A. Import data

NAMA = kevin Caesar

NIM = 162012133057

PRAKTIKUM 8 : KLASIFIKASI TEXT

```
pip install scikit-plot
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simp
Requirement already satisfied: scikit-plot in /usr/local/lib/python3.7/dist-packages (0.3.7)
Requirement already satisfied: scipy>=0.9 in /usr/local/lib/python3.7/dist-packages (from sciki
Requirement already satisfied: joblib>=0.10 in /usr/local/lib/python3.7/dist-packages (from sci
Requirement already satisfied: matplotlib>=1.4.0 in /usr/local/lib/python3.7/dist-packages (fro
Requirement already satisfied: scikit-learn>=0.18 in /usr/local/lib/python3.7/dist-packages (fr
Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.7/dist-packages (fro
```

```
[ ] !pip install nltk
    !pip install tensorflow
    !pip install keras
    !pip install demoji
    !pip install Sastrawi
    import nltk #import nltk
    nltk.download('wordnet') #download nltk wordnet
    nltk.download('punkt') #download nltk punkt
    nltk.download('stopwords') #download nltk stopwords
    nltk.download('omw-1.4') #download omw-1.4
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Requirement already satisfied: nltk in /usr/local/lib/python3.7/dist-packages (3.7)
Requirement already satisfied: tqdm in /usr/local/lib/python3.7/dist-packages (from nltk) (4.64.1)
Requirement already satisfied: click in /usr/local/lib/python3.7/dist-packages (from nltk) (7.1.2)
Requirement already satisfied: regex>=2021.8.3 in /usr/local/lib/python3.7/dist-packages (from nltk
Requirement already satisfied: joblib in /usr/local/lib/python3.7/dist-packages (from nltk) (1.2.0)
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
```

```
[ ] #cleaning
    import re
    import pandas as pd
    from string import punctuation
    from nltk.corpus import stopwords
    from nltk import sent_tokenize, word_tokenize
    import demoji

    #stemmer
    import Sastrawi
    from Sastrawi.Stemmer.StemmerFactory import StemmerFactory
    from nltk.stem import PorterStemmer

    #wordcloud
    from matplotlib import pyplot as plt
    from wordcloud import WordCloud
    import seaborn as sns

    #frekuensi kata
    from nltk.probability import FreqDist
```

```
#frekuensi kata
from nltk.probability import FreqDist
from sklearn.feature_extraction.text import TfidfVectorizer
#visualisasi data
import numpy as np
import seaborn as sns
sns.set()
from collections import Counter
import warnings
warnings.filterwarnings('ignore')
#melakukan klasifikasi
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.model_selection import train_test_split
from sklearn.naive_bayes import MultinomialNB
from sklearn.svm import SVC
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import accuracy_score, precision_score, recall_score, f1_sc
from scikitplot.metrics import plot_confusion_matrix, plot_roc
import tensorflow as tf
import keras
from sklearn.model_selection import cross_val_score, cross_validate, StratifiedK
```

```
data = pd.read_csv('/content/sample_data/all_agree.csv')
data.head()
```

	title	label	label_score
0	Masuk Radar Pilwalkot Medan, Menantu Jokowi Be...	non-clickbait	0
1	Malaysia Sudutkan RI: Isu Kabut Asap hingga In...	non-clickbait	0
2	Viral! Driver Ojol di Bekasi Antar Pesanan Mak...	clickbait	1
3	Kemensos Salurkan Rp 7,3 M bagi Korban Kerusuh...	non-clickbait	0
4	MPR: Amandemen UUD 1945 Tak Akan Melebar ke Ma...	non-clickbait	0

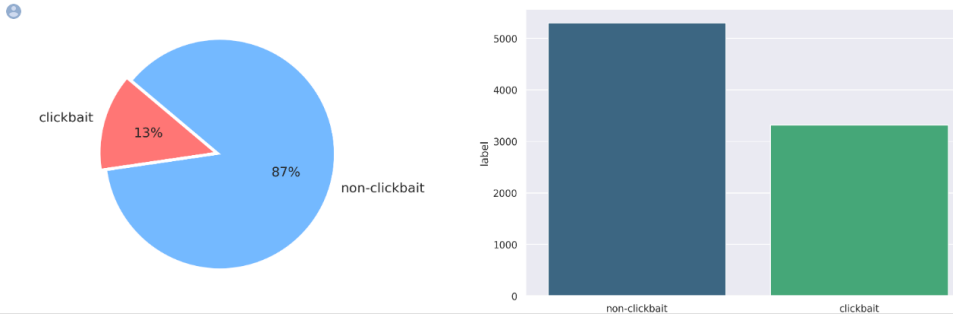
```
[ ] print(data.shape)
    data.isnull().sum()

    (8613, 3)
    title          0
    label          0
    label_score    0
    dtype: int64
```

dari data diatas terdapat jumlah data sebanyak 8613 yang memuat tiga informasi yaitu title, label, dan label score. kemudian, di cek tidak terdapat missing value

```
[ ] data['label'].value_counts()

    non-clickbait    5297
    clickbait        3316
    Name: label, dtype: int64
```

dari hasil yang ditampilkan bahwa terdapat berita non-clicbalt sebanyak 5297 dan clickbalt sebanyak 3316

```
plt.subplot(1, 2, 1)
plt.pie(sizes, labels = labels, textprops={'fontsize': 15}, startangle=140,
        autopct='%1.0f%%', colors=custom_colours, explode=[0, 0.05])

plt.subplot(1, 2, 2)
sns.barplot(x = data['label'].unique(), y = data['label'].value_counts(), palette= 'viridis')

plt.show()
```



dari visualisasi diatas dapat disimpulkan bahwa terdapat 87% berita kategori nonclickbait (>5000 data) dan 13% berita kategori clickbait (<3200 data)

B. Text Processing

B.1 cleaning

```
[ ] stop_words = set(stopwords.words('indonesian')+stopwords.words('english'))
    def preprocess_text(title):
     text = str(title) # Convert Object to str
     text = re.sub(r"@[A-Za-z0-9_]+","",text) # Remove mention
     text = re.sub(r"#[A-Za-z0-9]+","",text) # Remove hastag
     text = text.lower() # Lowercase text
     text = re.sub(f"[{re.escape(punctuation)}]", "", text) # Remove punctuation
     text = demoji.replace(text, "") # Remove emoji
     text = re.sub(r"\d+", "", text) # Remove number
     text = " ".join(text.split()) # Remove extra spaces, tabs, and new lines
     word_token = word_tokenize(text) # Tokenize text after cleaning
     clean_tokens = [w for w in word_token if not w in stop_words] # Remove text after cleaning in list stopwords

     return clean_tokens # return text after cleaning and remove stopwords
    data['cleaning_title'] = data['title'].apply(preprocess_text) # process preprocessing text with function
    data['cleaning_title'] = data['cleaning_title'].apply(' '.join) # join word in list
```

Kemudian, kita melakukan bagian nltk yang bermaksud agar mengubah type data object menjadi string, menyeragamkan menjadi huruf kecil, menghilangkan tanda baca, menghilangkan angka, menghilangkan space, dan menjadikan satu paragraf. Maka didapat hasil seperti berikut

B.2 stemming

```
[ ] # create stemmer and process stemmer
    factory = StemmerFactory()
    stemmer = factory.create_stemmer()
    out = stemmer.stem(hasil)
```

```
[ ] def stem_words(text):
        return " ".join([stemmer.stem(word) for word in text.split()])

    data["fixtitle"] = data["cleaning_title"].apply(lambda text: stem_words(text))
    data.head()
```

[ ]

	title	label	label_score	cleaning_title	fixtitle
0	Masuk Radar Pilwalkot Medan, Menantu Jokowi Be...	non-clickbait	0	masuk radar pilwalkot medan menantu jokowi ber...	masuk radar pilwalkot medan menantu jokowi tem...
1	Malaysia Sudutkan RI: Isu Kabut Asap hingga In...	non-clickbait	0	malaysia sudutkan ri isu kabut asap invasi babi	malaysia sudut ri isu kabut asap invasi babi
2	Viral! Driver Ojol di Bekasi Antar Pesanan Mak...	clickbait	1	viral driver ojol bekasi pesanan makanan pakai...	viral driver ojol bekas pesan makan pakai sepeda
3	Kemensos Salurkan Rp 7,3 M bagi Korban Kerusuh...	non-clickbait	0	kemensos salurkan rp korban kerusuhan sosial p...	kemensos salur rp korban rusuh sosial papua
4	MPR: Amandemen UUD 1945 Tak Akan Melebar ke Ma...	non-clickbait	0	mpr amandemen uud melebar manamana	mpr amandemen uud lebar manamana

```
[ ] out
```

```
'masuk radar pilwalkot medan menantu jokowi temu dpw nasdem sumut malaysia sudut ri isu kabut asap invasi babi viral driver ojol bekas pesan makan pakai sepeda k
emensos salur rp korban rusuh sosial papua mpr amandemen uud lebar manamana ingat islam banyuwangi gelar festival muharam wanita kendari perkosa jalan makassar l
aku buru hnw gbhn jamin rencana bangun ri jangka motor nyangkut bambu sleman jakpro protes adhi karya tender proyek jis wika pesan gamblang poyuono tolak revisi
uu kpk lokasi istana presiden ri papua menit jembatan holtekamp hias taman asia afrika bandung rusak terjang angin kencang polemik pb djarum kpai fadli zon mesti
musyawarah acara aju tangguh tahan kivlan zen eksepsi bassist boomerang hubert henry ganja tolak hakim jenguk bj habibie rspad kepala bppt beliau semangat recove
ry jk jenguk habibie rspad gatot soebroto mobil timpa pohon pondok indah kemudi luka demokrat bangun museum art gallery sbyani pacitan mendagri jamin laksana uu
otsus papua lanjut tegas dukung pe...'
```

Pada langkah ini dengan menggunakan package sastrawi kita akan mengubah tiap kata menjadi kata dasar contoh seperti di teks batalkan menjadi batal , ditangkap menjadi tangkap, dan sebagainya. Maka hasil yang akan muncul seperti diatas

```
[ ]  #TF-IDF
     #initialize the vectorizer
     vectorizer = TfidfVectorizer(sublinear_tf=True, min_df = 5, max_df = 0.95)
     # fit_transform applies TF-IDF to clean texts - we save the array of vector in X
     X_stem = vectorizer.fit_transform(data['fixtitle'])
```

B.3 visualisasi

B.3.1 click-bait dan non-clickbait

B.3.1 click-bait dan non-clickbait

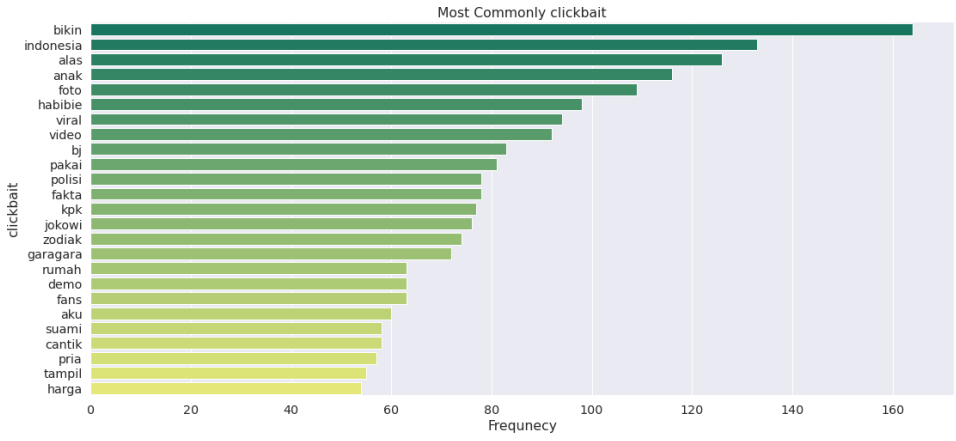
```
# create wordcloud
wordcloud = WordCloud(width = 800, height = 800,
 background_color ='black',
 min_font_size = 10).generate(out)
# plot the WordCloud image
plt.figure(figsize = (8, 8), facecolor = None)
plt.imshow(wordcloud)
plt.axis("off")
plt.tight_layout(pad = 0)
plt.show()
```

Pada visualiasi menggunakan NLTK untuk mengetahui kata pada judul berita yang muncul. Maka visualisasi dibawah didapat tiga kata yang sering dibahas/muncul yaitu (1)indonesia, (2)kpk , dan (3) polisi.

B.3.2 clickbait

```
text1 = " ".join(data[data['label'] == 'clickbait']['fixtitle'])
# create wordcloud
wordcloud = WordCloud(width = 800, height = 800,
 background_color ='black',
 min_font_size = 10).generate(text1)
# plot the WordCloud image
plt.figure(figsize = (8, 8), facecolor = None)
plt.imshow(wordcloud)
plt.axis("off")
plt.tight_layout(pad = 0)
```


```
all_clickbait_words1 = []
for sentence in data[data['label_score'] == 1]['fixtitle'].to_list():
    for word in sentence.split():
        all_clickbait_words1.append(word)

df = pd.DataFrame(Counter(all_clickbait_words1).most_common(25), columns= ['Word', 'Frequency'])

sns.set_context('notebook', font_scale= 1.3)
plt.figure(figsize=(18,8))
sns.barplot(y = df['Word'], x= df['Frequency'], palette= 'summer')
plt.title("Most Commonly clickbait")
plt.xlabel("Frequnecy")
plt.ylabel("clickbait")
plt.show()
```

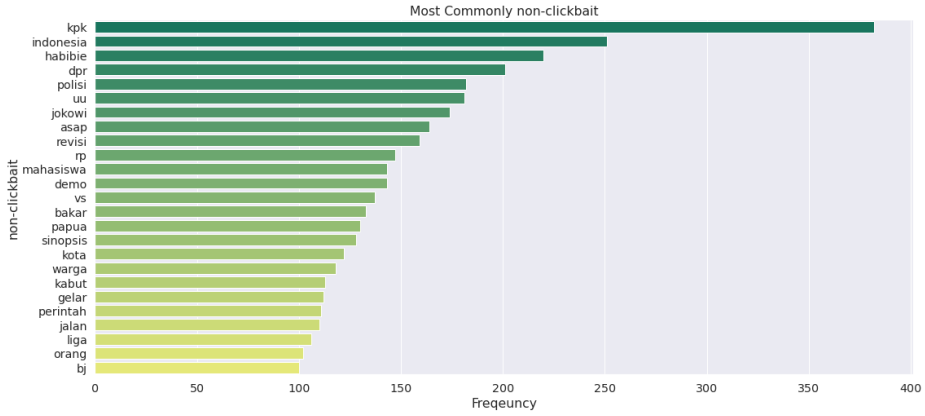


Pada visualiasi menggunakan freqdist dari NLTK untuk mengetahui jumlah frekuensi judul berita clickbait yang muncul. Maka visualisasi dibawah didapat tiga kata yang sering dibahas/muncul yaitu (1) bikin , (2)indonesia, dan (3) alas.

