Names	IDs
yahia ashraf	20200636
yahia mahmoud	20201222
hamza abdel hamid	20200162
ziad ibrahim	20200193
omar tarek	20200348

```
!pip install scikeras
```

```
import numpy as np
import tensorflow as tf
import pandas as pd
from sklearn.metrics import accuracy_score
from sklearn.feature_extraction.text import CountVectorizer, TfidfVectorizer
from sklearn.model_selection import GridSearchCV, train_test_split
from sklearn.metrics import classification_report
from tensorflow.keras import layers, Sequential
from scikeras.wrappers import KerasClassifier
from matplotlib import pyplot
import spacy
import matplotlib.pyplot as plt
from sklearn.svm import LinearSVC
```

```
df = pd.read_csv("sentimentdataset (Project 1).csv")
df
```

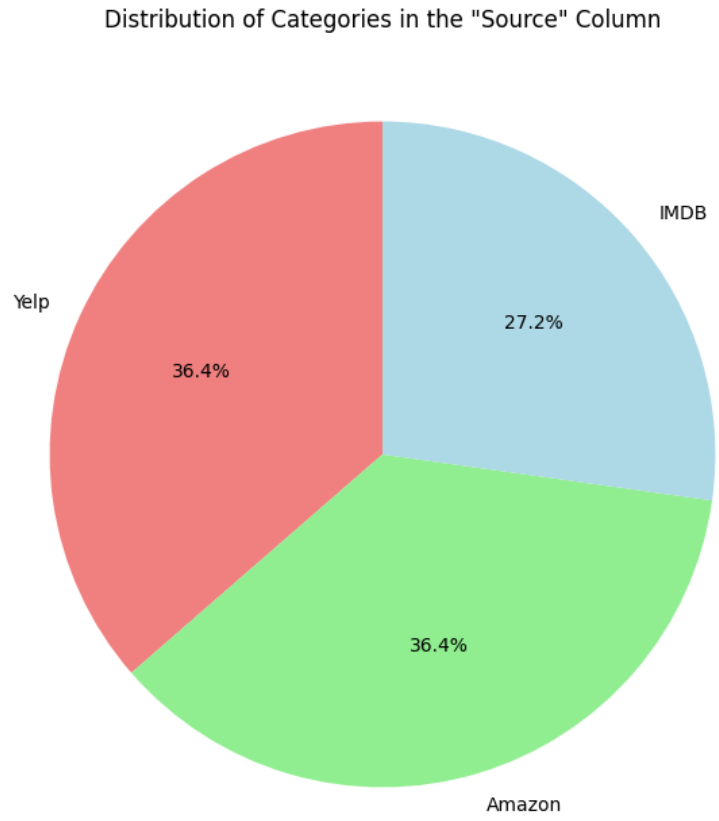
	Source	ID	Message	Target
0	Yelp	0	Crust is not good.	0
1	Yelp	1	Not tasty and the texture was just nasty.	0
2	Yelp	2	Stopped by during the late May bank holiday of...	1
3	Yelp	3	The selection on the menu was great and so wer...	1
4	Yelp	4	Now I am getting angry and I want my damn pho.	0
...	...	...	...	...
2740	Amazon	994	The screen does get smudged easily because it ...	0
2741	Amazon	995	What a piece of junk.. I lose more calls on th...	0
2742	Amazon	996	Item Does Not Match Picture.	0
2743	Amazon	997	The only thing that disappoint me is the infra...	0
2744	Amazon	998	You can not answer calls with the unit, never ...	0

2745 rows × 4 columns

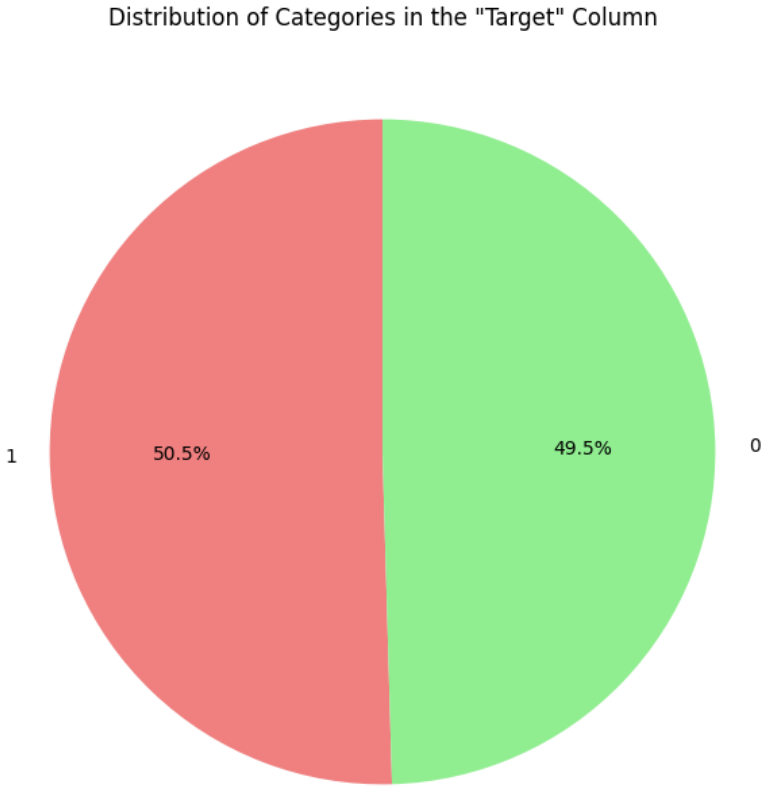
Exploratory Data Analysis

```
source_counts = df['Source'].value_counts()
target_counts = df['Target'].value_counts()
```

