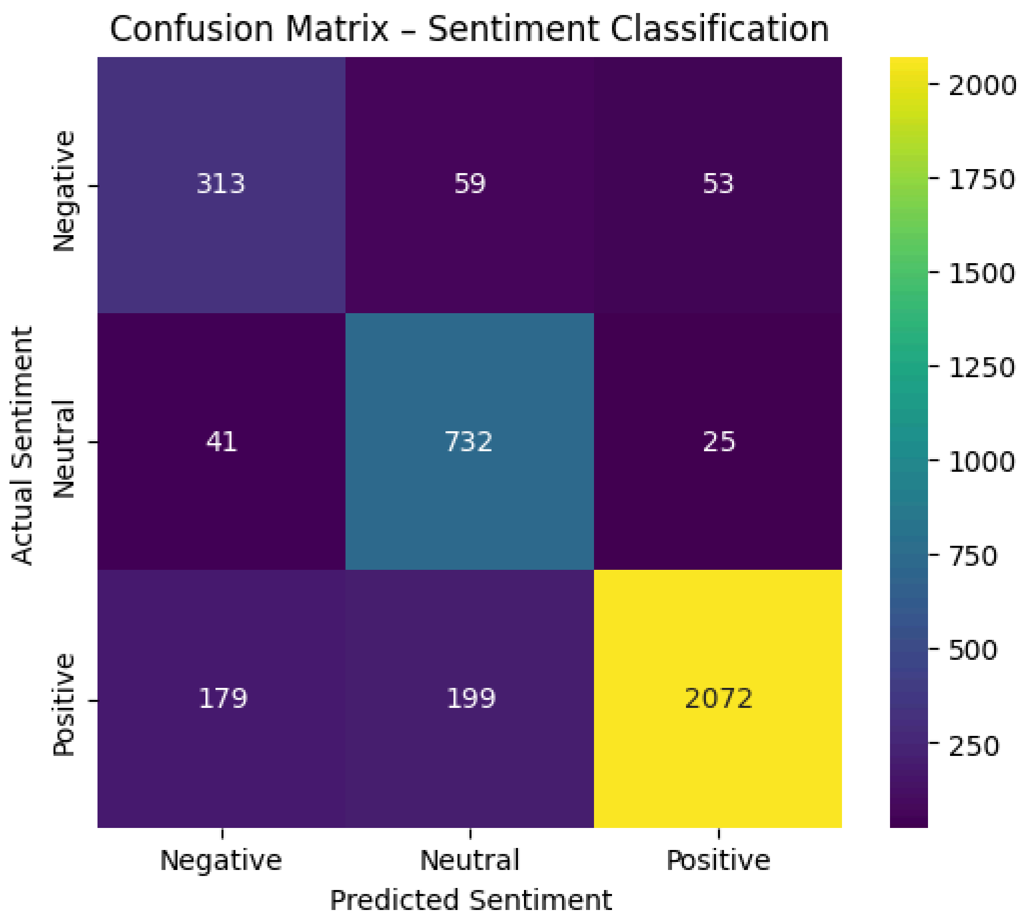
Confusion Matrix:

In [23]:

```
from sklearn.metrics import confusion_matrix
import seaborn as sns
import matplotlib.pyplot as plt

labels = ['Negative', 'Neutral', 'Positive']

cm = confusion_matrix(y_test, y_pred)
plt.figure(figsize=(6,5))
sns.heatmap(cm,annot=True,fmt='d',cmap='viridis',xticklabels=labels,yticklabels=
plt.xlabel("Predicted Sentiment")
plt.ylabel("Actual Sentiment")
plt.title("Confusion Matrix - Sentiment Classification")
plt.show()
```



11] Test on New Comments

In [24]:
```python
def predict_sentiment(comment):
    clean = preprocess_text(comment)
    vector = vectorizer.transform([clean])
    return model.predict(vector)[0]

predict_sentiment("This video is amazing 🔥")
```

Out[24]:
```
'positive'
```

In [ ]: