#CLASSIFICATION : TRUE VS FALSE VS OTHER VS MIXTURE:

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```
import sys
import pandas as pd
import numpy as np
import sklearn
from sklearn.preprocessing import LabelEncoder
from sklearn.metrics import accuracy_score, confusion_matrix,
classification_report, precision_recall_fscore_support as score
from sklearn.model_selection import train_test_split, KFold,
cross_val_score, GridSearchCV
from sklearn.linear_model import LogisticRegression
from sklearn.tree import DecisionTreeClassifier
from sklearn.neighbors import KNeighborsClassifier
from sklearn.naive_bayes import GaussianNB
from sklearn.svm import SVC
from sklearn.ensemble import RandomForestClassifier
from sklearn.feature_extraction.text import TfidfVectorizer
import nltk
from nltk.corpus import stopwords
from nltk.stem import PorterStemmer, WordNetLemmatizer
from nltk import word_tokenize
import re
import pickle
import string
import seaborn as sns
import matplotlib.pyplot as plt
from numpy import vstack
from torch.utils.data import Dataset, DataLoader
from torch.utils.data import random_split
from torch import Tensor
from torch.nn import Linear, ReLU, Sigmoid, Module, BCELoss
from torch.optim import SGD
from torch.nn.init import kaiming_uniform_, xavier_uniform_
```

```
from google.colab import drive
drive.mount('/content/gdrive/')
```

```
Mounted at /content/gdrive/
```

```
my_local_drive='/content/gdrive/My Drive/Colab Notebooks'
# Ajout du path pour les librairies, fonctions et données
sys.path.append(my_local_drive)
# Se positionner sur le répertoire associé
%cd $my_local_drive
%ls
```

```
%pwd
```

```
/content/gdrive/My Drive/Colab Notebooks
 bonFakeNEWS4.ipynb
'BON_TRUE FALSE_vs_OTHER_entités_nommées.ipynb'
'Copie de FakeNEWS.ipynb'
'Copie de True_False_Other_Mixture.ipynb'
'Copie de TRUE FALSE_vs_OTHER_entités_nommées.ipynb'
'Copie de  Vrai_Faux._entites_marche_bien.ipynb'
 FakeNewsLastVersion.ipynb
 ml_entiteesNommeesTest.ipynb
'Traitement sémantique'/
 True_False_Other_Mixture_final.ipynb
 Untitled0.ipynb
 version2ml_entiteesNommeesTest.ipynb
'VRAI FAUX OTHER MIXTURE_avec_entites_nommees.ipynb'
```

```
{"type":"string"}
```

La fonction qui sera utilisée pour les prétraitements: MyCleanText

- Mettre le texte en minuscule
- Se débarasser des stopwords
- Se débarasser des nombres
- Stemmatisation
- Lemmatisation ..

```
#.....................................................Fonction
MyCleanText ..........................................................
.....................
# mettre en minuscule
#enlever les stopwords
#se debarasser des nombres
#stemmatisation
#lemmatisation
#.....................................................................
.....................................................................
...........
```

```
nltk.download('wordnet')
nltk.download('stopwords')
nltk.download('punkt')
#liste des stopwords en anglais
stop_words = set(stopwords.words('english'))

def MyCleanText(X,
                lowercase=False, #mettre en minuscule
                removestopwords=False, #supprimer les stopwords
```

```
                removedigit=False, #supprimer les nombres
                getstemmer=False, #conserver la racine des termes
                getlemmatisation=False #lemmatisation des termes
                ):
  #conversion du texte d'entrée en chaîne de caractères
    sentence=str(X)
    #suppression des caractères spéciaux
    sentence = re.sub(r'[^\w\s]',' ', sentence)
    # suppression de tous les caractères uniques
    sentence = re.sub(r'\s+[a-zA-Z]\s+', ' ', sentence)
    # substitution des espaces multiples par un seul espace
    sentence = re.sub(r'\s+', ' ', sentence, flags=re.I)

    # decoupage en mots
    tokens = word_tokenize(sentence)
    if lowercase:
          tokens = [token.lower() for token in tokens]

    # suppression ponctuation
    table = str.maketrans('', '', string.punctuation)
    words = [token.translate(table) for token in tokens]

    # suppression des tokens non alphabetique ou numerique
    words = [word for word in words if word.isalnum()]

    # suppression des tokens numerique
    if removedigit:
        words = [word for word in words if not word.isdigit()]

    # suppression des stopwords
    if removestopwords:
        words = [word for word in words if not word in stop_words]

    # lemmatisation
    if getlemmatisation:
        lemmatizer=WordNetLemmatizer()
        words = [lemmatizer.lemmatize(word)for word in words]


    # racinisation
    if getstemmer:
        ps = PorterStemmer()
        words=[ps.stem(word) for word in words]

    sentence= ' '.join(words)

    return sentence
```

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

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

- La classe TextNormalizer qui contiendra la fonction MyCleanText.
- Fit_transform de mon corpus propre.

```
#.....................................................Etape 1 :
prétraitement du
texte ..........................................................
.....................................
#.....................................................Fonction
TextNormalizer  ..................................................
.......................
#fit_transform de mon corpus propre
#.....................................................................
.....................................................................
...........
```

```
from sklearn.base import BaseEstimator, TransformerMixin

class TextNormalizer(BaseEstimator, TransformerMixin):
    def __init__(self,
                 removestopwords=False, # suppression des stopwords
                 lowercase=False,# passage en minuscule
                 removedigit=False, # supprimer les nombres
                 getstemmer=False,# racinisation des termes
                 getlemmatisation=False # lemmatisation des termes
                ):

        self.lowercase=lowercase
        self.getstemmer=getstemmer
        self.removestopwords=removestopwords
        self.getlemmatisation=getlemmatisation
        self.removedigit=removedigit

    def transform(self, X, **transform_params):
        # Nettoyage du texte
        X=X.copy() # pour conserver le fichier d'origine
        return [MyCleanText(text,lowercase=self.lowercase,
                            getstemmer=self.getstemmer,
                            removestopwords=self.removestopwords,
                            getlemmatisation=self.getlemmatisation,
                            removedigit=self.removedigit) for text in
X]

    def fit(self, X, y=None, **fit_params):
        return self
```

```
    def fit_transform(self, X, y=None, **fit_params):
        return self.fit(X).transform(X)

    def get_params(self, deep=True):
        return {
            'lowercase':self.lowercase,
            'getstemmer':self.getstemmer,
            'removestopwords':self.removestopwords,
            'getlemmatisation':self.getlemmatisation,
            'removedigit':self.removedigit
        }

    def set_params (self, **parameters):
        for parameter, value in parameters.items():
            setattr(self,parameter,value)
        return self
```

- La fonction MyShowAllScores prend en entrée y_test et y_predict et affiche la classification report et la matrice de confusion

```
from sklearn.metrics._plot.confusion_matrix import
ConfusionMatrixDisplay
# fonction qui affiche le classification report et la matrice de
confusion
from sklearn import metrics
from sklearn.metrics import confusion_matrix , ConfusionMatrixDisplay
from sklearn.metrics import classification_report



def MyshowAllScores(y_test,y_pred):
  classes= np.unique(y_test)
  print("Accuracy : %0.3f"%(accuracy_score(y_test,y_pred)))
  print("Classification Report")
  print(classification_report(y_test,y_pred,digits=5))
  cnf_matrix = confusion_matrix(y_test,y_pred)
  disp=ConfusionMatrixDisplay(cnf_matrix,display_labels=classes)
  disp.plot()
```

##**True/False VS Mixture/OTHER**

###**Etape 1 : Préparer les données**

- Load et preparer les données à partir des 2 fichiers csv
- Sélectionner que les lignes où on a True ou False et les lignes où on a other ou mixture en sortie.
- Après en créant une nouvelle colonne "regrouped" si la valeur de la colonne rating est true ou bien false on mettra TRUE/FALSE sinon on mettra MIXTURE/OTHER

```
dftrain1 = pd.read_csv("/content/gdrive/MyDrive/newsTrain2.csv",
names=['id','text','title','rating'], header=0,sep=',',
encoding='utf8')
dftrain1.reset_index(drop = True, inplace = True)

dftrain2 = pd.read_csv("/content/gdrive/MyDrive/projet_ML/newsTrain -
newsTrain.csv", names=['id','text','title','rating'],
header=0,sep=',', encoding='utf8')
dftrain2.reset_index(drop = True, inplace = True)


# concaténer les deux dataframes en ajoutant les lignes du deuxième à
la fin du premier
dftrainbase = pd.concat([dftrain1, dftrain2], ignore_index=True)
dftrain=dftrainbase

#On crée une colonne regroupe qui va mettre dans les lignes là où a
true ou bien false la valeur TRUE/FALSE et OTHER ça laisse
#dftrain['truefalse'] = dftrain['rating'].apply(lambda x: 'TRUE/FALSE'
if x in ['TRUE', 'FALSE'] else '')
#On crée une colonne regroupe qui va mettre dans les lignes là où a
true ou bien false la valeur TRUE/FALSE et OTHER ça laisse
#dftrain['mixtureother'] = dftrain['rating'].apply(lambda
x:'MIXTURE/OTHER' if x in ['MIXTURE', 'OTHER'] else '')

dftrain['regrouped'] = dftrain['rating'].apply(lambda x:'TRUE/FALSE'
if x in ['TRUE', 'FALSE'] else 'MIXTURE/OTHER')



print("Echantillon de mon dataset \n")
print(dftrain.sample(n=10))
print("\n")
print("Quelques informations importantes \n")
dftrain.info()
print("\n")
X_text=dftrain["text"]
X_title=dftrain["title"]


print("le texte est")
display(X_text)
print("\n")
print("le titre est")
display(X_title)
print("\n")
y=dftrain.iloc[0:,-1]
print("voici la dernière case de rating")
display(y)
```

```
print("\n")
print("la taille de Xt est",X_text.shape)
print("\n")
print(" y EST " ,y)
print("\n")
y = y.str.lower()
print("Les valeurs de true et false sont:\n", y.value_counts())
```

```
Echantillon de mon dataset

            id                                               text  \
1512  6130328a  After the Korean Medical Association had calle...
1825  0192a5cc  The shooting of 18-year-old Michael Brown is a...
933   8fba8857  In a scenario straight out of “The Twilight Zo...
733   c5a4ee2d  If you needed any more proof that the migrant ...
1152  ea647a18  The number of children and teenagers needing s...
835   996025bf  WASHINGTON (AP) _ Canadian-born quiz show host...
1053  246c4405  A report by the National Audit Office has said...
9     f2182a54  FEMA camps, portable human cages, it's all rea...
2513  3d1a155a  There is nothing we can do about it, except to...
1358  cbb6ee95  Equally troubling was the more recent discover...

                                                  title   rating  \
1512  Flu Vaccine Deaths in South Korea risen to nea...  mixture
1825         Rand Paul: We Must Demilitarize the Police     TRUE
933   Christian Pastor In Vermont Sentenced To One Y...    FALSE
733   White House considers arguing that Trump wasn'...    other
1152         Childhood diabetes is up 40% in four years     TRUE
835   MPs vote to decriminalise abortion in England ...     TRUE
1053  Cuts, cuts, cuts. Headteachers tell of school ...  mixture
9     Fields of human cages discovered in Caruthers ...    FALSE
2513  The Sea Is Rising, but Not Because of Climate ...  mixture
1358  The Fight for Wisconsin’s Soul - The New York ...  mixture

          regrouped
1512  MIXTURE/OTHER
1825     TRUE/FALSE
933      TRUE/FALSE
733   MIXTURE/OTHER
1152     TRUE/FALSE
835      TRUE/FALSE
1053  MIXTURE/OTHER
9        TRUE/FALSE
2513  MIXTURE/OTHER
1358  MIXTURE/OTHER


Quelques informations importantes

<class 'pandas.core.frame.DataFrame'>
```

```
RangeIndex: 2528 entries, 0 to 2527
Data columns (total 5 columns):
 #   Column     Non-Null Count  Dtype 
---  ------     --------------  ----- 
 0   id         2528 non-null   object
 1   text       2528 non-null   object
 2   title      2482 non-null   object
 3   rating     2528 non-null   object
 4   regrouped  2528 non-null   object
dtypes: object(5)
memory usage: 98.9+ KB
```

le texte est

```
0       Distracted driving causes more deaths in Canad...
1       Missouri politicians have made statements afte...
2       Home Alone 2: Lost in New York is full of viol...
3       But things took a turn for the worse when riot...
4       It’s no secret that Epstein and Schiff share a...
                              ...
2523    More than four million calls to the taxman are...
2524    More under-18s are being taken to court for se...
2525    The Government’s much vaunted Help to Buy Isa ...
2526    The late Robin Williams once called cocaine “G...
2527    The late Robin Williams once called cocaine “G...
Name: text, Length: 2528, dtype: object
```

le titre est

```
0       You Can Be Fined $1,500 If Your Passenger Is U...
1           Missouri lawmakers condemn Las Vegas shooting
2       CBC Cuts Donald Trump's 'Home Alone 2' Cameo O...
3       Obama’s Daughters Caught on Camera Burning US ...
4       Leaked Visitor Logs Reveal Schiff’s 78 Visits ...
                              ...
2523    Taxman fails to answer four million calls a ye...
2524    Police catch 11-year-olds being used to sell d...
2525    Help to Buy Isa scandal: 500,000 first-time bu...
2526             A coke-snorting generation of hypocrites
2527             A coke-snorting generation of hypocrites
Name: title, Length: 2528, dtype: object
```

voici la dernière case de rating

```
0          TRUE/FALSE
1       MIXTURE/OTHER
```

```
2       MIXTURE/OTHER
3          TRUE/FALSE
4          TRUE/FALSE
            ...
2523       TRUE/FALSE
2524       TRUE/FALSE
2525       TRUE/FALSE
2526       TRUE/FALSE
2527       TRUE/FALSE
Name: regrouped, Length: 2528, dtype: object



la taille de Xt est (2528,)


 y EST  0          TRUE/FALSE
1       MIXTURE/OTHER
2       MIXTURE/OTHER
3          TRUE/FALSE
4          TRUE/FALSE
            ...
2523       TRUE/FALSE
2524       TRUE/FALSE
2525       TRUE/FALSE
2526       TRUE/FALSE
2527       TRUE/FALSE
Name: regrouped, Length: 2528, dtype: object


Les valeurs de true et false sont:
 true/false       1578
mixture/other     950
Name: regrouped, dtype: int64
```

Le jeu de données étant déséquilibré, on a pensé à appliquer le downsampling pour équilibrer nos données. on séléctionne des lignes aléatoirement de TRUE/FALSE de telle sorte que le nombre de lignes de TRUE/FALSE soit = au nbr de lignes de Other/Mixture. et on mélange le DataFrame.

```
#On applique du sous-échantillonnage (downsampling) : car on a plus de
FALSE (578) que des TRUE (211)

# Séparer les classes en deux dataframes
df_false_true = dftrain[dftrain['regrouped'] == 'TRUE/FALSE']
df_other_mixture = dftrain [dftrain['regrouped'] == 'MIXTURE/OTHER']

# Sous-échantillonner la classe majoritaire (FALSE) pour obtenir un
nombre égal d'échantillons pour chaque classe
df_subsampled = df_false_true.sample(n=len(df_other_mixture),
```

```
random_state=42)

# Concaténer les deux dataframes
dftrain = pd.concat([df_subsampled, df_other_mixture])

# Mélanger aléatoirement les données
dftrain = dftrain.sample(frac=1, random_state=42)

X_text=dftrain.iloc[0:,1:2]
X_title=dftrain.iloc[0:,2:3]

print("le texte est")
display(X_text)
print("le titre est")
display(X_title)

y=dftrain.iloc[0:,-1]
print("le y est")
display(y)
print("la taille de X_text est",X_text.shape)
print("la taille de y_train est " ,y.shape)
print("les valeurs de TRUE et FALSE maintenant sont
" ,y.value_counts())
```

```
le texte est

                                                   text
847   Also on the naughty list were Christmas carols...
447   The number of people applying for UK universit...
2243  Unvaccinated Children Pose No Risk To Anyone, ...
1202  Australia’s Great Barrier Reef has worst coral...
1059  One in ten patients admitted to hospital are s...
...                                                 ...
637   As Democrats basked in the glory of their take...
1022  HON. STEFAN I. MYCHAJLIW ERIE COUNTY COMPTROLL...
1515  We’ve reported on numerous events identified i...
1432  The 2021 Act on Climate, legislation sponsored...
628   Antibody tests support what’s been obvious: Co...

[1900 rows x 1 columns]

le titre est

                                                  title
847   Principal banned candy canes because 'J' shape...
447   On the Capitol: Part-time pay for part-time Le...
2243  One of the strengths—and weaknesses—of a Weste...
1202  Australia’s Great Barrier Reef has worst coral...
1059  Hospitals deluged by 5,000 diabetics a DAY: On...
...                                                 ...
```

```
637                UK inflation soars to two-year high
1022                                                NaN
1515  BREAKING EXCLUSIVE: System ‘Glitch’ Also Uncov...
1432             State of Rhode Island General Assembly
628           President Buhari Never Said he will Resign

[1900 rows x 1 columns]

le y est

847     MIXTURE/OTHER
447        TRUE/FALSE
2243       TRUE/FALSE
1202       TRUE/FALSE
1059    MIXTURE/OTHER
           ...
637     MIXTURE/OTHER
1022    MIXTURE/OTHER
1515       TRUE/FALSE
1432    MIXTURE/OTHER
628     MIXTURE/OTHER
Name: regrouped, Length: 1900, dtype: object

la taille de X_text est (1900, 1)
la taille de y_train est  (1900,)
les valeurs de TRUE et FALSE maintenant sont  MIXTURE/OTHER    950
TRUE/FALSE       950
Name: regrouped, dtype: int64
```

On divise notre grand X en jeu de données d'apprentissage et de test (20% de test).

```
X=dftrain.iloc[0:, 1:3]
print(X)

X_train,X_test,y_train,y_test=train_test_split(X,y,test_size =
0.2,random_state=8)
print("X_train is",X_train)
print("y_train is",y_train)
print("X_test is",X_test)
print("y_test is",y_test)

                                                   text  \
847   Also on the naughty list were Christmas carols...
447   The number of people applying for UK universit...
2243  Unvaccinated Children Pose No Risk To Anyone, ...
1202  Australia’s Great Barrier Reef has worst coral...
1059  One in ten patients admitted to hospital are s...
...                                                 ...
637   As Democrats basked in the glory of their take...
1022  HON. STEFAN I. MYCHAJLIW ERIE COUNTY COMPTROLL...
```

```
1515  We’ve reported on numerous events identified i...
1432  The 2021 Act on Climate, legislation sponsored...
628   Antibody tests support what’s been obvious: Co...

                                                  title
847   Principal banned candy canes because 'J' shape...
447   On the Capitol: Part-time pay for part-time Le...
2243  One of the strengths—and weaknesses—of a Weste...
1202  Australia’s Great Barrier Reef has worst coral...
1059  Hospitals deluged by 5,000 diabetics a DAY: On...
...                                                 ...
637                UK inflation soars to two-year high
1022                                               NaN
1515  BREAKING EXCLUSIVE: System ‘Glitch’ Also Uncov...
1432             State of Rhode Island General Assembly
628          President Buhari Never Said he will Resign

[1900 rows x 2 columns]
X_train is                                                    text  \
1625  Smoking could be considered a distraction unde...
2164  Former state House Majority Leader Adam Hasner...
221   Why does Dr. Anthony Fauci’s name appear on 4 ...
721   TIJUANA, Mexico — It’s the image from the unfo...
2413  Where in the world do you think the following ...
...                                                 ...
840   Mr Deputy Speaker, Today, I report on a Britai...
1155  To read an annotated version of this article, ...
453   During a flight from New York City to Chicago,...
2146  Poor British people in 2020 are unhealthier th...
948   top cancer researchers harvard epa agree fluor...

                                                  title
1625  You Can be Fined $2,500 And Banned From Drivin...
2164                              - The Washington Post
221   Why Does Fauci Hold Patents on a Key HIV Compo...
721   A discussion of ‘smokers’ black lungs’ started...
2413       We won’t let women be second class citizens
...                                                 ...
840   USC Professor Joel Hay says there is no scient...
1155  When Will The Planet Be Too Hot For Humans? Mu...
453   United Airlines Flight Attendant Slaps Crying ...
2146  Union blasts Gov. Scott Walker's boost in scho...
948   A Report on Updated Overtime and Food Expenses...

[1520 rows x 2 columns]
y_train is 1625       TRUE/FALSE
2164    MIXTURE/OTHER
221        TRUE/FALSE
721        TRUE/FALSE
2413    MIXTURE/OTHER
```

```
          ...
840     MIXTURE/OTHER
1155    MIXTURE/OTHER
453        TRUE/FALSE
2146       TRUE/FALSE
948     MIXTURE/OTHER
Name: regrouped, Length: 1520, dtype: object
X_test is                                                        text  \
1847  Unvaccinated Children Pose No Risk To Anyone, ...
103   MONTGOMERY, Ala., Jan. 12, 2013 /PRNewswire/ -...
818   Earth Could Be Facing Another Ice Age, Scienti...
68    Why does it look like the state is testing at ...
2039  More nightmare fuel for boba lovers There has ...
...                                                    ...
1461  A study found that activities such as gardenin...
879   MOSCOW, August 13. /TASS/. The United States' ...
606   U.S. Government Finally Admits Marijuana Reall...
859   Joe Biden's Inauguration has been cancelled, P...
2268  President Vladimir Putin held his annual end-o...

                                                  title
1847  One of the strengths—and weaknesses—of a Weste...
103   Alabama Supreme Court Recognizes Unborn as Per...
818   Central Europe would veto any Brexit deal limi...
68    Banned By Facebook — DO NOT READ! Bad Math Dri...
2039  Early help for children cut by half, say chari...
...                                                    ...
1461  Ten minutes' exercise each week cuts risk of e...
879                                                   NaN
606   Abe Lincoln Statue Vandalized With Poop, Paint...
859   Australian Authorities: Arsonists to Blame for...
2268  Florida GOP candidates for governor weigh in o...

[380 rows x 2 columns]
y_test is 1847       TRUE/FALSE
103        TRUE/FALSE
818        TRUE/FALSE
68         TRUE/FALSE
2039    MIXTURE/OTHER
           ...
1461       TRUE/FALSE
879     MIXTURE/OTHER
606     MIXTURE/OTHER
859        TRUE/FALSE
2268    MIXTURE/OTHER
Name: regrouped, Length: 380, dtype: object
```

###**Etape 2 : Classification selon la colonne TEXT :**

Tester avec plusieurs classifieurs classiques.

```python
from sklearn.datasets import fetch_20newsgroups
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.model_selection import train_test_split, GridSearchCV
from sklearn.pipeline import Pipeline
from sklearn.metrics import accuracy_score
from sklearn.naive_bayes import MultinomialNB
from sklearn.linear_model import LogisticRegression
from sklearn.svm import SVC
from sklearn.naive_bayes import MultinomialNB
import time
import numpy as np

# Utilisez la méthode ravel() pour transformer y_train en un tableau
unidimensionnel
#X_train = np.ravel(X_train)
print("X_train", X_train.shape)
print("y_train", y_train.shape)
np.random.seed(42)  # Set the random seed for NumPy

score = 'accuracy'
seed = 7
allresults = []
results = []
names = []


# Liste des modèles à tester
models = [
    ('MultinomialNB', MultinomialNB()),
    ('LogisticRegression', LogisticRegression(random_state=42))
]


models.append(('KNN', KNeighborsClassifier()))
models.append(('CART', DecisionTreeClassifier(random_state=42)))
models.append(('RF', RandomForestClassifier(random_state=42)))
models.append(('SVM', SVC(random_state=42)))

# Création d'un pipeline pour chaque modèle
pipelines = []
for name,model in models:
    pipeline = Pipeline([
        ('normalize', TextNormalizer()),
        ('tfidf', TfidfVectorizer()),
        (name,model)
    ])
    pipelines.append((name,pipeline))
    #pipeline.fit(X_train,y_train)
```

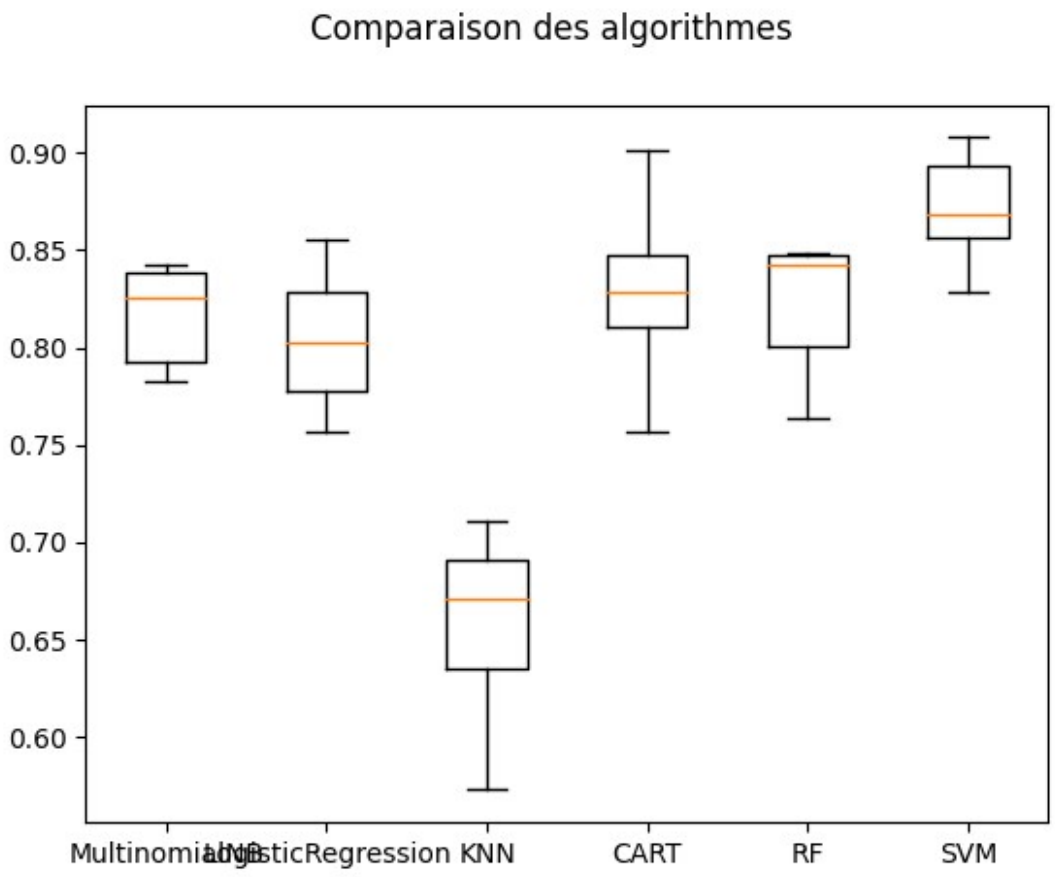
```
all_results=[]
scores=[]
for p in pipelines:
    print(p[1])
    # cross validation en 10 fois
    kfold = KFold(n_splits=10,random_state=seed,shuffle=True)

#    print ("Evaluation de ",p)
    start_time = time.time()
    # application de la classification
    cv_results = cross_val_score(p[1],X_train['title'],y_train,
cv=kfold, scoring=score)
    #print("Pour le classifieur",p[0],"on a un score
de",cv_results.mean(),"et un écart type de",cv_results.std())
    scores.append(cv_results)
    names.append(p[0])

    all_results.append((p[0],cv_results.mean(),cv_results.std()))
    end_time = time.time()


print("all resultats", all_results)

all_results = sorted(all_results, key=lambda x: (-x[1], -x[2]))
print("all resultats", all_results)
    # affichage des résultats
#print ('\nLe meilleur resultat : ',max(results))

X_train (1520, 2)
y_train (1520,)
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('MultinomialNB', MultinomialNB())])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('LogisticRegression',
LogisticRegression(random_state=42))])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('KNN', KNeighborsClassifier())])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('CART', DecisionTreeClassifier(random_state=42))])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('RF', RandomForestClassifier(random_state=42))])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('SVM', SVC(random_state=42))])
all resultats [('MultinomialNB', 0.8171052631578947,
```

```
0.022561089736160823), ('LogisticRegression', 0.8039473684210527,
0.0328684105178863), ('KNN', 0.6572368421052632,
0.044078947368421065), ('CART', 0.8276315789473685,
0.03730907073357322), ('RF', 0.8230263157894736,
0.030069460215859038), ('SVM', 0.8710526315789473,
0.023938691314026664)]
all resultats [('SVM', 0.8710526315789473, 0.023938691314026664),
('CART', 0.8276315789473685, 0.03730907073357322), ('RF',
0.8230263157894736, 0.030069460215859038), ('MultinomialNB',
0.8171052631578947, 0.022561089736160823), ('LogisticRegression',
0.8039473684210527, 0.0328684105178863), ('KNN', 0.6572368421052632,
0.044078947368421065)]
```

On affiche les accuracy de chaque classifieur, on remarque la médiane (en rouge) de chaque et l'écart type aussi.

```
import matplotlib.pyplot as plt
fig = plt.figure()
fig.suptitle('Comparaison des algorithmes')
ax = fig.add_subplot(111)
plt.boxplot(scores)
ax.set_xticklabels(names)
```

```
[Text(1, 0, 'MultinomialNB'),
 Text(2, 0, 'LogisticRegression'),
 Text(3, 0, 'KNN'),
 Text(4, 0, 'CART'),
 Text(5, 0, 'RF'),
 Text(6, 0, 'SVM')]
```



Choisir les meilleurs paramètres et hyperparamètres pour SVM, RF et LR :

On a un pipeline pour chaque prétraitement différent, on essaye pas mal (miniscule, lemmatisation, miniscule + lemmatisation..) et on stocke le fit_transorm de nos X_train, X_test sur les pipelines dans des listes qui vont contenir tous les fit_transform des pipelines pour chaque classifieur, par la suite on parcourt ces listes là, on itère dessus, et chaque élement de la liste (train) va passer par le GridSearch et puis on predict sur son corresapondant dans liste (test).

```
from sklearn.model_selection import GridSearchCV
```

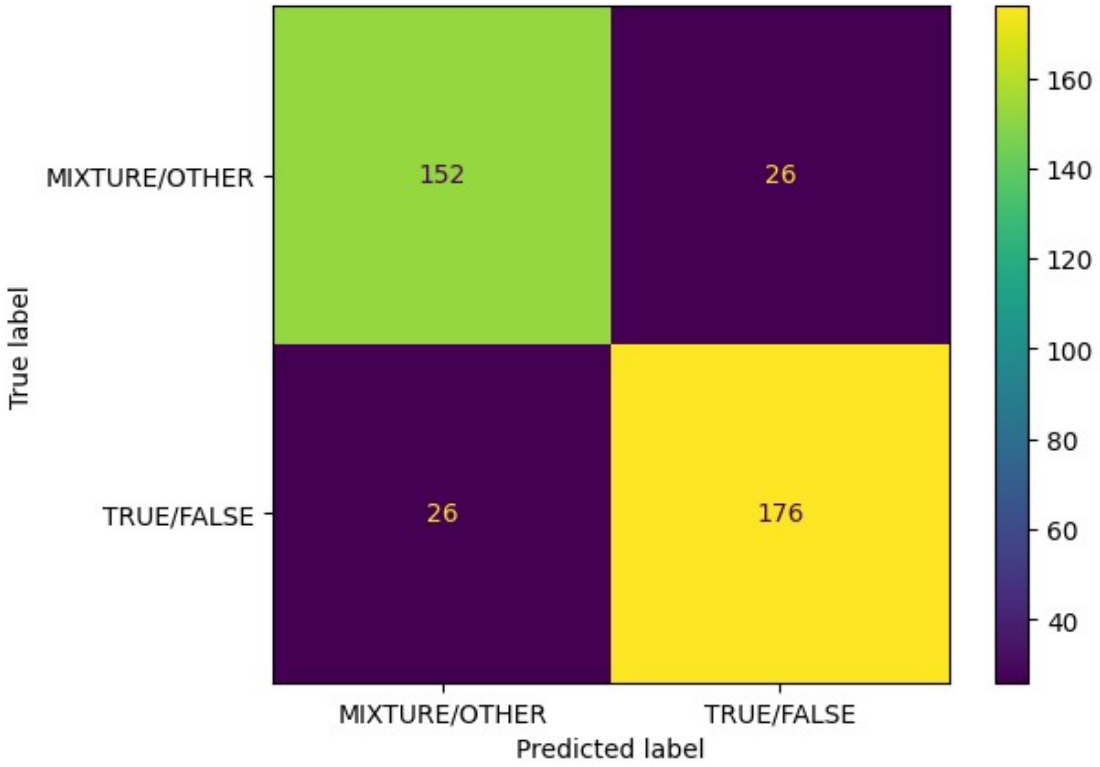
```
from sklearn.datasets import fetch_20newsgroups
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.model_selection import train_test_split, GridSearchCV
from sklearn.pipeline import Pipeline
from sklearn.metrics import accuracy_score
from sklearn.naive_bayes import MultinomialNB
from sklearn.linear_model import LogisticRegression
from sklearn.svm import SVC
from sklearn.naive_bayes import MultinomialNB
from tabulate import tabulate
```

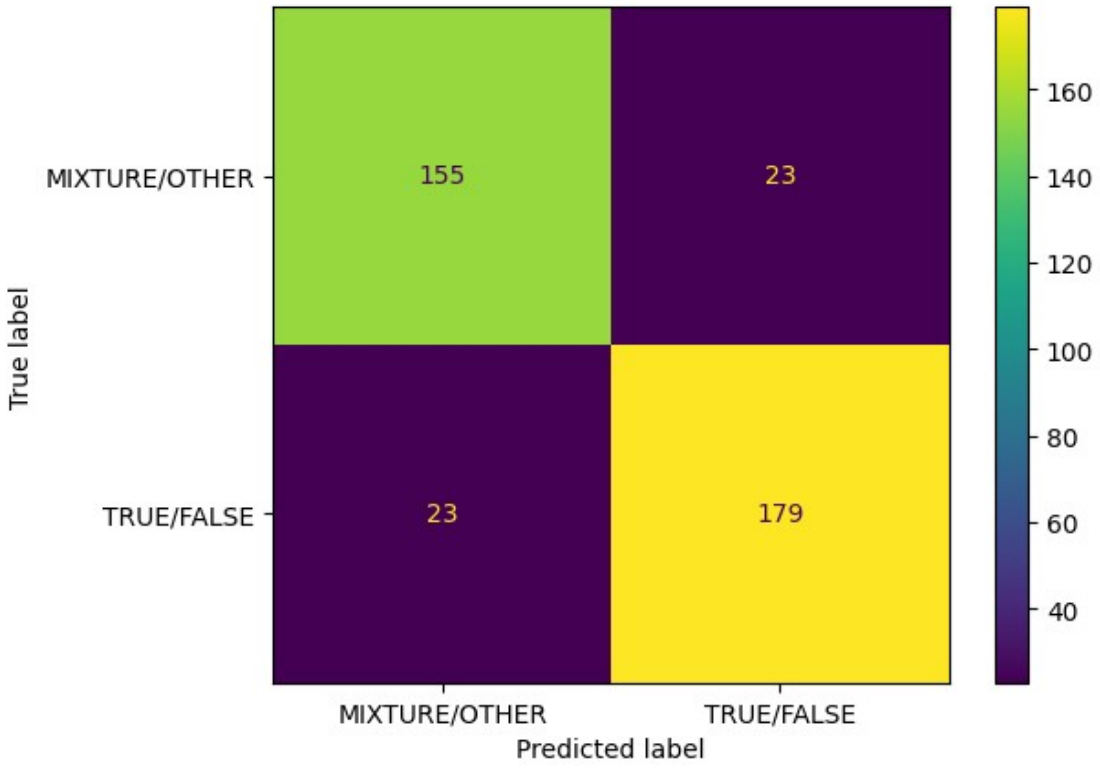
```
import numpy as np
np.random.seed(42)  # Set the random seed for NumPy
print("y_train", y_train.shape)
print("y_test", y_test.shape)
#X_test = np.ravel(X_test)
print("X_test", X_test.shape)
# le plus simple est de faire un test sur differents pipelines.


# pipeline de l'utilisation de TfidfVectorizer avec differents pre-
traitements
TFIDF_brut = Pipeline ([('cleaner', TextNormalizer()),
                    ('tfidf_vectorizer',
TfidfVectorizer(lowercase=False))])

TFIDF_lowcase = Pipeline([('cleaner',
TextNormalizer(removestopwords=False,lowercase=True,

getstemmer=False,removedigit=False)),
                    ('tfidf_vectorizer',
TfidfVectorizer(lowercase=False))])
TFIDF_lowStop = Pipeline([('cleaner',
TextNormalizer(removestopwords=True,lowercase=True,

getstemmer=False,removedigit=False)),
                    ('tfidf_vectorizer',
TfidfVectorizer(lowercase=False))])

TFIDF_lowStopstem = Pipeline([('cleaner',
TextNormalizer(removestopwords=True,lowercase=True,

getstemmer=True,removedigit=False)),
                    ('tfidf_vectorizer',
TfidfVectorizer(lowercase=False))])


# Liste de tous les modeles à tester
all_models = [
    ("TFIDF_lowcase", TFIDF_lowcase),
    ("TFIDF_lowStop", TFIDF_lowStop),
    ("TFIDF_lowStopstem",TFIDF_lowStopstem),
    ("TFIDF_brut", TFIDF_brut)
]