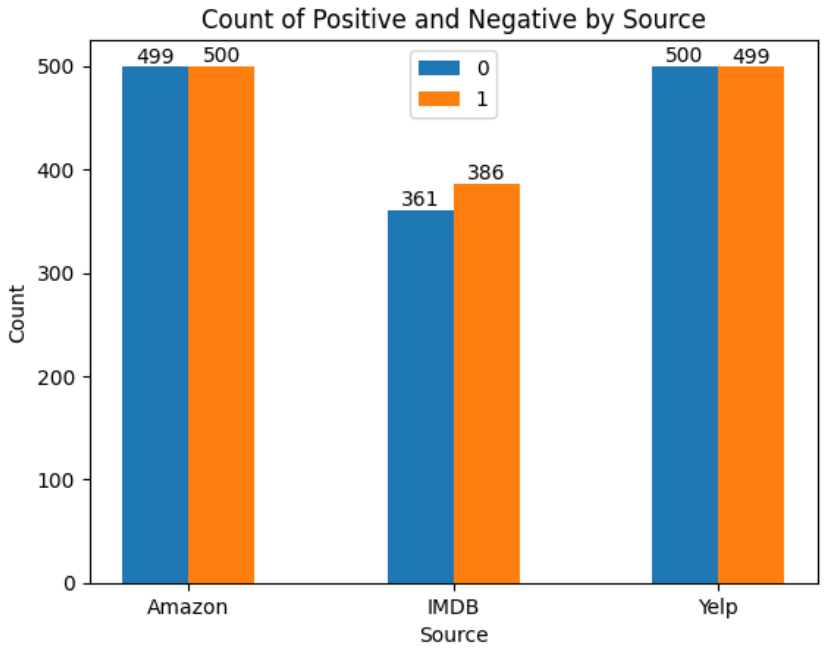
```
plt.figure(figsize=(8, 8))
plt.pie(source_counts, labels=source_counts.index, autopct='%1.1f%%', startangle=90, colors=
plt.title('Distribution of Categories in the "Source" Column')
plt.show()
```




```
1 plt.figure(figsize=(8, 8))
2 plt.pie(target_counts, labels=target_counts.index, autopct='%1.1f%%', startangle=90, colors=
3 plt.title('Distribution of Categories in the "Target" Column')
4 plt.show()
```



```
# Group by 'source' and 'target' and get the count
grouped_data = df.groupby(['Source', 'Target']).size().unstack()

# Plotting the bar chart
fig, ax = plt.subplots()
width = 0.25  # the width of the bars

sources = grouped_data.index
ind = range(len(sources))

bar_0 = ax.bar(ind, grouped_data[0], width, label='0')
bar_1 = ax.bar([i + width for i in ind], grouped_data[1], width, label='1')

# Adding labels and title
ax.set_xlabel('Source')
ax.set_ylabel('Count')
ax.set_title('Count of Positive and Negative by Source')
ax.set_xticks([i + width/2 for i in ind])
ax.set_xticklabels(sources)
ax.legend()

for bar in bar_0:
    yval = bar.get_height()
    plt.text(bar.get_x() + bar.get_width()/2, yval, round(yval, 2), ha='center', va='bottom')

for bar in bar_1:
    yval = bar.get_height()
    plt.text(bar.get_x() + bar.get_width()/2, yval, round(yval, 2), ha='center', va='bottom')


plt.show()
```



Preproccessing

```
nlp = spacy.load('en_core_web_sm')
# Add 'not' to spaCy stop words
spacy_stop_words = spacy.lang.en.stop_words.STOP_WORDS

# add others
words_to_keep = ["not", "no", "never", "but", "only", "against",
    "don't", "doesn't", "didn't", "isn't", "aren't", "wasn't", "weren't",
    "hasn't", "haven't", "hadn't", "won't", "wouldn't", "can't", "cannot",
    "could've", "should've", "would've", "doesn't", "didn't", "isn't", "ain't"]

for word in words_to_keep:
    spacy_stop_words.discard(word)

# Function for lemmatization and removing stop words
def lemmatize_and_remove_stop_words(text):
    doc = nlp(text)
    lemmatized_text = [token.lemma_ for token in doc if token.text.lower() not in spacy_stop_
    return ' '.join(lemmatized_text)

df = pd.read_csv("sentimentdataset (Project 1).csv")

df.drop(columns = ['Source', 'ID'], inplace=True)

# Apply the function to the "Message" column
df['Message'] = df['Message'].apply(lemmatize_and_remove_stop_words)

print(df['Message'])

# Save the updated DataFrame to a new CSV file
df.to_csv('sentimentdataset_stopwords_lemmatized.csv', index=False)
```

```
0                                    crust not good .
1                             not tasty texture nasty .
2       stop late bank holiday Rick Steve recommendati...
3                          selection menu great price .
4                             get angry want damn pho .
                           ...
2740               screen smudge easily touch ear face .
2741                     piece junk .. lose call phone .
2742                          item not match Picture .
2743      only thing disappoint infra red port ( irda ) .
2744                 not answer call unit , never work !
Name: Message, Length: 2745, dtype: object
```

```
# read the preprocessed file
df = pd.read_csv("sentimentdataset_stopwords_lemmatized.csv")
df
```