B.3.3 non-clickbit

```
[ ] text1 = " ".join(data[data['label'] == 'non-clickbait']['fixtitle'])
    # create wordcloud
    wordcloud = WordCloud(width = 800, height = 800,
     background_color ='black',
     min_font_size = 10).generate(text1)
    # plot the WordCloud image
    plt.figure(figsize = (8, 8), facecolor = None)
    plt.imshow(wordcloud)
    plt.axis("off")
    plt.tight_layout(pad = 0)
    plt.show()
```


```
[ ]  all_nonclickbait_words = []
     for sentence in data[data['label_score'] == 0]['fixtitle'].to_list():
         for word in sentence.split():
             all_nonclickbait_words.append(word)

     df = pd.DataFrame(Counter(all_nonclickbait_words).most_common(25), columns= ['Word', 'Frequency'])

     sns.set_context('notebook', font_scale= 1.3)
     plt.figure(figsize=(18,8))
     sns.barplot(y = df['Word'], x= df['Frequency'], palette= 'summer')
     plt.title("Most Commonly non-clickbait")
     plt.xlabel("Freqeuncy")
     plt.ylabel("non-clickbait")
     plt.show()
```



Pada visualiasi menggunakan freqdist dari NLTK untuk mengetahui jumlah frekuensi kata judul berita non-clickbait yang muncul. Maka visualisasi dibawah didapat tiga kata yang sering dibahas/muncul yaitu (1)kpk, (2)indonesia, dan (3) habibie.

C. modeling

C.1 Train dan test split

```
[ ]  # membuat dataframe untuk menyimpan hasil evaluasi
     stem_model_eval_tts_train = pd.DataFrame(columns=['Accuracy'])
     stem_model_eval_tts_test = pd.DataFrame(columns=['Accuracy'])
```

```
[ ]  #We separate our data is train and test
     y = data['label_score'] # clickbait or none clickbait
     X_train_stem, X_test_stem, Y_train_stem, Y_test_stem = train_test_split(
         X_stem,y, test_size = 0.2, random_state = 0, stratify = y)
```

C.2 KLASIFIKASI

C.2.1 Random Forest

```
clf = RandomForestClassifier()
clf.fit(X_train_stem, Y_train_stem)
Y_pred_stem = clf.predict(X_test_stem)
Y_pred_tr_stem = clf.predict(X_train_stem)
# confusion matrix
cnf_matrix = confusion_matrix(Y_test_stem, Y_pred_stem)
print(cnf_matrix)
print(classification_report(Y_test_stem, Y_pred_stem))
```

```
[[928 132]
 [216 447]]
              precision    recall  f1-score   support

           0       0.81      0.88      0.84      1060
           1       0.77      0.67      0.72       663

    accuracy                           0.80      1723
   macro avg       0.79      0.77      0.78      1723
weighted avg       0.80      0.80      0.80      1723
```

interpretasi:

Menggunakan random forest dengan proses stemming:

1. 928 Judul non-clickbait telah diklasifikasikan dengan benar
2. 447 Judul clickbait telah diklasifikasikan dengan benar
3. 132 Judul non-clickbait telah diklasifikasikan sebagai judul berita clickbait (False Positif)
4. 216 Judul clickbait diklasifikasikan sebagai judul berita non-clickbait (False Negatif)

```
[ ] #Train
    accuracy_tr = accuracy_score(Y_train_stem, Y_pred_tr_stem)
    #Test
    accuracy = accuracy_score(Y_test_stem, Y_pred_stem)
    #Save Evaluation
    stem_model_eval_tts_train.loc['Random Forest'] = [accuracy_tr]
    stem_model_eval_tts_test.loc['Random Forest'] = [accuracy]
```

C.2.2 Naive baiyes

```
[ ]  nb = MultinomialNB()
     nb.fit(X_train_stem, Y_train_stem)
     Y_pred_stem = nb.predict(X_test_stem)
     Y_pred_tr_stem = nb.predict(X_train_stem)
     # confusion matrix
     cnf_matrix = confusion_matrix(Y_test_stem, Y_pred_stem)
     print(cnf_matrix)
     print(classification_report(Y_test_stem, Y_pred_stem))
```

```
[[983  77]
 [243 420]]
              precision    recall  f1-score   support

           0       0.80      0.93      0.86      1060
           1       0.85      0.63      0.72       663

    accuracy                           0.81      1723
   macro avg       0.82      0.78      0.79      1723
weighted avg       0.82      0.81      0.81      1723
```

```
[ ]  #Train
     accuracy_tr = accuracy_score(Y_train_stem, Y_pred_tr_stem)
     #Test
     accuracy = accuracy_score(Y_test_stem, Y_pred_stem)
     #Save Evaluation
     stem_model_eval_tts_train.loc['Naive Baiyes'] = [accuracy_tr]
     stem_model_eval_tts_test.loc['Naive Baiyes'] = [accuracy]
```

interpretasi:

Menggunakan naive bayes dengan proses stemming:

1. 983 Judul non-clickbait telah diklasifikasikan dengan benar
2. 420 Judul clickbait telah diklasifikasikan dengan benar
3. 77 Judul non-clickbait telah diklasifikasikan sebagai judul berita clickbait (False Positif)
4. 243 Judul clickbait diklasifikasikan sebagai judul berita non-clickbait (False Negatif)

C.2.3 SVM

```
[ ]  svm = SVC()
     svm.fit(X_train_stem, Y_train_stem)
     Y_pred_stem = svm.predict(X_test_stem)
     Y_pred_tr_stem = svm.predict(X_train_stem)
     # confusion matrix
     cnf_matrix = confusion_matrix(Y_test_stem, Y_pred_stem)
     print(cnf_matrix)
     print(classification_report(Y_test_stem, Y_pred_stem))
```

```
[[997  63]
 [251 412]]
              precision    recall  f1-score   support

           0       0.80      0.94      0.86      1060
           1       0.87      0.62      0.72       663

    accuracy                           0.82      1723
   macro avg       0.83      0.78      0.79      1723
weighted avg       0.83      0.82      0.81      1723
```

interpretasi:

Menggunakan support vector machine dengan proses stemming:

1. 997 Judul non-clickbait telah diklasifikasikan dengan benar
2. 412 Judul clickbait telah diklasifikasikan dengan benar
3. 63 Judul non-clickbait telah diklasifikasikan sebagai judul berita clickbait (False Positif)
4. 251 Judul clickbait diklasifikasikan sebagai judul berita non-clickbait (False Negatif)

```
[ ]  #Train
     accuracy_tr = accuracy_score(Y_train_stem, Y_pred_tr_stem)
     #Test
     accuracy = accuracy_score(Y_test_stem, Y_pred_stem)
     #Save Evaluation
     stem_model_eval_tts_train.loc['Support Vector Machine'] = [accuracy_tr]
     stem_model_eval_tts_test.loc['Support Vector Machine'] = [accuracy]
```

C.3 CROSS VALIDATIOM

```
[ ]  # membuat dataframe untuk menyimpan hasil evaluasi
     stem_model_eval_cv = pd.DataFrame(columns=['Accuracy'])
```

C.3.1 Random Forest

```
[ ] model = RandomForestClassifier()
    def return_score(model,X_train, X_test, y_train, y_test):
      model.fit(X_train, y_train)
      score = model.score(X_test, y_test)
      return score

    scores = []

    #StratifiedK-Fold (Stratified5-Fold)
    cv = StratifiedKFold(n_splits=5, shuffle=False)
    for train_index, test_index in cv.split(X_stem,y):
      X_train, X_test, y_train, y_test = train_test_split(X_stem,y,
                                                          test_size=0.2,random_state = 42)
      score = return_score(model,X_train, X_test, y_train, y_test)
      scores.append(score)

    accuracy = np.mean(scores)
    print("Accuracy score in each iteration: {}".format(scores))
    print("K-Fold Score: {}".format(np.mean(scores)))
    stem_model_eval_cv.loc['Random Forest'] = [accuracy]
```

```
Accuracy score in each iteration: [0.8026697620429484, 0.8090539756239118, 0.8061520603598374, 0.8026697620429484, 0.8096343586767266]
K-Fold Score: 0.8060359837492745
```

Dengan menggunakan Cross Validation, random forest 5 Fold tidak ditemukan overfitting karena akurasi di tiap iterasi nilainya mendekati. Didapatkan rata-rata akurasi model Random Forest sebesar 80,6%