X_train_title_SVC = []
X_test_title_SVC = []
```

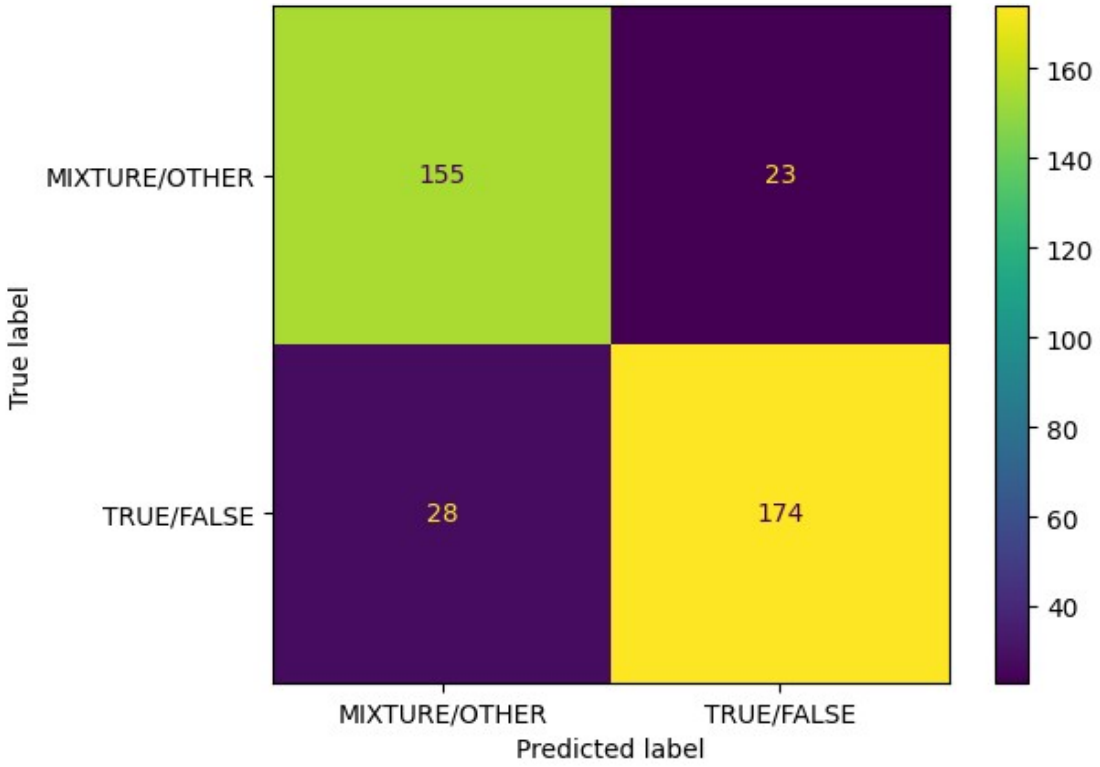
```
for name, pipeline in all_models :

X_train_title_SVC.append(pipeline.fit_transform(X_train['title']).toar
ray())

X_test_title_SVC.append(pipeline.transform(X_test['title']).toarray())



models = {
    'SVC': SVC(random_state=42)
}


params = {'SVC': [{'C': [0.01, 0.1, 1,2]},
             {'gamma': [0.1,0.2,1]},
             {'kernel': ['linear', 'rbf']}]
}

for model_name, model in models.items():
    score='accuracy'
    X_train_title = eval('X_train_title_' + model_name)
    X_test_title = eval('X_test_title_' + model_name)
    for i in range (len(X_train_title)):
      grid_search = GridSearchCV(model, params[model_name], n_jobs=-1,
verbose=1,scoring=score)
      print("grid search fait")
      print("X_train",X_train_title[i].shape)
      print("y_train",y_train.shape)
      grid_search.fit(X_train_title[i],y_train)
      print ('meilleur score %0.3f'%(grid_search.best_score_),'\n')
      print ('meilleur estimateur',grid_search.best_estimator_,'\n')
      y_pred = grid_search.predict(X_test_title[i])
      MyshowAllScores(y_test,y_pred)

      print("Ensemble des meilleurs paramètres :")
      best_parameters = grid_search.best_estimator_.get_params()
      for param_dict in params[model_name]:
        for param_name, param_value in param_dict.items():
            print("\t%s: %r" % (param_name,
best_parameters[param_name]))

y_train (1520,)
y_test (380,)
X_test (380, 2)
grid search fait
X_train (1520, 6968)
y_train (1520,)
Fitting 5 folds for each of 9 candidates, totalling 45 fits
```

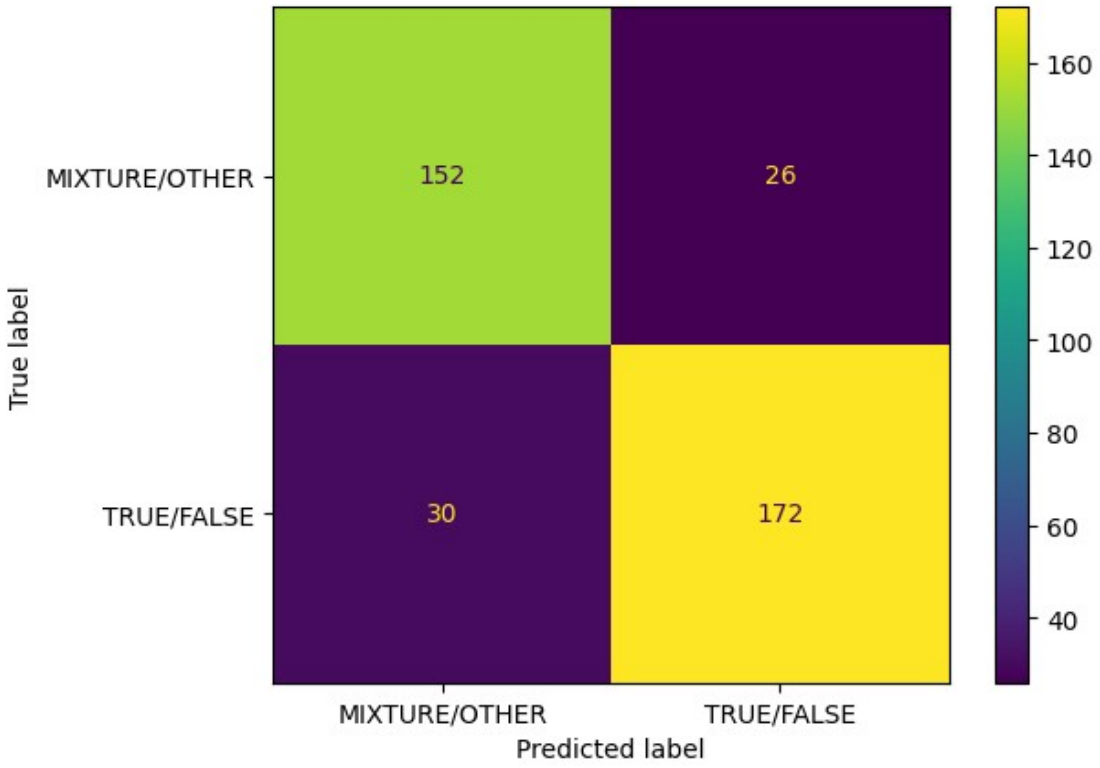
```
meilleur score 0.857

meilleur estimateur SVC(C=1, random_state=42)

Accuracy : 0.863
Classification Report
               precision    recall  f1-score   support

MIXTURE/OTHER    0.85393   0.85393   0.85393       178
   TRUE/FALSE    0.87129   0.87129   0.87129       202

     accuracy                        0.86316       380
    macro avg    0.86261   0.86261   0.86261       380
 weighted avg    0.86316   0.86316   0.86316       380

Ensemble des meilleurs paramètres :
     C: 1
     gamma: 'scale'
     kernel: 'rbf'
grid search fait
X_train (1520, 6837)
y_train (1520,)
Fitting 5 folds for each of 9 candidates, totalling 45 fits
meilleur score 0.857

meilleur estimateur SVC(C=1, random_state=42)

Accuracy : 0.879
Classification Report
               precision    recall  f1-score   support

MIXTURE/OTHER    0.87079   0.87079   0.87079       178
   TRUE/FALSE    0.88614   0.88614   0.88614       202

     accuracy                        0.87895       380
    macro avg    0.87846   0.87846   0.87846       380
 weighted avg    0.87895   0.87895   0.87895       380

Ensemble des meilleurs paramètres :
     C: 1
     gamma: 'scale'
     kernel: 'rbf'
grid search fait
X_train (1520, 5026)
y_train (1520,)
Fitting 5 folds for each of 9 candidates, totalling 45 fits
meilleur score 0.841

meilleur estimateur SVC(C=1, random_state=42)
```

```
Accuracy : 0.866
Classification Report
               precision    recall  f1-score   support

MIXTURE/OTHER    0.84699   0.87079   0.85873       178
   TRUE/FALSE    0.88325   0.86139   0.87218       202

     accuracy                        0.86579       380
    macro avg    0.86512   0.86609   0.86545       380
 weighted avg    0.86627   0.86579   0.86588       380

Ensemble des meilleurs paramètres :
     C: 1
     gamma: 'scale'
     kernel: 'rbf'
grid search fait
X_train (1520, 8444)
y_train (1520,)
Fitting 5 folds for each of 9 candidates, totalling 45 fits
meilleur score 0.861

meilleur estimateur SVC(C=1, random_state=42)

Accuracy : 0.853
Classification Report
               precision    recall  f1-score   support

MIXTURE/OTHER    0.83516   0.85393   0.84444       178
   TRUE/FALSE    0.86869   0.85149   0.86000       202

     accuracy                        0.85263       380
    macro avg    0.85193   0.85271   0.85222       380
 weighted avg    0.85298   0.85263   0.85271       380

Ensemble des meilleurs paramètres :
     C: 1
     gamma: 'scale'
     kernel: 'rbf'
```


MIXTURE/OTHER
TRUE/FALSE
True label
152
26
26
176
MIXTURE/OTHER
TRUE/FALSE
Predicted label
160
140
120
100
80
60
40


MIXTURE/OTHER
TRUE/FALSE
True label
155
23
23
179
MIXTURE/OTHER
TRUE/FALSE
Predicted label
160
140
120
100
80
60
40





###**Etape 3 : Classification selon la colonne TITRE :**

Ici, c'est une étape importante, on va tester différents classifieurs, pour chacun des classifieurs, on va appliquer le prétraitement + Vectorisation TfIdf, et on applique une cross_val_score avec un Kfold de 10 fois, par la suite on stocke dans une liste all_results la moyenne des accuracy + l'écart type et on la trie par ordre décroissant de moyenne d'accuracy et d'écart type. on remarque que les 2 meilleurs sont SVM et RF qu'on va séléctionner pour leur appliquer le GridSearch sur les paramètres des prétraitements + leurs hyperparamètres pour pouvoir choisir le meilleur.

```
from sklearn.datasets import fetch_20newsgroups
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.model_selection import train_test_split, GridSearchCV
from sklearn.pipeline import Pipeline
from sklearn.metrics import accuracy_score
from sklearn.naive_bayes import MultinomialNB
from sklearn.linear_model import LogisticRegression
from sklearn.svm import SVC
from sklearn.naive_bayes import MultinomialNB
import time

score = 'accuracy'
seed = 7
allresults = []
results = []
names = []


X_train_text=X_train['text']
X_train_text.reset_index(drop = True, inplace = True)


# Liste des modèles à tester
models = [
    ('MultinomialNB', MultinomialNB()),
    ('LogisticRegression', LogisticRegression(random_state=42))
]


models.append(('KNN', KNeighborsClassifier()))
models.append(('CART', DecisionTreeClassifier()))
models.append(('RF', RandomForestClassifier()))
models.append(('SVM', SVC()))


# Création d'un pipeline pour chaque modèle
pipelines = []
for name,model in models:
    pipeline = Pipeline([
        ('normalize', TextNormalizer()),
```

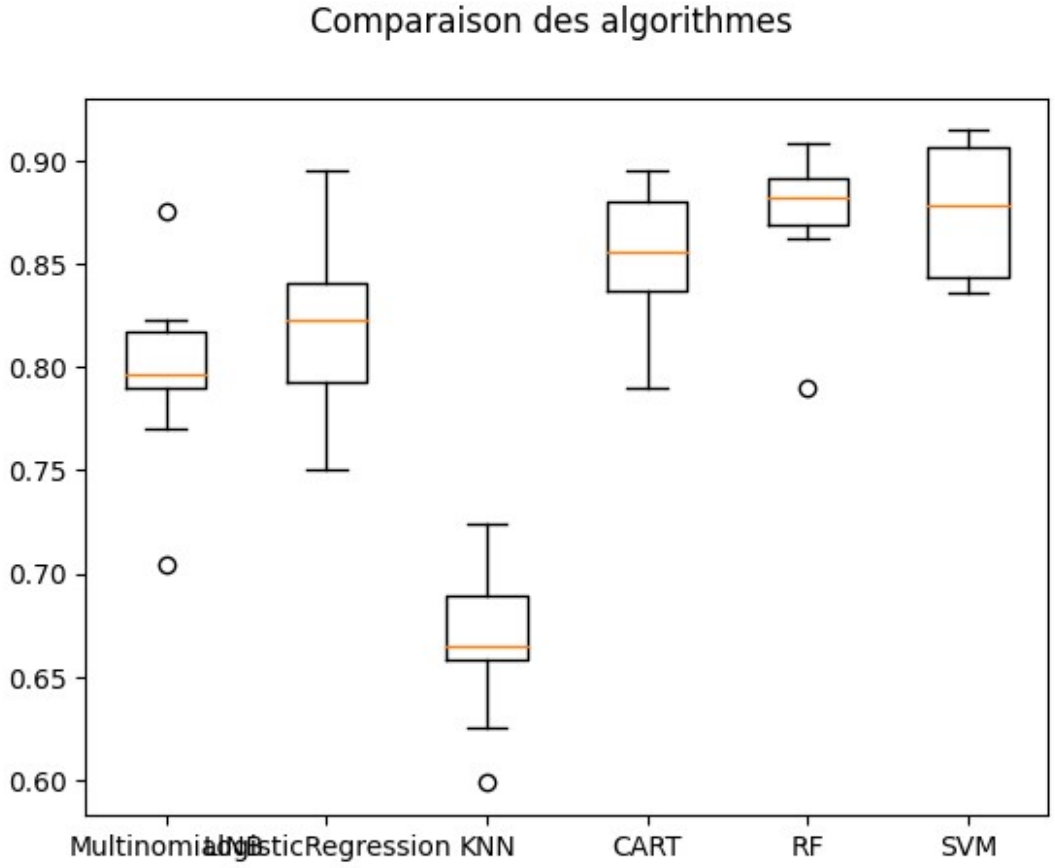
```
        ('tfidf', TfidfVectorizer()),
        (name,model)
    ])
    pipelines.append((name,pipeline))
    #pipeline.fit(X_train_text,y_train)
all_results=[]
scores=[]
for p in pipelines:
    print(p[1])
    # cross validation en 10 fois
    kfold = KFold(n_splits=10,random_state=seed,shuffle=True)

