Text and multimedia mining project

Research question

To what extent do reviews from well-known film critics represent the opinion of the average movie viewer?

Dataset

https://www.kaggle.com/datasets/stefanoleone992/rotten-tomatoes-movies-and-critic-reviews-dataset?select=rotten_tomatoes_critic_reviews.csv

Imports

```
import numpy as np
import pandas as pd
import nltk
import re
from sklearn.model_selection import train_test_split
from nltk.corpus import stopwords
from nltk.tokenize import word_tokenize
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn import svm
from sklearn.metrics import f1_score, accuracy_score, precision_score, recall_score
import pickle
import matplotlib.pyplot as plt

nltk.download('stopwords')
nltk.download('punkt')
nltk.download('averaged_perceptron_tagger')
nltk.download('universal_tagset')
```

```
[nltk_data] Downloading package stopwords to
[nltk_data]     C:\Users\eldik\AppData\Roaming\nltk_data...
[nltk_data]   Package stopwords is already up-to-date!
[nltk_data] Downloading package punkt to
[nltk_data]     C:\Users\eldik\AppData\Roaming\nltk_data...
[nltk_data]   Package punkt is already up-to-date!
[nltk_data] Downloading package averaged_perceptron_tagger to
[nltk_data]     C:\Users\eldik\AppData\Roaming\nltk_data...
[nltk_data]   Package averaged_perceptron_tagger is already up-to-
[nltk_data]       date!
[nltk_data] Downloading package universal_tagset to
[nltk_data]     C:\Users\eldik\AppData\Roaming\nltk_data...
[nltk_data]   Package universal_tagset is already up-to-date!
True
```

Data retrieval

```
!wget -nc https://transfer.sh/pYLJf7/rotten_tomatoes_critic_reviews.csv
```

```
'wget' is not recognized as an internal or external command,
operable program or batch file.
```

```
df = pd.read_csv('rotten_tomatoes_critic_reviews.csv')[['top_critic', 'review_score', 'rot
print(df)
```

```
         top_critic review_score rotten_tomatoes_link  \
0             False          NaN            m/0814255
1             False          NaN            m/0814255
2             False          NaN            m/0814255
3             False        3.5/5            m/0814255
4              True          NaN            m/0814255
...             ...          ...                  ...
1130012       False          2/5          m/zulu_dawn
1130013       False        3.5/5          m/zulu_dawn
1130014       False           B+          m/zulu_dawn
1130015       False        3.5/5          m/zulu_dawn
1130016       False           C           m/zulu_dawn

                                          review_content
0        A fantasy adventure that fuses Greek mythology...
1        Uma Thurman as Medusa, the gorgon with a coiff...
2        With a top-notch cast and dazzling special eff...
3        Whether audiences will get behind The Lightnin...
4        What's really lacking in The Lightning Thief i...
...                                                    ...
1130012                                              NaN
1130013  Seen today, it's not only a startling indictme...
1130014  A rousing visual spectacle that's a prequel of...
1130015  A simple two-act story: Prelude to war, and th...
1130016  Rides the line between being a pure artifact o...

[1130017 rows x 4 columns]
```

Data processing

In the dataset there some value are not filled in, those will be removed. Furthermore, the reviews containing characters not used in normal texts will be removed.

```
df = df.dropna()

def create_mask_special_char(df):
    regexpr = re.compile(r'\@|\#|\$|\%|\^|\*|\||\<|\>|\/')
    mask = []
    for review in df['review_content']:
        if regexpr.search(review) == None:
```

```
            mask.append(True)
        else:
            mask.append(False)
    return mask

df = df[create_mask_special_char(df)]
```

For the review_score several scoring methods are used. To fix this issue all scores will be conversed to a value between 1 and 10 or if that is not possible the reviews will be removed.

```
def convert_score(score):
    # check if score is a single number
    # with single numbers the scale is unknown, so those scores are set to None
    if score.isnumeric():
        return None

    # check if score looks like 'a/b'
    elif '/' in score:
        a, b = score.split('/')
        # check if score looks like 'a/0'
        if float(b) in [5.0, 10.0, 100.0]:
            score = round(5 * float(a) / float(b))
            if score == 0 or score > 5:
                return None
            else:
                return score
        else:
            return None

    # score is letter based
    else:
        if 'A' in score:
            return 5
        elif 'B' in score:
            return 4
        elif 'C' in score:
            return 3
        elif 'D' in score:
            return 2
        elif 'F' in score:
            return 1
        else:
            return None

df['review_score'] = df['review_score'].map(convert_score)
df = df.dropna()
df['review_score'] = df['review_score'].astype('int16')
```