C.3.2 Naive Baiyes

```
model2 = MultinomialNB()
scores = []
#StratifiedK-Fold (Stratified5-Fold)
cv = StratifiedKFold(n_splits=5, shuffle=False)
for train_index, test_index in cv.split(X_stem,y):
  X_train, X_test, y_train, y_test = train_test_split(X_stem,y,test_size=0.2)
  score = return_score(model2,X_train, X_test, y_train, y_test)
  scores.append(score)

accuracy = np.mean(scores)
print("Accuracy score in each iteration: {}".format(scores))
print("K-Fold Score: {}".format(np.mean(scores)))
stem_model_eval_cv.loc['Naive Baiyes'] = [accuracy]
```

```
Accuracy score in each iteration: [0.8212420197330238, 0.8154381892048752, 0.8264654672083576, 0.8183401044689496, 0.7986070806732444]
K-Fold Score: 0.8160185722576901
```

Dengan menggunakan Cross Validation, naive bayes 5 Fold tidak ditemukan overfitting karena akurasi di tiap iterasi nilainya mendekati. Didapatkan rata-rata akurasi model naive baiyes sebesar 81,6%

C.3.3 SVM

```
[ ] model3 = SVC()
    scores = []
    #StratifiedK-Fold (Stratified5-Fold)
    cv = StratifiedKFold(n_splits=5, shuffle=False)
    for train_index, test_index in cv.split(X_stem,y):
      X_train, X_test, y_train, y_test = train_test_split(X_stem,y,test_size=0.2)
      score = return_score(model3,X_train, X_test, y_train, y_test)
      scores.append(score)

    accuracy = np.mean(scores)
    print("Accuracy score in each iteration: {}".format(scores))
    print("K-Fold Score: {}".format(np.mean(scores)))
    stem_model_eval_cv.loc['Support Vector Machine'] = [accuracy]
```

```
Accuracy score in each iteration: [0.840975043528729, 0.8055716773070226, 0.8340104468949506, 0.83633197910621, 0.824143934997098]
K-Fold Score: 0.828206616366802
```

Dengan menggunakan Cross Validation, support vector machine 5 Fold tidak ditemukan overfitting karena akurasi di tiap iterasi nilainya mendekati. Didapatkan rata-rata akurasi model support vector machine sebesar 82,82%

D. evaluation

D.1 Train dan test split

```
[ ]  stem_model_eval_tts_train
```

	Accuracy
Random Forest	0.999129
Naive Baiyes	0.860522
Support Vector Machine	0.959361

```
stem_model_eval_tts_test
```

	Accuracy
Random Forest	0.798027
Naive Baiyes	0.814277
Support Vector Machine	0.817760

interpretasi:

Dari hasil evaluasi berupa akurasi untuk Random Forest dan support vector machine Terjadi Overfitting karena selisih yang signifikan dari akurasi data train dan data tes sementara untuk Naive Bayes tidak terjadi overfitting karena selisih tidak signifikan dari akurasi data train dan data tes . Skor akurasi tertinggi diperoleh oleh support vector machine dengan skor akurasi 81,17%

D.2 Cross Validation

```
[ ]  stem_model_eval_cv
```

	Accuracy
Random Forest	0.806036
Naive Baiyes	0.816019
Support Vector Machine	0.828207

Interpretasi :

Skor akurasi tertinggi diperoleh oleh algortima Support Vector Machine dengan skor akurasi 82,82% dan semua model tidak diindentifikasi overfitting.

Dengan menggunakan stemming hasil evaluasi yang diperoleh tidak berbeda jauh malah hampir sama dan model terbaik dari ketiga model yang diujikan yaitu Support Vector Machine karena memiliki akurasi yang tertinggi namun terindentifikasi overffiting di antara ketiga algoritma tersebut sehingga langkah yang dilakukan selanjutnya untuk memprediksi yaitu text preprocessing melakukan cross validation agar mengatasi overfitting model yang digunakan adalah support vector machine ataupun model lain yang memiliki akurasi yang baik dan tidak terjadi overfitting