```
import pandas as pd
import numpy as np
import seaborn as sns
import re
import nltk
import matplotlib.pyplot as plt
from wordcloud import WordCloud
from sklearn.ensemble import RandomForestClassifier
from sklearn.linear_model import LogisticRegression
from sklearn.svm import LinearSVC
from sklearn.naive_bayes import MultinomialNB
from sklearn.feature_extraction.text import CountVectorizer, TfidfVectorizer
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score, classification_report
from sklearn.preprocessing import LabelEncoder
from tensorflow.keras.preprocessing.text import Tokenizer
from tensorflow.keras.preprocessing.sequence import pad_sequences
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Embedding, LSTM, Dense
from tensorflow.keras.callbacks import EarlyStopping
```

```
nltk.download('stopwards')
```

```
[nltk_data] Error loading stopwards: Package 'stopwards' not found in
[nltk_data]     index
False
```

```
nltk.download()
```

```
Hit Enter to continue:

Collections:
  [ ] all-corpora......... All the corpora
  [ ] all-nltk............ All packages available on nltk_data gh-pages
                           branch
  [ ] all................. All packages
  [ ] book................ Everything used in the NLTK Book
  [ ] popular............. Popular packages
  [ ] tests............... Packages for running tests
  [ ] third-party......... Third-party data packages

([*] marks installed packages)

Download which package (l=list; x=cancel)?
  Identifier>

---------------------------------------------------------------------------
    d) Download   l) List    u) Update   c) Config   h) Help   q) Quit
---------------------------------------------------------------------------
Downloader> q
True
```

```
nltk.download('stopwords')
```

```
[nltk_data] Downloading package stopwords to /root/nltk_data...
[nltk_data]   Unzipping corpora/stopwords.zip.
True
```

```
lemmatizer = nltk.stem.WordNetLemmatizer()
stopwords = set(nltk.corpus.stopwords.words("english"))
stemmer = nltk.stem.snowball.SnowballStemmer("english")
```

```
def load_dataset(filepath):
    data = []
    with open(filepath) as f:
        lines = f.readlines()
        for line in lines:
            data.append(line.strip().split(";"))
    return pd.DataFrame(data, columns = ["text", "emotion"])
```

```
train_data = load_dataset("/content/train.txt")
validation_data = load_dataset("/content/val.txt")
test_data = load_dataset("/content/test.txt")
```

```
train_data.head()
```

	text	emotion
0	i didnt feel humiliated	sadness
1	i can go from feeling so hopeless to so damned...	sadness
2	im grabbing a minute to post i feel greedy wrong	anger
3	i am ever feeling nostalgic about the fireplac...	love
4	i am feeling grouchy	anger

```
df = pd.concat([train_data, validation_data, test_data])
```

```
df.head()
```

	text	emotion
0	i didnt feel humiliated	sadness
1	i can go from feeling so hopeless to so damned...	sadness
2	im grabbing a minute to post i feel greedy wrong	anger
3	i am ever feeling nostalgic about the fireplac...	love

```
df['emotion'].value_counts()
```

```
joy         6761
sadness     5797
anger       2709
fear        2373
love        1641
surprise     719
Name: emotion, dtype: int64
```

```
df.isnull().sum()
```

```
text       0
emotion    0
dtype: int64
```

```
df.duplicated().sum()
```

```
1
```

```
df.drop_duplicates(inplace = True)
```

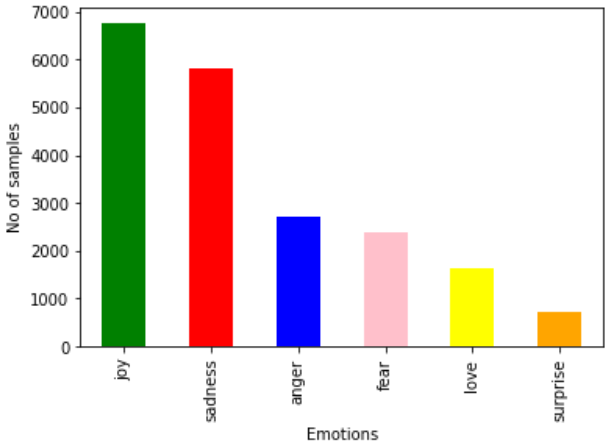
```
df.duplicated().sum()
```

```
0
```

```
len(df)
```

```
19999
```

```
df['emotion'].value_counts().plot(kind='bar', color = ['green', 'red', 'blue', 'pink', 'yellow', 'orange'])
plt.xlabel('Emotions')
plt.ylabel('No of samples')
plt.show()
```

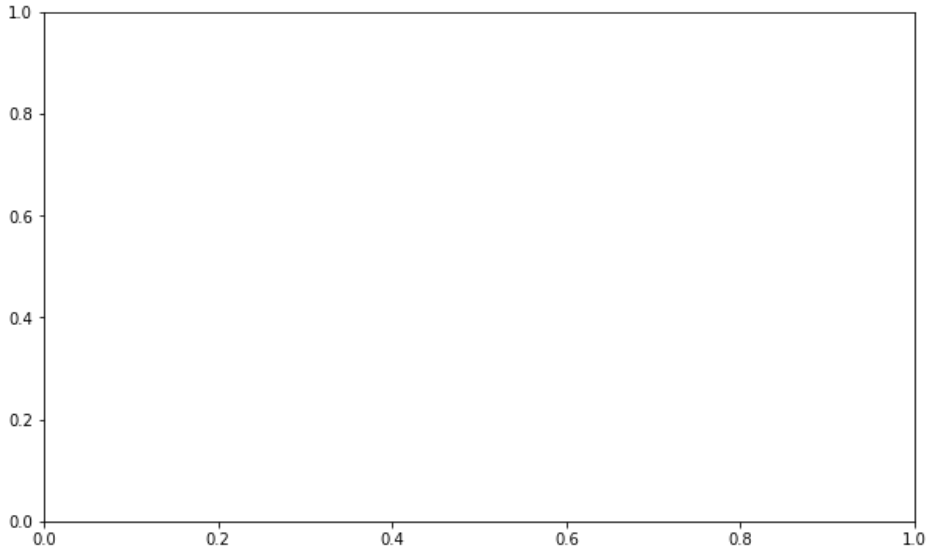



```
df['length'] = df.text.apply(lambda x:len(x))
```

```
fig = plt.figure(figsize=(10,6))
sns.kdeplot(x=df['length'], hue=df["emotion"])
plt.show()
```

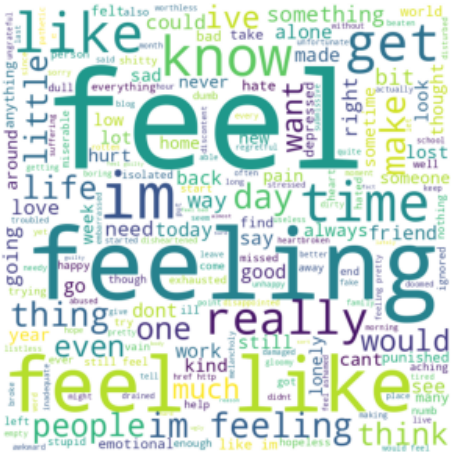
```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
<ipython-input-34-2c061eb5c5f5> in <module>
      1 df['length'] = df.text.apply(lambda x:len(x))
      2 fig = plt.figure(figsize=(10,6))
----> 3 sns.kdeplot(x=df['length'], hue=df["emotion"])
      4 plt.show()

                                15 frames
/usr/local/lib/python3.8/dist-packages/pandas/core/indexes/base.py in _validate_can_reindex(self, indexer)
   3783         # trying to reindex on an axis with duplicates
   3784         if not self._index_as_unique and len(indexer):
-> 3785             raise ValueError("cannot reindex from a duplicate axis")
   3786
   3787     def reindex(

ValueError: cannot reindex from a duplicate axis
```

SEARCH STACK OVERFLOW

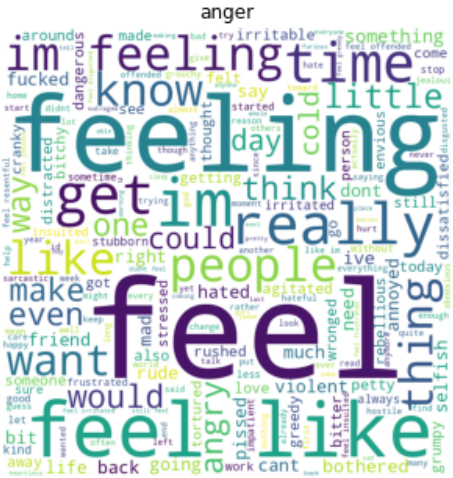



```
emotions = df['emotion'].unique()
for emotion in emotions:
    text = " ".join(df[df['emotion'] == emotion]['text'])
    wordcloud = WordCloud(width = 800, height = 800,
                    background_color ='white',
                    stopwords = stopwords,
                    min_font_size = 10).generate(text)
    plt.figure(figsize = (4, 4), facecolor = None)
    plt.imshow(wordcloud)
    plt.axis("off")
    plt.tight_layout(pad = 0)
    plt.title(emotion)
    plt.show()
```