The column rotten_tomatoes_link contains an id to the information over the movie that is reviewed. This can be used as a feature for the review. So this information will be conversed to a unique integer value for every movie.

```
df['rotten_tomatoes_link'] = df['rotten_tomatoes_link'].astype('category').cat.codes
df['review_content'] = df['review_content'].astype('string')
print(df.dtypes)
```

```
top_critic               bool
review_score            int16
rotten_tomatoes_link    int16
review_content         string
dtype: object
```

The dataset is quite big and we want an equal distribution from top critics and not top critics, so we select random reviews from the set.

```
df = pd.concat([df[df['top_critic']].sample(n=50000, random_state = 1), df[~df['top_critic
df = df.reset_index(drop = True)
print(df)
```

```
       top_critic  review_score  rotten_tomatoes_link  \
0            True             4                  6525
1            True             4                 16910
2            True             1                 12357
3            True             2                  4661
4            True             2                  7004
...           ...           ...                   ...
99995       False             2                  5122
99996       False             4                  1597
99997       False             4                 14609
99998       False             1                 13345
99999       False             4                  4284

                                        review_content
0      The film will probably end up preaching to the...
1      Radcliffe is delightful, showcasing a sly, win...
2      Even though the once-and-forever Dude abides b...
3      Coco and Igor manages to drag this sorry, unse...
4      By the end, we're laughing at dialogue that's ...
...                                                  ...
99995  Date Night feels too much like a lame married ...
99996  Jason Statham sports enough stubble to scrape ...
99997  Although it runs down an expected checklist, t...
99998   One of the better Pauly movies, not saying much!
99999  Helmer [Martin] Campbell shows great skill wit...

[100000 rows x 4 columns]
```

Extracting features

Before the features are extracted, the text is preprocessed to reduce the amount of features. The words in the reviews will be marked with Parts of Speech Tagging. Then the words with the right tags will be kept and some extra important words. Furthermore, all words will be converted to lower case and stopwords will be removed.

```
def reduce_features(df):
    stop_words = set(stopwords.words('english'))
    stop_words.remove('not')
    wanted_tags = ["ADJ", "ADV", "verb"]
    wanted_words = ["neither", "no", "n't", "not", "nor", "none", "nobody", "although", "h
    reviews = []
    for review in df['review_content']:
        words = word_tokenize(review)
        tagged_words = nltk.pos_tag(words, tagset='universal')
        words = []
        for word, tag in tagged_words:
            word = word.lower()
            if word in wanted_words or tag in wanted_tags and word not in stop_words and '
                words.append(word)
        reviews.append(" ".join(words))
    df['review_content'] = reviews
    return df

df = reduce_features(df)
print(df)
```

```
       top_critic  review_score  rotten_tomatoes_link  \
0            True             4                  6525
1            True             4                 16910
2            True             1                 12357
3            True             2                  4661
4            True             2                  7004
...           ...           ...                   ...
99995       False             2                  5122
99996       False             4                  1597
99997       False             4                 14609
99998       False             1                 13345
99999       False             4                  4284

                                       review_content
0                                 probably surprisingly
1      delightful sly comedic bit twee also undefined...
2                                              even n't
3                   unseemly yet hardly earth barely n't
4                                            serious no
...                                                 ...
99995               much married couple mild tensionless
99996                    enough stubble not slight silly
99997  although expected incredibly likable largely d...
99998                                  better not much
99999                            great huge many copious

[100000 rows x 4 columns]
```

```
def extract_TF_IDF(df):
    vectorizer = TfidfVectorizer()
    vectorizer.fit(df['review_content'].tolist())
    vector = vectorizer.transform(df['review_content'].tolist())
    return vector
```

```
vector = extract_TF_IDF(df)
print(vector.shape)
```

```
(100000, 13540)
```

Splitting the dataset

To train the models, the dataset has to be split up in a training and test sets. Furthermore the dataset has to be split up in reviews from top critics and reviews from not top critics. So in total there will be six sets.

```
# split top critics and not top critics
tc_df = df[df['top_critic']]
ntc_df = df[~df['top_critic']]

# split train and test set
tc_df_train, tc_df_test = train_test_split(tc_df , random_state=1, shuffle=True)
ntc_df_train, ntc_df_test = train_test_split(ntc_df , random_state=1, shuffle=True)
```