#    print ("Evaluation de ",p)
    start_time = time.time()
    # application de la classification
    cv_results = cross_val_score(p[1],X_train_text,y_train, cv=kfold,
scoring=score)
    #print("Pour le classifieur",p[0],"on a un score
de",cv_results.mean(),"et un écart type de",cv_results.std())
    scores.append(cv_results)
    names.append(p[0])

    all_results.append((p[0],cv_results.mean(),cv_results.std()))
    end_time = time.time()

all_results = sorted(all_results, key=lambda x: (-x[1], -x[2]))
print("all resultats", all_results)
    # affichage des résultats
#print ('\nLe meilleur resultat : ',max(results))

Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('MultinomialNB', MultinomialNB())])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('LogisticRegression',
LogisticRegression(random_state=42))])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('KNN', KNeighborsClassifier())])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('CART', DecisionTreeClassifier())])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('RF', RandomForestClassifier())])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('SVM', SVC())])
all resultats [('SVM', 0.8756578947368421, 0.03078075675076207),
```

```
('RF', 0.8730263157894737, 0.030865010804578687), ('CART',
0.8546052631578946, 0.029925172146168837), ('LogisticRegression',
0.8217105263157896, 0.03963235653112902), ('MultinomialNB',
0.7967105263157895, 0.041132892190369946), ('KNN', 0.6664473684210527,
0.0340647196473674)]
```

On affiche les accuracy de chaque classifieur, on remarque la médiane (en rouge) de chaque et l'écart type aussi.

```
import matplotlib.pyplot as plt
fig = plt.figure()
fig.suptitle('Comparaison des algorithmes')
ax = fig.add_subplot(111)
plt.boxplot(scores)
ax.set_xticklabels(names)
```

```
[Text(1, 0, 'MultinomialNB'),
 Text(2, 0, 'LogisticRegression'),
 Text(3, 0, 'KNN'),
 Text(4, 0, 'CART'),
 Text(5, 0, 'RF'),
 Text(6, 0, 'SVM')]
```



####Choisir les meilleurs paramètres pour SVM et RF :

On a un pipeline pour chaque prétraitement différent, on essaye pas mal (miniscule, lemmatisation, miniscule + lemmatisation..) et on stocke le fit_transorm de nos X_train, X_test sur les pipelines dans des listes qui vont contenir tous les fit_transform des pipelines pour chaque classifieur, par la suite on parcourt ces listes là, on itère dessus, et chaque élement de la liste (train) va passer par le GridSearch et puis on predict sur son corresapondant dans liste (test).

```
from sklearn.model_selection import GridSearchCV


from sklearn.datasets import fetch_20newsgroups
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.model_selection import train_test_split, GridSearchCV
from sklearn.pipeline import Pipeline
from sklearn.metrics import accuracy_score
from sklearn.naive_bayes import MultinomialNB
from sklearn.linear_model import LogisticRegression
from sklearn.svm import SVC
from sklearn.naive_bayes import MultinomialNB
from tabulate import tabulate
import numpy as np

np.random.seed(42)  # Set the random seed for NumPy


# le plus simple est de faire un test sur differents pipelines.

# pipeline de l'utilisation de TfidfVectorizer avec differents pre-
traitements
TFIDF_brut = Pipeline ([('cleaner', TextNormalizer()),
                    ('tfidf_vectorizer',
TfidfVectorizer(lowercase=False))])

TFIDF_lowcase = Pipeline([('cleaner',
TextNormalizer(removestopwords=False,lowercase=True,

getstemmer=False,removedigit=False)),
                    ('tfidf_vectorizer',
TfidfVectorizer(lowercase=False))])
TFIDF_lowStop = Pipeline([('cleaner',
TextNormalizer(removestopwords=True,lowercase=True,

getstemmer=False,removedigit=False)),
                    ('tfidf_vectorizer',
TfidfVectorizer(lowercase=False))])

TFIDF_lowStopstem = Pipeline([('cleaner',
TextNormalizer(removestopwords=True,lowercase=True,
```

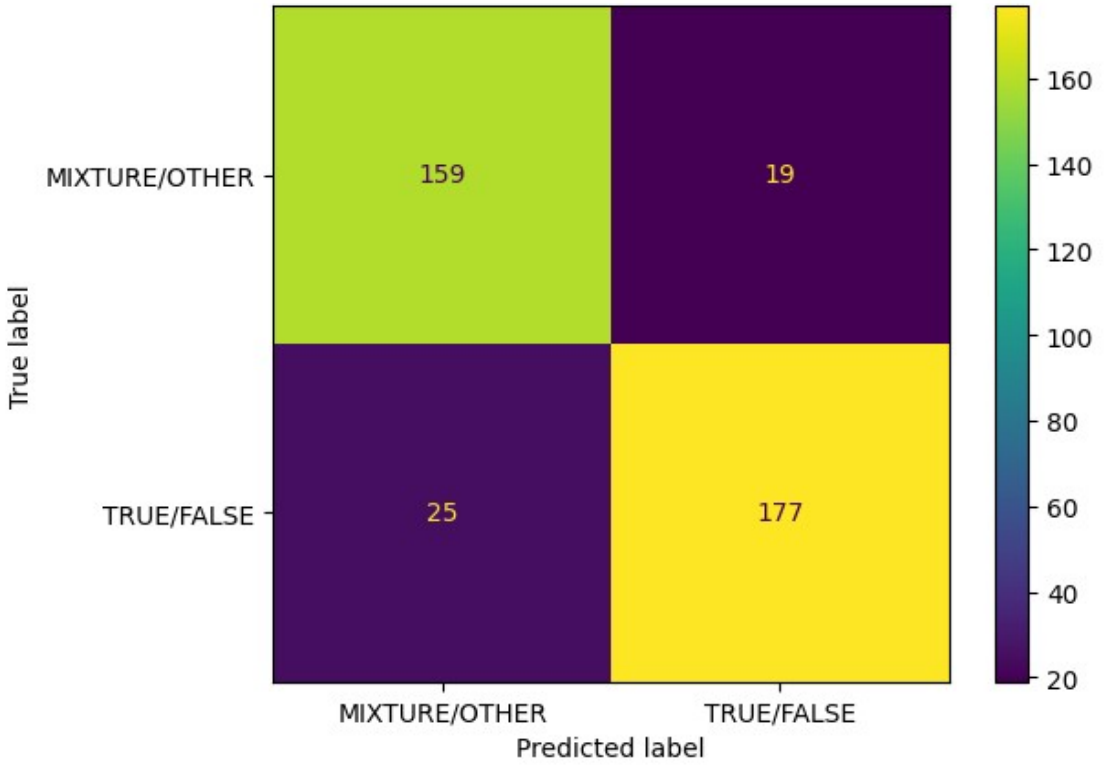
```
getstemmer=True,removedigit=False)),
                    ('tfidf_vectorizer',
TfidfVectorizer(lowercase=False))])


# Liste de tous les modeles à tester
all_models = [
    ("TFIDF_lowcase", TFIDF_lowcase),
    ("TFIDF_lowStop", TFIDF_lowStop),
    ("TFIDF_lowStopstem",TFIDF_lowStopstem),
    ("TFIDF_brut", TFIDF_brut)
]

X_train_text_SVC = []
X_test_text_SVC = []




for name, pipeline in all_models :

X_train_text_SVC.append(pipeline.fit_transform(X_train['text']).toarra
y())

X_test_text_SVC.append(pipeline.transform(X_test['text']).toarray())


models = {
    'SVC': SVC(random_state=42),
}


params = {'SVC': [{'C': [0.1, 1,10]},
             {'gamma': [0.001, 0.01, 0.1,1]},
             {'kernel': ['linear', 'rbf']}]

}

for model_name, model in models.items():
    score='accuracy'
    X_train_text = eval('X_train_text_' + model_name)
    X_test_text = eval('X_test_text_' + model_name)
    for i in range (len(X_train_text)):
      grid_search = GridSearchCV(model, params[model_name], n_jobs=-1,
verbose=1,scoring=score)
      print("grid search fait")
      print("X_train_text",X_train_text[i].shape)
      print("y_train",y_train.shape)
```

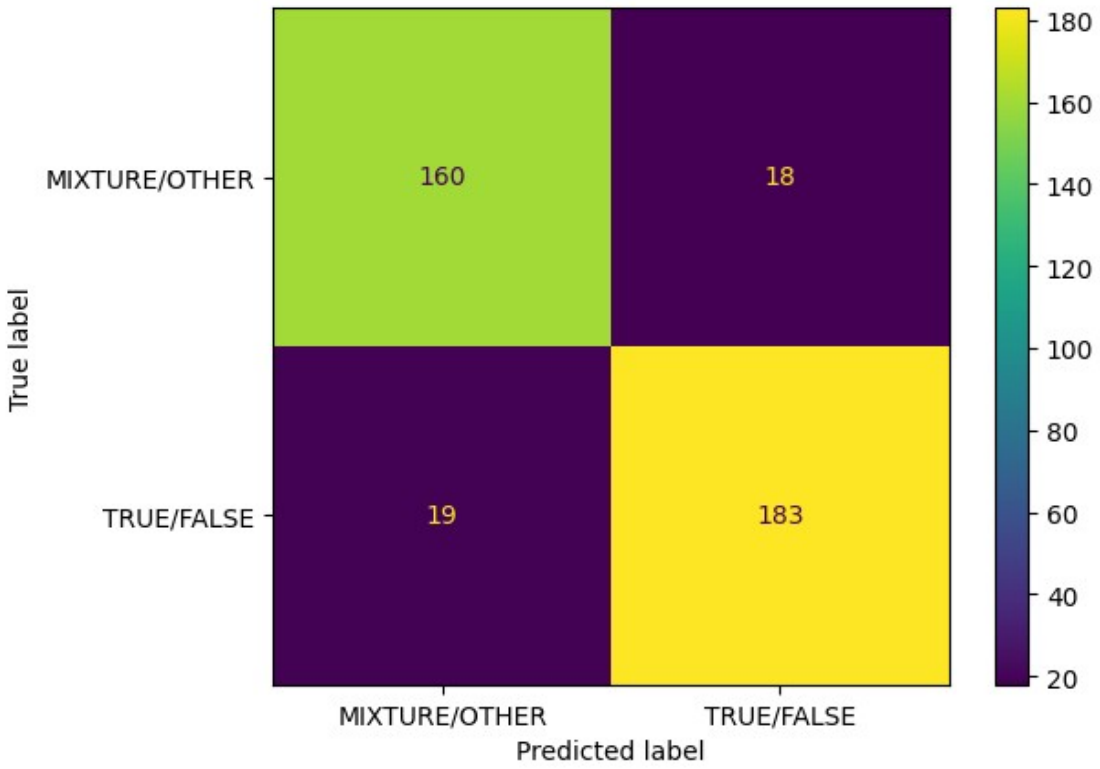
```
      grid_search.fit(X_train_text[i],y_train)
      print ('meilleur score %0.3f'%(grid_search.best_score_),'\n')
      print ('meilleur estimateur',grid_search.best_estimator_,'\n')
      y_pred = grid_search.predict(X_test_text[i])
      MyshowAllScores(y_test,y_pred)