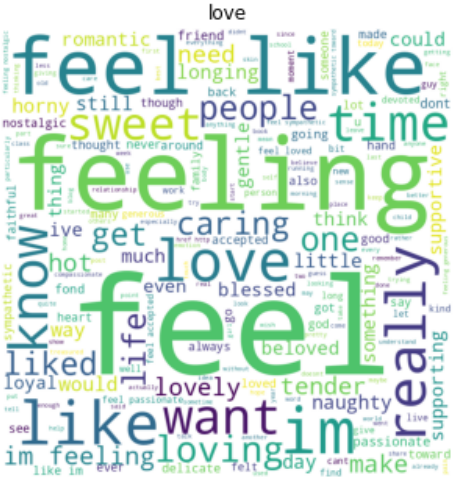
sadness



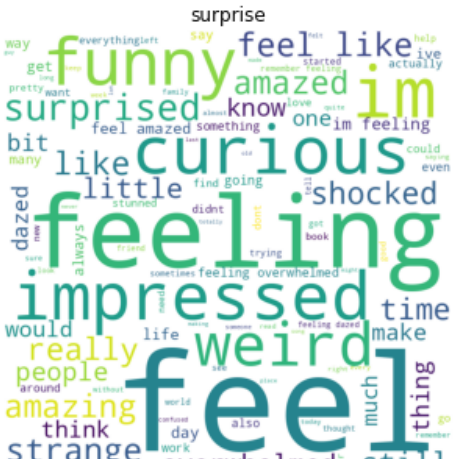
anger



love



surprise



```
def preprocess_text(text):
    text = re.sub("[^a-zA-Z]", " ", text.lower())
    tokens = nltk.word_tokenize(text)
    lemmatized_tokens = [lemmatizer.lemmatize(token) for token in tokens if token not in stopwords]
    preprocessed_text = " ".join(lemmatized_tokens)
    return preprocessed_text
```

```
nltk.download('punkt')
```

```
[nltk_data] Downloading package punkt to /root/nltk_data...
[nltk_data]   Unzipping tokenizers/punkt.zip.
True
```

```
nltk.download('wordnet')
```

```
[nltk_data] Downloading package wordnet to /root/nltk_data...
True
```

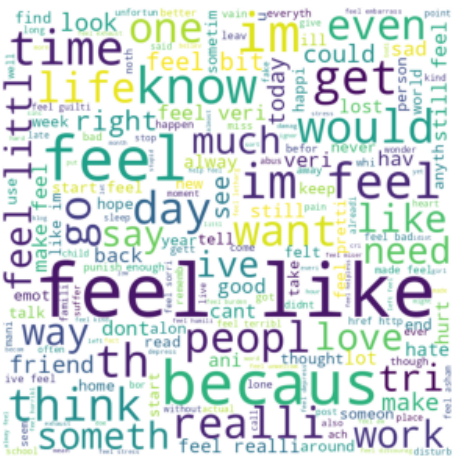
```
nltk.download('omw-1.4')
```

```
[nltk_data] Downloading package omw-1.4 to /root/nltk_data...
True
```

```
df['text'] = df['text'].apply(lambda x: ' '.join([stemmer.stem(word) if not word.endswith('ing') else stemmer.stem(word[
df["text"] = df["text"].apply(lambda x: preprocess_text(x))
```

```
emotions = df['emotion'].unique()
for emotion in emotions:
    text = " ".join(df[df['emotion'] == emotion]['text'])
    wordcloud = WordCloud(width = 800, height = 800,
                    background_color ='white',
                    stopwords = stopwords,
                    min_font_size = 10).generate(text)
    plt.figure(figsize = (4, 4), facecolor = None)
    plt.imshow(wordcloud)
    plt.axis("off")
    plt.tight_layout(pad = 0)
    plt.title(emotion)
    plt.show()
```