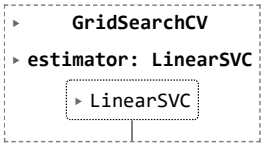
Message Target

```
X = df['Message']
y = df['Target']
```

```
# Create a TfidfVectorizer
vectorizer = TfidfVectorizer()

# Transform the training and testing data
X_tfidf = vectorizer.fit_transform(X)

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X_tfidf, y, test_size=0.2, random_state=4
```

SVC Model

```
# to convert it to a data frame
# df_tfidf = pd.DataFrame(X_train_tfidf.toarray(), columns=vectorizer.get_feature_names_out()

svc = LinearSVC(max_iter=100000, dual=False)

# Define the parameter grid for grid search
param_grid = {
    'C': [0.001, 0.01, 0.1, 1, 10, 100],
    'penalty': ['l1', 'l2'],
    'loss': ['squared_hinge'],
    'tol': [1e-3, 1e-2, 1e-1, 1],
    'class_weight': [None, 'balanced']
}

# Perform grid search with 5-fold cross-validation
grid_search = GridSearchCV(svc, param_grid, scoring='accuracy', error_score='raise', cv=5)
grid_search.fit(X_train, y_train)
```




```
# Print the best parameters found by grid search
print("Best Parameters: ", grid_search.best_params_)
```

```
Best Parameters:  {'C': 0.1, 'class_weight': 'balanced', 'loss': 'squared_hinge', 'penalty': 'l2', 'tol': 0.01}
```

```
# Predict on the testing set with the best model
y_pred = grid_search.predict(X_test)

# Evaluate the model
accuracy = accuracy_score(y_test, y_pred)
print("Accuracy on Testing Set: {:.2f}%".format(accuracy * 100))
```

```
Accuracy on Testing Set: 83.79%
```

```
# Display additional metrics
print("\nClassification Report:")
print(classification_report(y_test, y_pred))
```

```
Classification Report:
              precision    recall  f1-score   support

           0       0.81      0.86      0.84       265
           1       0.87      0.81      0.84       284

    accuracy                           0.84       549
   macro avg       0.84      0.84      0.84       549
weighted avg       0.84      0.84      0.84       549
```

ANN Model

```
def build_model(neurons=16, learning_rate=0.01):
  model = Sequential()
  model.add(layers.Dense(units=neurons, activation='relu', input_dim=X_train.shape[1]))
  model.add(layers.Dense(units=neurons, activation='relu'))
  model.add(layers.Dense(units=1, activation='sigmoid'))

  model.compile(optimizer=tf.keras.optimizers.Adam(learning_rate=learning_rate),
                loss='binary_crossentropy',
                metrics=['accuracy'])
  return model
```

```
model = KerasClassifier(build_fn=build_model,neurons = [16, 32, 64, 128], learning_rate = [0.

print(model.get_params().keys())
param_grid = {
    'neurons': [16, 32, 64, 128],
    'learning_rate': [0.001, 0.01, 0.1],
    'batch_size': [16, 32, 64, 128]
}

```

```
dict_keys(['model', 'build_fn', 'warm_start', 'random_state', 'optimizer', 'loss', 'metrics', 'batch_size', 'validation
```

```
grid = GridSearchCV(estimator=model, param_grid=param_grid, cv=3)
grid_result = grid.fit(X_train, y_train)
```

```
print("Best: ANN model is %f using %s" % (grid_result.best_score_, grid_result.best_params_))
```

```
Best: ANN model is 0.791439 using {'batch_size': 16, 'learning_rate': 0.01, 'neurons': 16}
```

```
best_model = grid_result.best_estimator_
best_model.fit(X_train, y_train)
prediction = best_model.predict(X_test)
acc = accuracy_score(y_pred=prediction, y_true=y_test)
print(f'Test Accuracy: {acc}')
```

```
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`
  X, y = self._initialize(X, y)
Test Accuracy: 0.8415300546448088
```

```
report = classification_report(y_test, prediction)
print("Classification Report:\n", report)
```

```
Classification Report:
               precision    recall  f1-score   support

           0       0.84      0.83      0.83       265
           1       0.84      0.85      0.85       284

    accuracy                           0.84       549
   macro avg       0.84      0.84      0.84       549
weighted avg       0.84      0.84      0.84       549
```