      print("Ensemble des meilleurs paramètres :")
      best_parameters = grid_search.best_estimator_.get_params()
      for param_dict in params[model_name]:
        for param_name, param_value in param_dict.items():
            print("\t%s: %r" % (param_name,
best_parameters[param_name]))
```

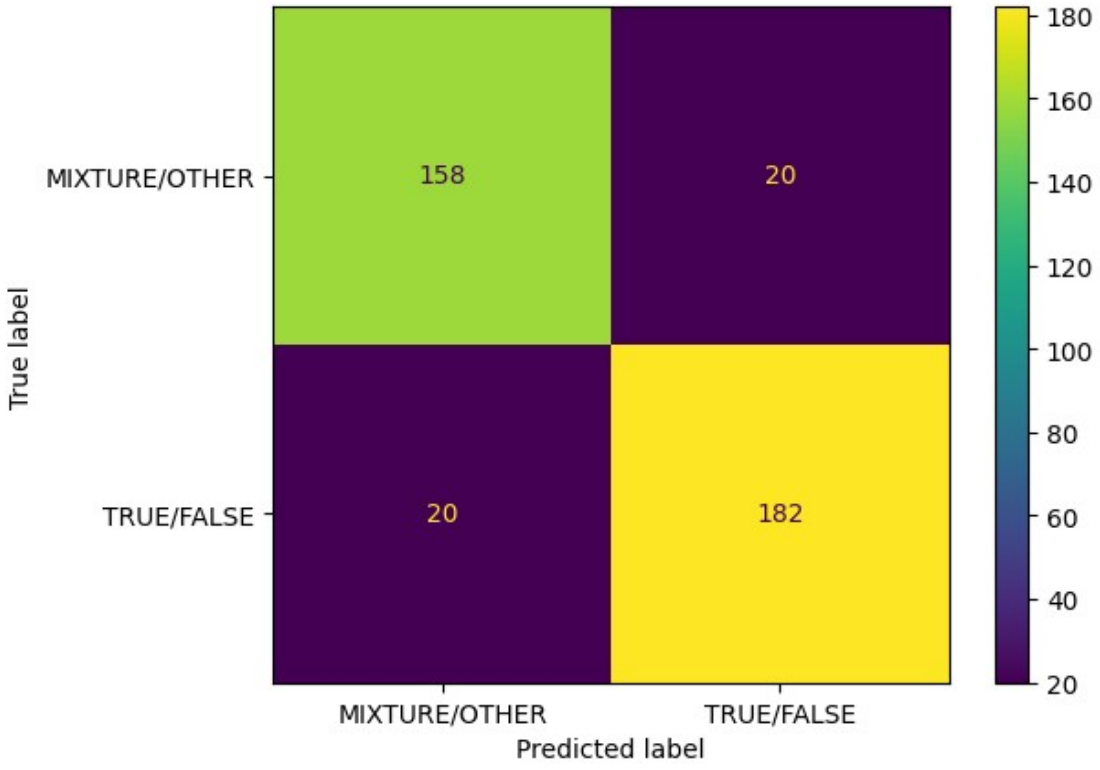
```
grid search fait
X_train_text (1520, 29370)
y_train (1520,)
Fitting 5 folds for each of 9 candidates, totalling 45 fits
meilleur score 0.855

meilleur estimateur SVC(gamma=1, random_state=42)

Accuracy : 0.884
Classification Report
               precision    recall  f1-score   support

MIXTURE/OTHER    0.86413   0.89326   0.87845       178
   TRUE/FALSE    0.90306   0.87624   0.88945       202

     accuracy                        0.88421       380
    macro avg    0.88360   0.88475   0.88395       380
 weighted avg    0.88483   0.88421   0.88430       380

Ensemble des meilleurs paramètres :
     C: 1.0
     gamma: 1
     kernel: 'rbf'
grid search fait
X_train_text (1520, 29228)
y_train (1520,)
Fitting 5 folds for each of 9 candidates, totalling 45 fits
meilleur score 0.857

meilleur estimateur SVC(C=10, random_state=42)

Accuracy : 0.903
Classification Report
               precision    recall  f1-score   support

MIXTURE/OTHER    0.89385   0.89888   0.89636       178
   TRUE/FALSE    0.91045   0.90594   0.90819       202
```

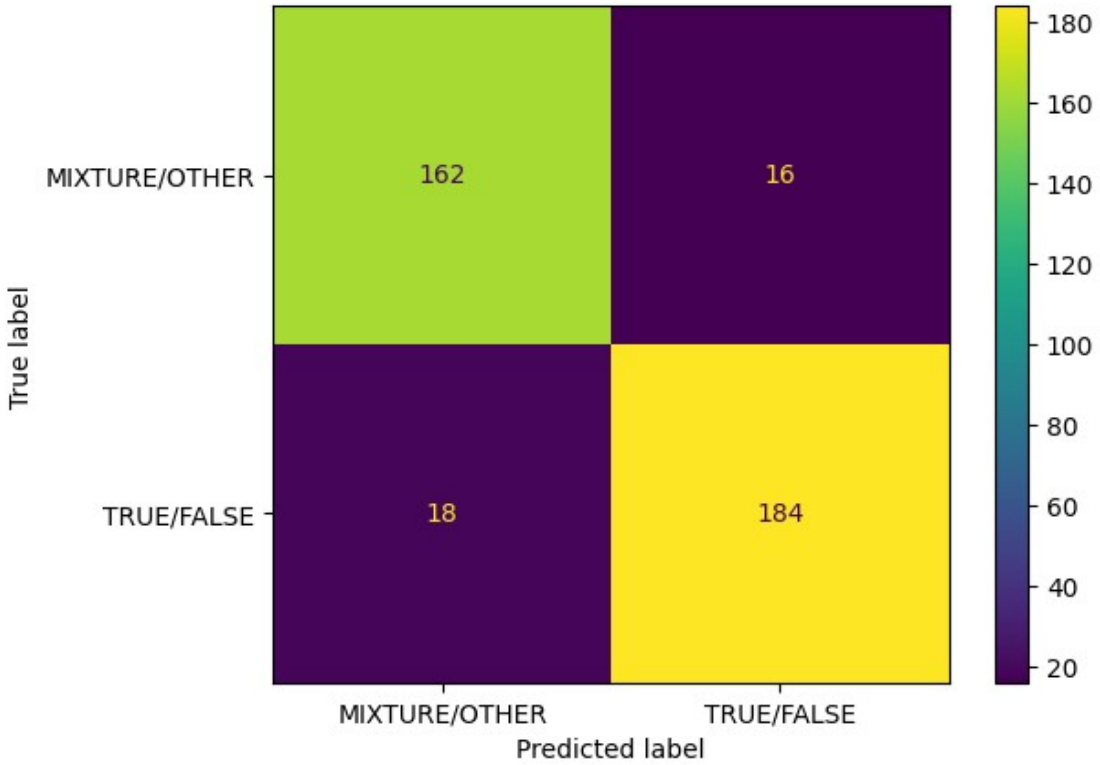
```
     accuracy                           0.90263       380
    macro avg    0.90215   0.90241   0.90227       380
 weighted avg    0.90268   0.90263   0.90265       380

Ensemble des meilleurs paramètres :
     C: 10
     gamma: 'scale'
     kernel: 'rbf'
grid search fait
X_train_text (1520, 19946)
y_train (1520,)
Fitting 5 folds for each of 9 candidates, totalling 45 fits
meilleur score 0.855

meilleur estimateur SVC(C=10, random_state=42)

Accuracy : 0.895
Classification Report
               precision    recall  f1-score   support

MIXTURE/OTHER    0.88764   0.88764   0.88764       178
   TRUE/FALSE    0.90099   0.90099   0.90099       202

     accuracy                           0.89474       380
    macro avg    0.89432   0.89432   0.89432       380
 weighted avg    0.89474   0.89474   0.89474       380

Ensemble des meilleurs paramètres :
     C: 10
     gamma: 'scale'
     kernel: 'rbf'
grid search fait
X_train_text (1520, 35432)
y_train (1520,)
Fitting 5 folds for each of 9 candidates, totalling 45 fits
meilleur score 0.857

meilleur estimateur SVC(C=10, random_state=42)

Accuracy : 0.911
Classification Report
               precision    recall  f1-score   support

MIXTURE/OTHER    0.90000   0.91011   0.90503       178
   TRUE/FALSE    0.92000   0.91089   0.91542       202

     accuracy                           0.91053       380
    macro avg    0.91000   0.91050   0.91023       380
```

```
 weighted avg    0.91063   0.91053   0.91055       380

Ensemble des meilleurs paramètres :
      C: 10
      gamma: 'scale'
      kernel: 'rbf'
```




MIXTURE/OTHER
TRUE/FALSE
True label
160
18
19
183
MIXTURE/OTHER
TRUE/FALSE
Predicted label
180
160
140
120
100
80
60
40
20


MIXTURE/OTHER
TRUE/FALSE
True label
158
20
20
182
MIXTURE/OTHER
TRUE/FALSE
Predicted label
180
160
140
120
100
80
60
40
20



###**Etape 4 : Classification selon le TITRE ET TEXT ENSEMBLE (Concaténés):**

- On va à partir de X_train concaténer les 2 colonnes TEXT et TITLE en mettant un espace entre les deux
- Vu qu'on va travailler sur la colonne text_titre qu'on vient de créer, on va séléctionner cette dernière depuis le X_train et X_test pour apprendre et tester après.

```
#concaténation
X_train=X_train.apply(lambda row: ' '.join([str(val) for val in row]),
axis=1)
X_test=X_test.apply(lambda row: ' '.join([str(val) for val in row]),
axis=1)
```

Ici, c'est une étape importante, on va tester différents classifieurs, pour chacun des classifieurs, on va appliquer le prétraitement + Vectorisation TfIdf, et on applique une cross_val_score avec un Kfold de 10 fois, par la suite on stocke dans une liste all_results la moyenne des accuracy + l'écart type et on la trie par ordre décroissant de moyenne d'accuracy et d'écart type. on remarque que les 2 meilleurs sont SVM et RF qu'on va séléctionner pour leur appliquer le GridSearch sur les paramètres des prétraitements + leurs hyperparamètres pour pouvoir choisir le meilleur.

```
from sklearn.datasets import fetch_20newsgroups
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.feature_extraction.text import TfidfVectorizer
```

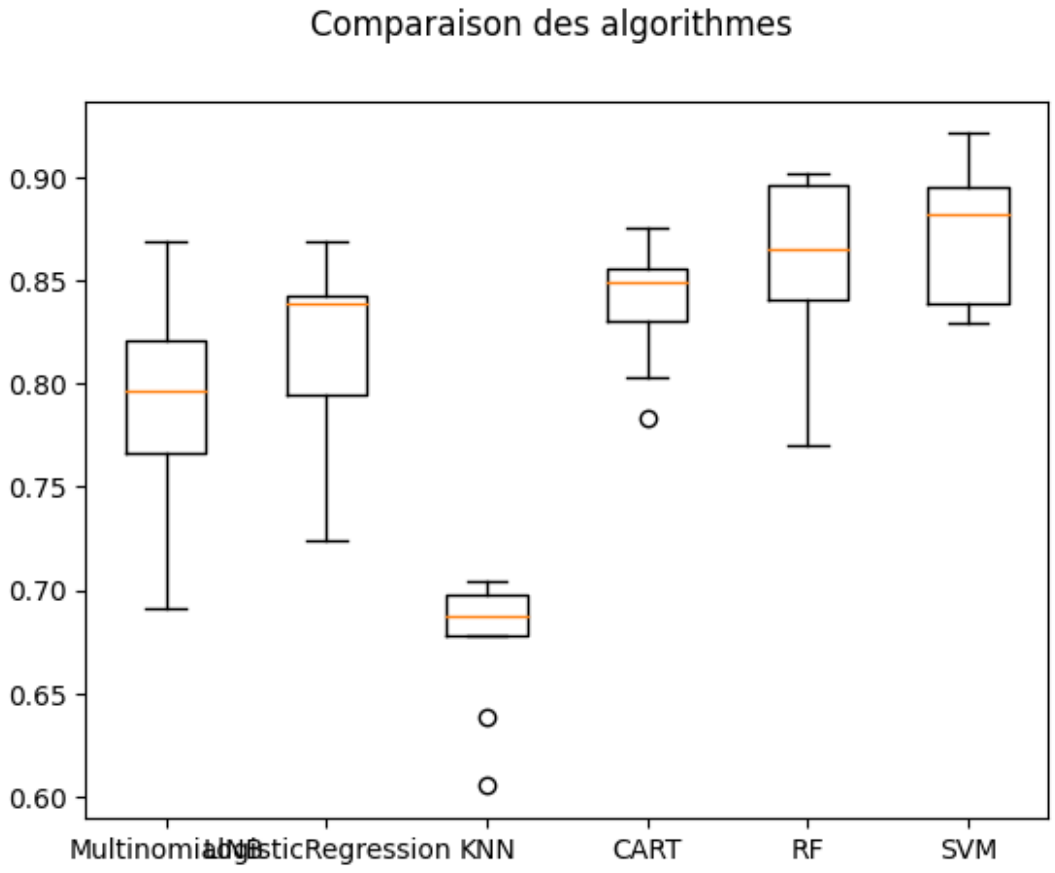
```
from sklearn.model_selection import train_test_split, GridSearchCV
from sklearn.pipeline import Pipeline
from sklearn.metrics import accuracy_score
from sklearn.naive_bayes import MultinomialNB
from sklearn.linear_model import LogisticRegression
from sklearn.svm import SVC
from sklearn.naive_bayes import MultinomialNB
import time
import numpy as np



score = 'accuracy'
seed = 7
allresults = []
results = []
names = []