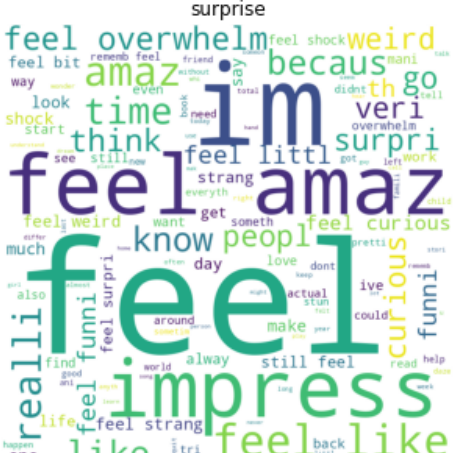
sadness



anger

love

surprise



```
x_train, x_test, y_train, y_test = train_test_split(df["text"], df["emotion"], test_size=0.2, random_state=100)
```

```
cv = CountVectorizer()
x_train_cv = cv.fit_transform(x_train)
x_test_cv = cv.transform(x_test)
```

MACHINE LEARNING MODELS

```
rf = RandomForestClassifier(n_estimators=100, random_state=100)
rf.fit(x_train_cv, y_train)
```

```
RandomForestClassifier(random_state=100)
```

```
y_pred_rf = rf.predict(x_test_cv)
```

```
accuracy_rf = accuracy_score(y_test, y_pred_rf)
print("Accuracy of Random Forest classifier:", accuracy_rf)
```

```
Accuracy of Random Forest classifier: 0.85525
```

```
report_rf = classification_report(y_test, y_pred_rf)
print("Classification report of Random Forest classifier:\n", report_rf)
```

```
Classification report of Random Forest classifier:
                precision    recall  f1-score   support

         anger       0.81      0.90      0.85       538
          fear       0.84      0.83      0.83       494
           joy       0.89      0.87      0.88      1316
          love       0.77      0.69      0.73       326
       sadness       0.90      0.89      0.90      1198
      surprise       0.66      0.72      0.69       128

      accuracy                           0.86      4000
     macro avg       0.81      0.82      0.81      4000
  weighted avg       0.86      0.86      0.86      4000
```

```
lr = LogisticRegression(max_iter=1000, random_state=100)
lr.fit(x_train_cv, y_train)
```

```
LogisticRegression(max_iter=1000, random_state=100)
```

```
y_pred_lr = lr.predict(x_test_cv)
```

```
report_lr = classification_report(y_test, y_pred_lr)
print("Classification report of Logistic Regression (Multi-Class):\n", report_lr)
```

```
Classification report of Logistic Regression (Multi-Class):
                precision    recall  f1-score   support
```

```
              anger       0.87      0.82      0.84       538
               fear       0.86      0.80      0.83       494
                joy       0.86      0.91      0.88      1316
               love       0.77      0.67      0.72       326
            sadness       0.90      0.92      0.91      1198
           surprise       0.68      0.70      0.69       128

           accuracy                           0.86      4000
          macro avg       0.82      0.80      0.81      4000
       weighted avg       0.86      0.86      0.86      4000
```

```
nb = MultinomialNB()
nb.fit(x_train_cv, y_train)
```

```
MultinomialNB()
```

```
y_pred_nb = nb.predict(x_test_cv)
```

```
report_nb = classification_report(y_test, y_pred_nb)
```

```
print("Classification report of Navie Bayes:\n", report_nb)
```

```
Classification report of Navie Bayes:
                precision    recall  f1-score   support

              anger       0.86      0.65      0.74       538
               fear       0.87      0.61      0.72       494
                joy       0.74      0.93      0.82      1316
               love       0.87      0.31      0.46       326
            sadness       0.75      0.92      0.83      1198
           surprise       0.70      0.05      0.10       128

           accuracy                           0.77      4000
          macro avg       0.80      0.58      0.61      4000
       weighted avg       0.79      0.77      0.75      4000
```

```
svm = LinearSVC(random_state=100)
svm.fit(x_train_cv, y_train)
```

```
LinearSVC(random_state=100)
```

```
y_pred_svm = svm.predict(x_test_cv)
```

```
report_svm = classification_report(y_test, y_pred_svm)
print("Classification report of Linear SVM:\n", report_svm)
```

```
Classification report of Linear SVM:
                precision    recall  f1-score   support

              anger       0.85      0.83      0.84       538