Training the models

```
def get_features(data_set, vector):
    features = []
    for row in data_set.index.values:
        features.append(np.append(vector.getrow(row).toarray(), data_set['rotten_tomatoes_
    return features


tc_model = svm.SVC()
tc_model.fit(get_features(tc_df_train, vector), list(tc_df_train['review_score']))
pickle.dump(tc_model, open("tc_model.sav", 'wb'))


ntc_model = svm.SVC()
ntc_model.fit(get_features(ntc_df_train, vector), list(ntc_df_train['review_score']))
pickle.dump(ntc_model, open("ntc_model.sav", 'wb'))


tc_model = pickle.load(open("tc_model.sav", 'rb'))
ntc_model = pickle.load(open("ntc_model.sav", 'rb'))


tc_features = get_features(tc_df_test, vector)
tc_predictions = tc_model.predict(tc_features)
pickle.dump(tc_predictions, open("tc_predictions.sav", 'wb'))


tc_predictions = pickle.load(open("tc_predictions.sav", 'rb'))
```

```
ntc_features = get_features(ntc_df_test, vector)
ntc_predictions = ntc_model.predict(ntc_features)
pickle.dump(ntc_predictions, open("ntc_predictions.sav", 'wb'))
```

```
ntc_predictions = pickle.load(open("ntc_predictions.sav", 'rb'))
```

```
tc_fscore = f1_score(tc_df_test['review_score'], tc_predictions, average='weighted')
tc_accuracy = accuracy_score(tc_df_test['review_score'], tc_predictions)
tc_recall = recall_score(tc_df_test['review_score'], tc_predictions, average='weighted')
tc_precision = precision_score(tc_df_test['review_score'], tc_predictions, average='weight
print("F1-score top critic model: ", tc_fscore)
print("Accuracy top critic model: ", tc_accuracy)
print("Recall top critic model: ", tc_recall)
print("Precision top critic model: ", tc_precision)
```

```
F1-score top critic model:  0.19301909469852638
Accuracy top critic model:  0.36264
Recall top critic model:  0.36264
Precision top critic model:  0.13150776960000002
C:\Users\eldik\anaconda3\lib\site-packages\sklearn\metrics\_classification.py:1318:
  _warn_prf(average, modifier, msg_start, len(result))
```

```
ntc_fscore = f1_score(ntc_df_test['review_score'], ntc_predictions, average='weighted')
ntc_accuracy = accuracy_score(ntc_df_test['review_score'], ntc_predictions)
ntc_recall = recall_score(ntc_df_test['review_score'], ntc_predictions, average='weighted'
ntc_precision = precision_score(ntc_df_test['review_score'], ntc_predictions, average='wei
print("F1-score not top critic model: ", ntc_fscore)
print("Accuracy not top critic model: ", ntc_accuracy)
print("Recall not top critic model: ", ntc_recall)
print("Precision not top critic model: ", ntc_precision)
```

```
F1-score not top critic model:  0.25819272523782877
Accuracy not top critic model:  0.4296
Recall not top critic model:  0.4296
Precision not top critic model:  0.18455615999999997
C:\Users\eldik\anaconda3\lib\site-packages\sklearn\metrics\_classification.py:1318:
  _warn_prf(average, modifier, msg_start, len(result))
```

Running the models on the other datasets

```
tc_on_ntc_model_predictions = ntc_model.predict(tc_features)
pickle.dump(tc_on_ntc_model_predictions, open("tc_on_ntc_model_predictions.sav", 'wb'))
```

```
tc_on_ntc_model_predictions = pickle.load(open("tc_on_ntc_model_predictions.sav", 'rb'))
```

```
ntc_on_tc_model_predictions = tc_model.predict(ntc_features)
```

```
pickle.dump(ntc_on_tc_model_predictions, open("ntc_on_tc_model_predictions.sav", 'wb'))

ntc_on_tc_model_predictions = pickle.load(open("ntc_on_tc_model_predictions.sav", 'rb'))


tc_on_ntc_model_fscore = f1_score(tc_df_test['review_score'], tc_on_ntc_model_predictions,
tc_on_ntc_model_accuracy = accuracy_score(tc_df_test['review_score'], tc_on_ntc_model_prec
tc_on_ntc_model_recall = recall_score(tc_df_test['review_score'], tc_on_ntc_model_predicti
tc_on_ntc_model_precision = precision_score(tc_df_test['review_score'], tc_on_ntc_model_pr
print("F1-score not top critic model on top critic dataset: ", tc_on_ntc_model_fscore)
print("Accuracy not top critic model on top critic dataset: ", tc_on_ntc_model_accuracy)
print("Recall not top critic model on top critic dataset: ", tc_on_ntc_model_recall)
print("Precision not top critic model on top critic dataset: ", tc_on_ntc_model_precision)
```

```
F1-score not top critic model on top critic dataset:  0.19301909469852638
Accuracy not top critic model on top critic dataset:  0.36264
Recall not top critic model on top critic dataset:  0.36264
Precision not top critic model on top critic dataset:  0.13150776960000002
C:\Users\eldik\anaconda3\lib\site-packages\sklearn\metrics\_classification.py:1318:
  _warn_prf(average, modifier, msg_start, len(result))
```

```
ntc_on_tc_model_fscore = f1_score(ntc_df_test['review_score'], ntc_on_tc_model_predictions
ntc_on_tc_model_accuracy = accuracy_score(ntc_df_test['review_score'], ntc_on_tc_model_pre
ntc_on_tc_model_recall = recall_score(ntc_df_test['review_score'], ntc_on_tc_model_predict
ntc_on_tc_model_precision = precision_score(ntc_df_test['review_score'], ntc_on_tc_model_p
print("F1-score not top critic model on top critic dataset: ", ntc_on_tc_model_fscore)
print("Accuracy not top critic model on top critic dataset: ", ntc_on_tc_model_accuracy)
print("Recall not top critic model on top critic dataset: ", ntc_on_tc_model_recall)
print("Precision not top critic model on top critic dataset: ", ntc_on_tc_model_precision)
```

```
F1-score not top critic model on top critic dataset:  0.25819272523782877
Accuracy not top critic model on top critic dataset:  0.4296
Recall not top critic model on top critic dataset:  0.4296
Precision not top critic model on top critic dataset:  0.18455615999999997
C:\Users\eldik\anaconda3\lib\site-packages\sklearn\metrics\_classification.py:1318:
  _warn_prf(average, modifier, msg_start, len(result))
```