# Liste des modèles à tester
models = [
    ('MultinomialNB', MultinomialNB()),
    ('LogisticRegression', LogisticRegression(random_state=42))
]


#models.append(('LR', LogisticRegression(solver='lbfgs')))
models.append(('KNN', KNeighborsClassifier()))
models.append(('CART', DecisionTreeClassifier(random_state=42)))
models.append(('RF', RandomForestClassifier(random_state=42)))
models.append(('SVM', SVC(random_state=42)))

# Création d'un pipeline pour chaque modèle
pipelines = []
for name,model in models:
    pipeline = Pipeline([
        ('normalize', TextNormalizer()),
        ('tfidf', TfidfVectorizer()),
        (name,model)
    ])
    pipelines.append((name,pipeline))

all_results=[]
scores=[]
for p in pipelines:
    print(p[1])
    # cross validation en 10 fois
    kfold = KFold(n_splits=10,random_state=seed,shuffle=True)
```

```
#    print ("Evaluation de ",p)
    start_time = time.time()
    # application de la classification
    cv_results = cross_val_score(p[1],X_train,y_train, cv=kfold,
scoring=score)
    scores.append(cv_results)
    names.append(p[0])
    all_results.append((p[0],cv_results.mean(),cv_results.std()))
    end_time = time.time()


print("all resultats", all_results)

all_results = sorted(all_results, key=lambda x: (-x[1], -x[2]))
print("all resultats", all_results)
    # affichage des résultats
#print ('\nLe meilleur resultat : ',max(results))

Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('MultinomialNB', MultinomialNB())])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('LogisticRegression',
LogisticRegression(random_state=42))])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('KNN', KNeighborsClassifier())])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('CART', DecisionTreeClassifier(random_state=42))])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('RF', RandomForestClassifier(random_state=42))])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('SVM', SVC(random_state=42))])
all resultats [('MultinomialNB', 0.7914473684210526,
0.0461512102823568), ('LogisticRegression', 0.817763157894737,
0.042130954333119364), ('KNN', 0.6776315789473684,
0.0302917485084772), ('CART', 0.8401315789473685,
0.02745085005924349), ('RF', 0.8605263157894738, 0.03923171451546203),
('SVM', 0.8730263157894738, 0.03329363402336841)]
all resultats [('SVM', 0.8730263157894738, 0.03329363402336841),
('RF', 0.8605263157894738, 0.03923171451546203), ('CART',
0.8401315789473685, 0.02745085005924349), ('LogisticRegression',
0.817763157894737, 0.042130954333119364), ('MultinomialNB',
0.7914473684210526, 0.0461512102823568), ('KNN', 0.6776315789473684,
0.0302917485084772)]
```

On affiche les accuracy de chaque classifieur, on remarque la médiane (en rouge) de chaque et l'écart type aussi.

```
import matplotlib.pyplot as plt
fig = plt.figure()
fig.suptitle('Comparaison des algorithmes')
ax = fig.add_subplot(111)
plt.boxplot(scores)
ax.set_xticklabels(names)
```

```
[Text(1, 0, 'MultinomialNB'),
 Text(2, 0, 'LogisticRegression'),
 Text(3, 0, 'KNN'),
 Text(4, 0, 'CART'),
 Text(5, 0, 'RF'),
 Text(6, 0, 'SVM')]
```



Choisir les meilleurs paramètres pour SVM et RF :

On a un pipeline pour chaque prétraitement différent, on essaye pas mal (miniscule, lemmatisation, miniscule + lemmatisation..) et on stocke le fit_transorm de nos X_train, X_test sur les pipelines dans des listes qui vont contenir tous les fit_transform des pipelines pour chaque classifieur, par la suite on parcourt ces listes là, on itère dessus, et chaque

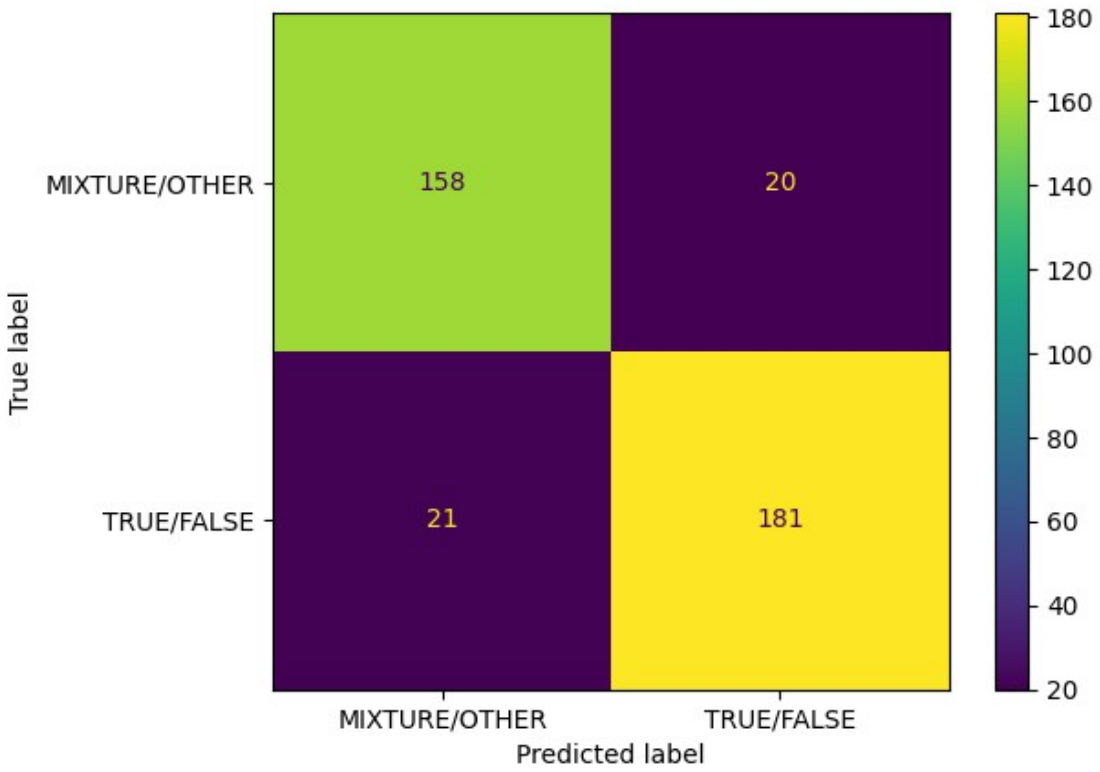
élement de la liste (train) va passer par le GridSearch et puis on predict sur son corresapondant dans liste (test).

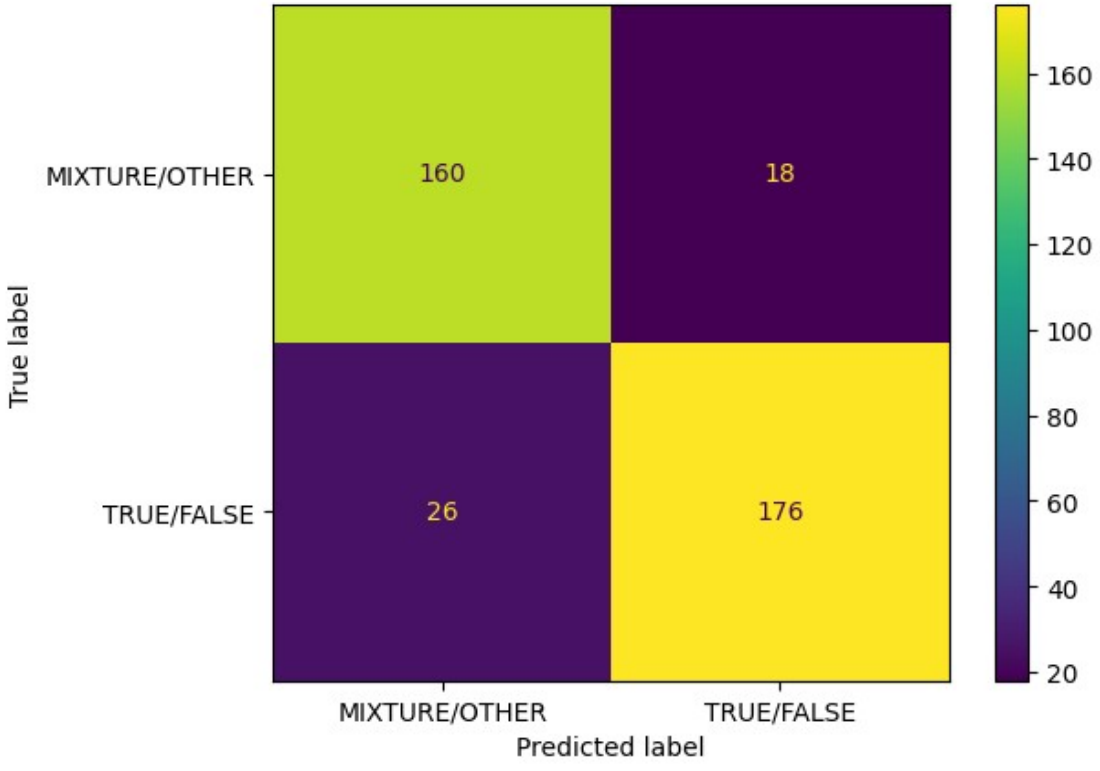
```
from sklearn.model_selection import GridSearchCV


from sklearn.datasets import fetch_20newsgroups
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.model_selection import train_test_split, GridSearchCV
from sklearn.pipeline import Pipeline
from sklearn.metrics import accuracy_score
from sklearn.naive_bayes import MultinomialNB
from sklearn.linear_model import LogisticRegression
from sklearn.svm import SVC
from sklearn.naive_bayes import MultinomialNB
from tabulate import tabulate
import numpy as np


# pipeline de l'utilisation de TfidfVectorizer avec differents pre-
traitements
TFIDF_brut = Pipeline ([('cleaner', TextNormalizer()),
                    ('tfidf_vectorizer',
TfidfVectorizer(lowercase=False))])

TFIDF_lowcase = Pipeline([('cleaner',
TextNormalizer(removestopwords=False,lowercase=True,

getstemmer=False,removedigit=False)),
                    ('tfidf_vectorizer',
TfidfVectorizer(lowercase=False))])
TFIDF_lowStop = Pipeline([('cleaner',
TextNormalizer(removestopwords=True,lowercase=True,

getstemmer=False,removedigit=False)),
                    ('tfidf_vectorizer',
TfidfVectorizer(lowercase=False))])

TFIDF_lowStopstem = Pipeline([('cleaner',
TextNormalizer(removestopwords=True,lowercase=True,

getstemmer=True,removedigit=False)),
                    ('tfidf_vectorizer',
TfidfVectorizer(lowercase=False))])


# Liste de tous les modeles à tester
all_models = [
```

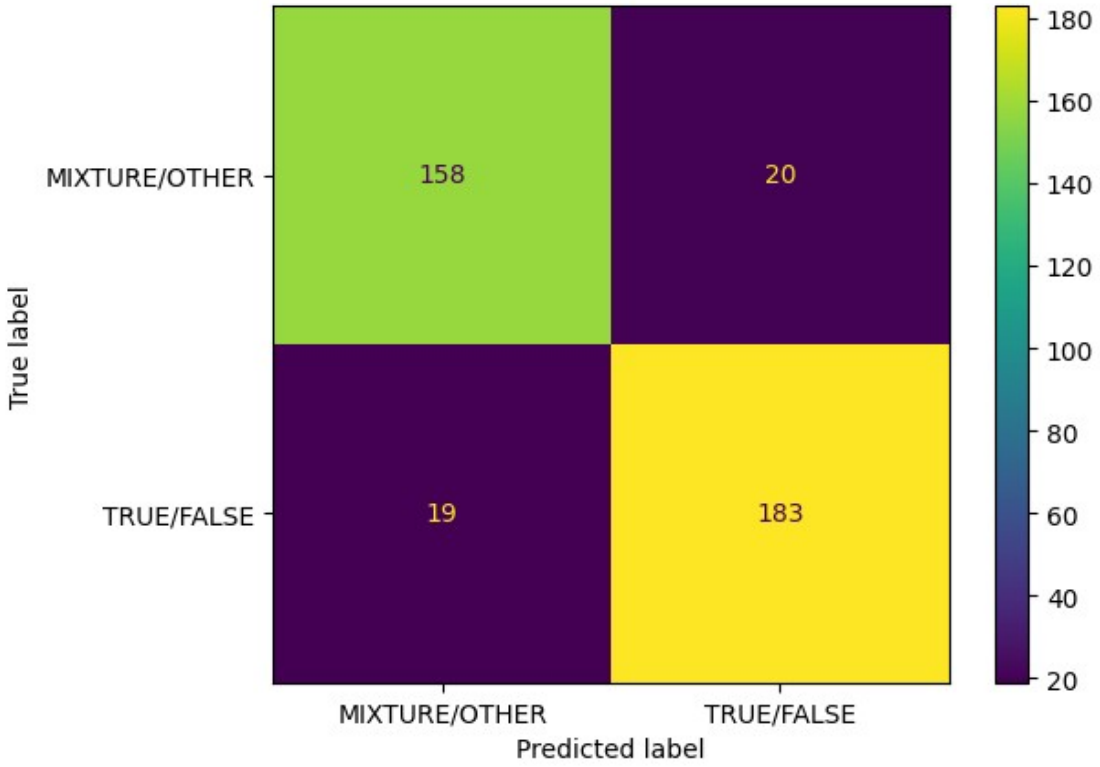
```
    ("TFIDF_lowcase", TFIDF_lowcase),
    ("TFIDF_lowStop", TFIDF_lowStop),
    ("TFIDF_lowStopstem",TFIDF_lowStopstem),
    ("TFIDF_brut", TFIDF_brut)
]