               fear       0.84      0.83      0.84       494
                joy       0.86      0.89      0.87      1316
               love       0.72      0.65      0.68       326
```

```
             sadness       0.90      0.91      0.91      1198
            surprise       0.72      0.73      0.72       128

            accuracy                           0.86      4000
           macro avg       0.82      0.81      0.81      4000
        weighted avg       0.85      0.86      0.85      4000
```

```
le = LabelEncoder()
y_train = le.fit_transform(y_train)
y_test = le.transform(y_test)
emotions = le.classes_
```

```
emotions
```

```
array(['anger', 'fear', 'joy', 'love', 'sadness', 'surprise'],
      dtype=object)
```

```
tokenizer = Tokenizer(num_words=5000)
tokenizer.fit_on_texts(x_train)
x_train_seq = tokenizer.texts_to_sequences(x_train)
x_test_seq = tokenizer.texts_to_sequences(x_test)
```

```
x_train_seq
```

```
 62,
 205,
 2921,
 554,
 3355,
 934,
 136,
 2154],
[1, 1690, 341, 173],
[30, 6, 85, 3, 1, 706],
[1, 2, 1110, 1199, 84, 729, 3356, 17, 51, 574, 1398],
[96, 17, 1, 2, 38, 417, 17, 463, 20, 192],
[1, 65, 279, 90, 1, 46, 1, 82],
[60, 35, 16, 27, 480, 275, 80, 1, 222],
[3, 21, 13, 945, 1, 36, 208, 4, 2, 126],
[1, 411, 11, 525, 816],
```

```
max_len = max(len(seq) for seq in x_train_seq)
x_train_padded = pad_sequences(x_train_seq, maxlen=max_len, padding='post')
x_test_padded = pad_sequences(x_test_seq, maxlen=max_len, padding='post')
```

```
model = Sequential()
model.add(Embedding(input_dim=5000, output_dim=32, input_length=max_len))
model.add(LSTM(32))
model.add(Dense(len(emotions), activation='softmax'))
model.compile(loss='sparse_categorical_crossentropy', optimizer='adam', metrics=['accuracy'])
```

```
early_stop = EarlyStopping(monitor='val_loss', patience=3)
history = model.fit(x_train_padded, y_train, epochs=30, validation_split=0.2, callbacks=[early_stop])
```

```
Epoch 1/30
400/400 [==============================] - 19s 36ms/step - loss: 1.4869 - accuracy: 0.3621 - val_loss: 1.2024 - va
Epoch 2/30
400/400 [==============================] - 10s 26ms/step - loss: 1.1197 - accuracy: 0.4739 - val_loss: 1.1032 - va
Epoch 3/30
400/400 [==============================] - 11s 26ms/step - loss: 0.9205 - accuracy: 0.6079 - val_loss: 0.9501 - va
Epoch 4/30
400/400 [==============================] - 11s 27ms/step - loss: 0.7039 - accuracy: 0.7104 - val_loss: 0.7434 - va
Epoch 5/30
400/400 [==============================] - 11s 28ms/step - loss: 0.5489 - accuracy: 0.7858 - val_loss: 0.6502 - va
Epoch 6/30
400/400 [==============================] - 11s 26ms/step - loss: 0.4111 - accuracy: 0.8680 - val_loss: 0.5264 - va
Epoch 7/30
400/400 [==============================] - 10s 25ms/step - loss: 0.2854 - accuracy: 0.9148 - val_loss: 0.5462 - va
Epoch 8/30
400/400 [==============================] - 11s 27ms/step - loss: 0.2210 - accuracy: 0.9339 - val_loss: 0.5474 - va
Epoch 9/30
400/400 [==============================] - 11s 28ms/step - loss: 0.1893 - accuracy: 0.9451 - val_loss: 0.5288 - va
```

```
y_pred = model.predict(x_test_padded)
y_pred = np.argmax(y_pred, axis=1)
accuracy = accuracy_score(y_test, y_pred)
report = classification_report(y_test, y_pred, target_names=emotions)
print("Accuracy:", accuracy)
print("Classification report of LSTM:\n", report)
```

```
125/125 [==============================] - 1s 7ms/step
Accuracy: 0.862
Classification report of LSTM:
               precision    recall  f1-score   support

       anger       0.87      0.84      0.85       538
        fear       0.86      0.84      0.85       494
         joy       0.91      0.90      0.90      1316
        love       0.69      0.68      0.69       326
     sadness       0.88      0.92      0.90      1198
```