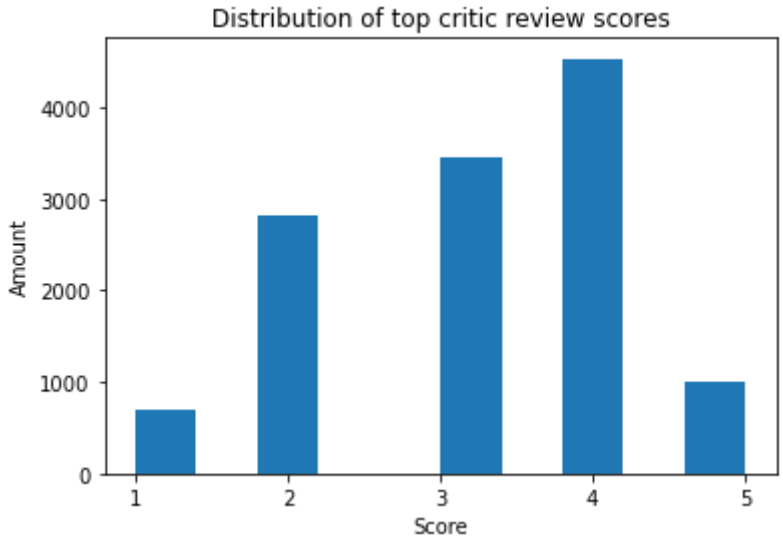
Evaluation

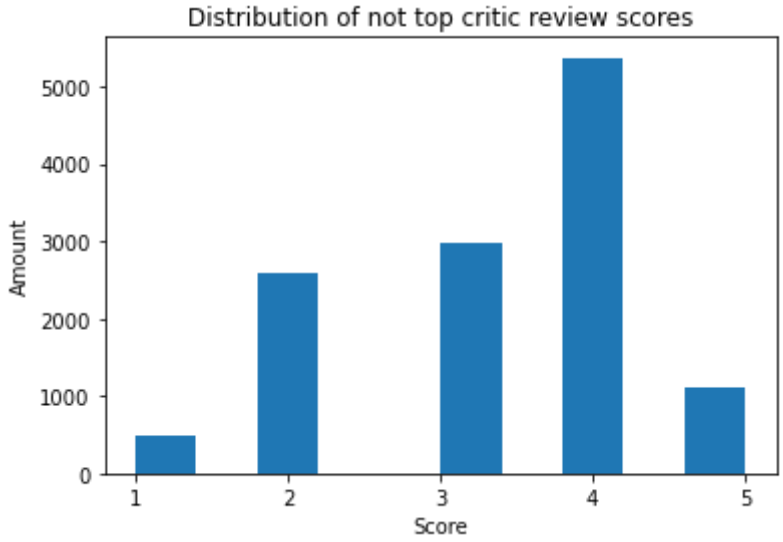
```
print("Average of top critic scores:", sum(tc_df_test['review_score']) / len(tc_df_test['r
print("Average of not top critic scores:", sum(ntc_df_test['review_score']) / len(ntc_df_t
```

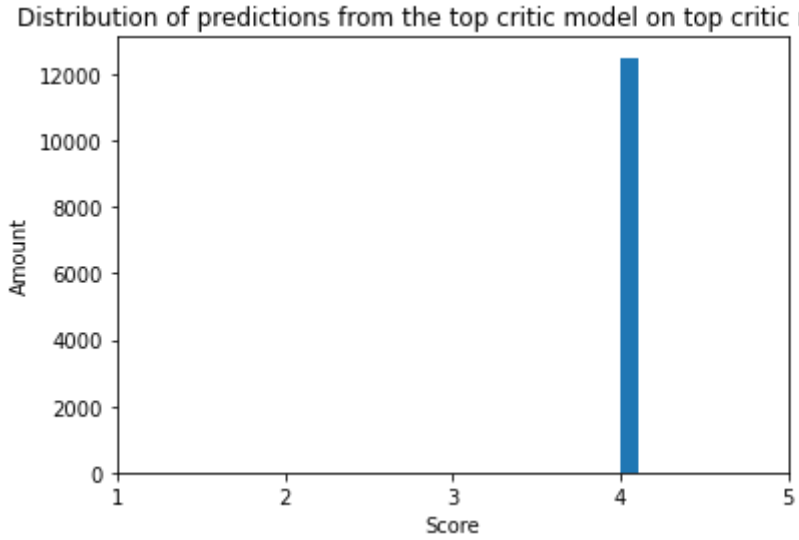
```
Average of top critic scores: 3.18712
Average of not top critic scores: 3.32112
```

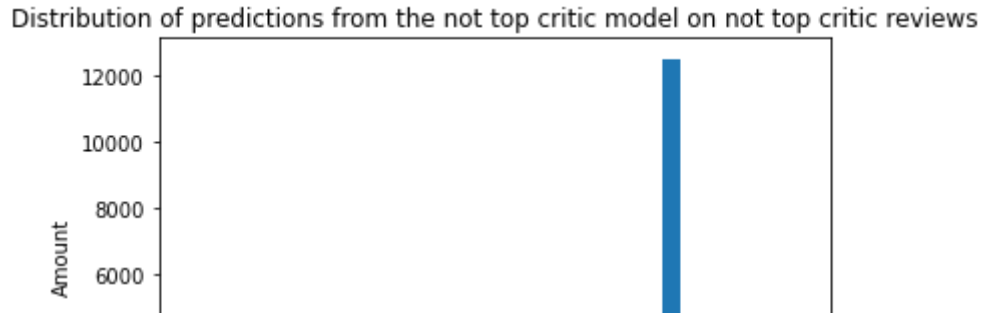
```
plt.hist(tc_df_test['review_score'])
plt.title("Distribution of top critic review scores")
plt.xlabel("Score")
plt.ylabel("Amount")
plt.xticks([1,2,3,4,5])
```

```
plt.show()

plt.hist(ntc_df_test['review_score'])
plt.title("Distribution of not top critic review scores")
plt.xlabel("Score")
plt.ylabel("Amount")
plt.xticks([1,2,3,4,5])
plt.show()

plt.hist(tc_predictions)
plt.title("Distribution of predictions from the top critic model on top critic reviews")
plt.xlabel("Score")
plt.ylabel("Amount")
plt.xticks([1,2,3,4,5])
plt.show()

plt.hist(ntc_predictions)
plt.title("Distribution of predictions from the not top critic model on not top critic rev
plt.xlabel("Score")
plt.ylabel("Amount")
plt.xticks([1,2,3,4,5])
plt.show()

plt.hist(tc_on_ntc_model_predictions)
plt.title("Distribution of predictions from the top critic model on not top critic reviews
plt.xlabel("Score")
plt.ylabel("Amount")
plt.xticks([1,2,3,4,5])
plt.show()

plt.hist(ntc_on_tc_model_predictions)
plt.title("Distribution of predictions from the not top critic model on top critic reviews
plt.xlabel("Score")
plt.ylabel("Amount")
plt.xticks([1,2,3,4,5])
plt.show()
```


Distribution of top critic review scores
Amount
Score
0
1000
2000
3000
4000
1
2
3
4
5


Distribution of not top critic review scores
Amount
Score
0
1000
2000
3000
4000
5000
1
2
3
4
5


Distribution of predictions from the top critic model on top critic reviews
Amount
Score
0
2000
4000
6000
8000
10000
12000
1
2
3
4
5


Distribution of predictions from the not top critic model on not top critic reviews
Amount
6000
8000
10000
12000

Betaalde Colab-producten - Zeg contracten hier op