X_train_title_text_SVC = []
X_test_title_text_SVC = []




for name, pipeline in all_models :

X_train_title_text_SVC.append(pipeline.fit_transform(X_train).toarray(
))
    X_test_title_text_SVC.append(pipeline.transform(X_test).toarray())




models = {
    'SVC': SVC(random_state=42)
}


params = {'SVC': [{'C': [ 0.01, 0.1, 1,2]},
             {'gamma': [0.001, 0.01, 0.1,0.2]},
             {'kernel': ['linear', 'rbf']}]
}

for model_name, model in models.items():
    score='accuracy'
    X_train_title_text = eval('X_train_title_text_' + model_name)
    X_test_title_text = eval('X_test_title_text_' + model_name)
    for i in range (len(X_train_title_text)):
      grid_search = GridSearchCV(model, params[model_name], n_jobs=-1,
verbose=1,scoring=score)
      print("grid search fait")
      print("X_train_title_text",X_train_title_text[i].shape)
      print("y_train",y_train.shape)
      grid_search.fit(X_train_title_text[i],y_train)
      print ('meilleur score %0.3f'%(grid_search.best_score_),'\n')
      print ('meilleur estimateur',grid_search.best_estimator_,'\n')
      y_pred = grid_search.predict(X_test_title_text[i])
      MyshowAllScores(y_test,y_pred)

      print("Ensemble des meilleurs paramètres :")
      best_parameters = grid_search.best_estimator_.get_params()
```

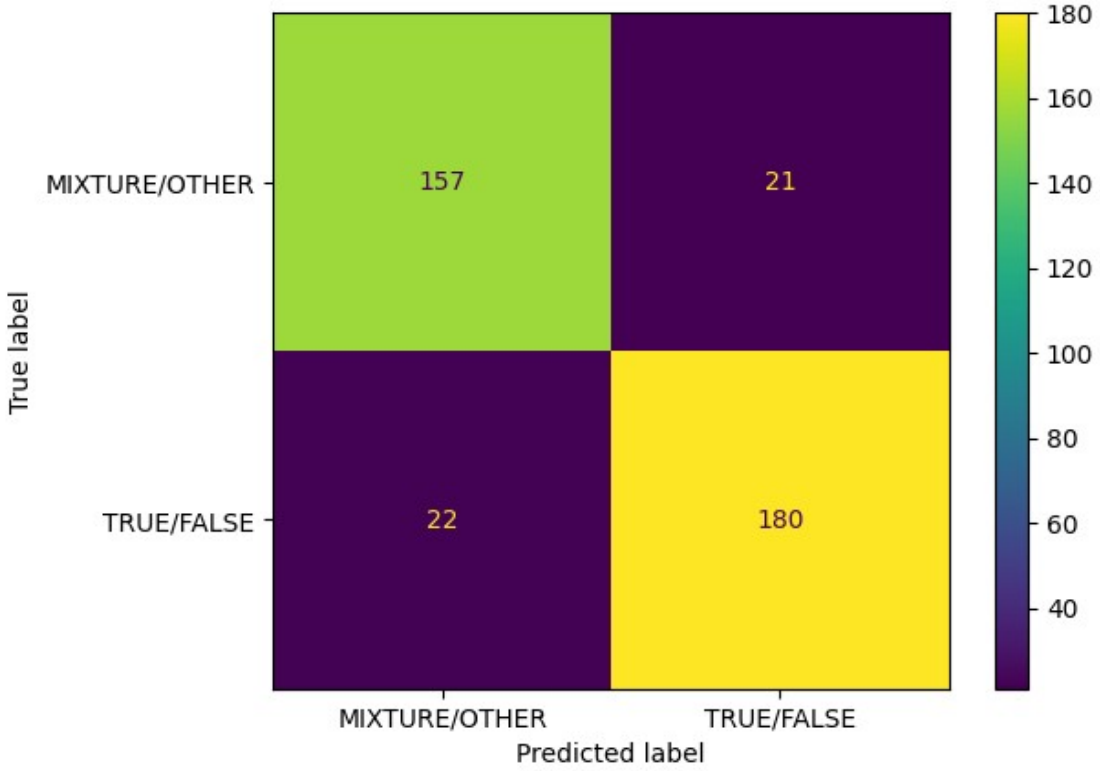
```
      for param_dict in params[model_name]:
        for param_name, param_value in param_dict.items():
            print("\t%s: %r" % (param_name,
best_parameters[param_name]))

grid search fait
X_train_title_text (1520, 30034)
y_train (1520,)
Fitting 5 folds for each of 10 candidates, totalling 50 fits
meilleur score 0.857

meilleur estimateur SVC(C=2, random_state=42)

Accuracy : 0.892
Classification Report
              precision    recall  f1-score   support

MIXTURE/OTHER    0.88268   0.88764   0.88515       178
   TRUE/FALSE    0.90050   0.89604   0.89826       202

     accuracy                        0.89211       380
    macro avg    0.89159   0.89184   0.89171       380
 weighted avg    0.89215   0.89211   0.89212       380

Ensemble des meilleurs paramètres :
     C: 2
     gamma: 'scale'
     kernel: 'rbf'
grid search fait
X_train_title_text (1520, 29892)
y_train (1520,)
Fitting 5 folds for each of 10 candidates, totalling 50 fits
meilleur score 0.857

meilleur estimateur SVC(C=1, random_state=42)

Accuracy : 0.884
Classification Report
              precision    recall  f1-score   support

MIXTURE/OTHER    0.86022   0.89888   0.87912       178
   TRUE/FALSE    0.90722   0.87129   0.88889       202

     accuracy                        0.88421       380
    macro avg    0.88372   0.88508   0.88400       380
 weighted avg    0.88520   0.88421   0.88431       380

Ensemble des meilleurs paramètres :
     C: 1
```

```
     gamma: 'scale'
     kernel: 'rbf'
grid search fait
X_train_title_text (1520, 20387)
y_train (1520,)
Fitting 5 folds for each of 10 candidates, totalling 50 fits
meilleur score 0.853

meilleur estimateur SVC(C=2, random_state=42)

Accuracy : 0.897
Classification Report
               precision    recall  f1-score   support

MIXTURE/OTHER    0.89266   0.88764   0.89014       178
   TRUE/FALSE    0.90148   0.90594   0.90370       202

     accuracy                        0.89737       380
    macro avg    0.89707   0.89679   0.89692       380
 weighted avg    0.89735   0.89737   0.89735       380

Ensemble des meilleurs paramètres :
     C: 2
     gamma: 'scale'
     kernel: 'rbf'
grid search fait
X_train_title_text (1520, 36709)
y_train (1520,)
Fitting 5 folds for each of 10 candidates, totalling 50 fits
meilleur score 0.861

meilleur estimateur SVC(C=1, random_state=42)

Accuracy : 0.887
Classification Report
               precision    recall  f1-score   support

MIXTURE/OTHER    0.87709   0.88202   0.87955       178
   TRUE/FALSE    0.89552   0.89109   0.89330       202

     accuracy                        0.88684       380
    macro avg    0.88631   0.88656   0.88643       380
 weighted avg    0.88689   0.88684   0.88686       380

Ensemble des meilleurs paramètres :
     C: 1
     gamma: 'scale'
     kernel: 'rbf'
```


MIXTURE/OTHER
TRUE/FALSE
True label
158
20
21
181
MIXTURE/OTHER
TRUE/FALSE
Predicted label
180
160
140
120
100
80
60
40
20


MIXTURE/OTHER
TRUE/FALSE
True label
160
18
26
176
MIXTURE/OTHER
TRUE/FALSE
Predicted label
160
140
120
100
80
60
40
20





##Seconde classification sur Other vs mixture avec les données

###**Etape 1 : Préparer les données**

On crée un nouveau dataframe avec que les lignes contenant dans la colonne rating les valeurs other et mixture

```
dftrain = dftrainbase.loc[dftrainbase['rating'].isin(['other',
'mixture'])]
y=dftrain.iloc[0:,-1]
print("les valeurs de OTHER et MIXTURE maintenant sont
" ,y.value_counts())
```

```
les valeurs de OTHER et MIXTURE maintenant sont  MIXTURE/OTHER    950
Name: regrouped, dtype: int64
```

Le jeu de données étant déséquilibré, on a pensé à appliquer le downsampling pour équilibrer nos données. on séléctionne des lignes aléatoirement de TRUE/FALSE de telle sorte que le nombre de lignes de TRUE/FALSE soit = au nbr de lignes de Other. et on mélange le DataFrame.

```
# Compter le nombre d'observations dans chaque catégorie
mixture_count = dftrain['rating'].value_counts()['mixture']
other_count = dftrain['rating'].value_counts()['other']

# Trouver le nombre minimum d'observations parmi les catégories
min_count = min( mixture_count, other_count)

# Sous-échantillonner les catégories pour équilibrer les quantités
mixture_sampled = dftrain[dftrain['rating'] ==
'mixture'].sample(min_count, random_state=42)
other_sampled = dftrain[dftrain['rating'] ==
'other'].sample(min_count, random_state=42)


# Concaténer les échantillons pour obtenir un nouveau dataframe
équilibré
dftrain = pd.concat([mixture_sampled,other_sampled])

# Mélanger aléatoirement les données
dftrain = dftrain.sample(frac=1, random_state=42)
print(dftrain)
X_text=dftrain["text"]
X_title=dftrain["title"]
y=dftrain.iloc[0:,-2]
print("\n")
print("la taille de y_train est " ,y.shape)
print("\n")
print("les valeurs de OTHER et MIXTURE maintenant sont
" ,y.value_counts())
```

```
            id                                                text  \
2236  d190254d  For immediate release: For more information: J...
```

```
2450  648e6bc4  Despite recent attempts to paint the United St...
1802  8f40a510  RT America host Rick Sanchez has broken down t...
2359  d462dc8d  A blitz on helping people with drink, drug and...
1931  4107c249  From new funding to support veterans to reduci...
...        ...                                                ...
1887  11aea5b0  By Jim Francesconi As we pass the governance t...
1940  347530a3  On Tuesday, radio show host John Fredricks sta...
1837  073f3552  EXCLUSIVE: Third of cases won by terrorists, m...
458   bfcfac7d  We all need to keep in mind that, except for a...
817   9f4d9fd2  Aung San Suu Kyi Residence Rangoon, Burma 12:3...

                                                  title   rating  \
2236  COVID-19: ''Abba Kyari Dead Of Coronavirus’ – ...  mixture
2450  WHO: United States Among Least Polluting Natio...  mixture
1802  Trump Won Two-Thirds of Election Lawsuits Wher...  mixture
2359  Addicts and alcoholics cost us £10billion a ye...    other
1931  Electric Car-Owners Shocked: New Study Confirm...  mixture
...                                                 ...      ...
1887  DUP man dating Poots' daughter claims his 'tea...  mixture
1940                          Warren Statement on Boeing    other
1837                 European Court of Killers’ Rights    other
458   Almost 2,400 people declared 'fit to work' wer...    other
817                Fighting Human Trafficking in Texas  mixture

         regrouped
2236  MIXTURE/OTHER
2450  MIXTURE/OTHER
1802  MIXTURE/OTHER
2359  MIXTURE/OTHER
1931  MIXTURE/OTHER
...             ...
1887  MIXTURE/OTHER
1940  MIXTURE/OTHER
1837  MIXTURE/OTHER
458   MIXTURE/OTHER
817   MIXTURE/OTHER

[468 rows x 5 columns]


la taille de y_train est  (468,)


les valeurs de OTHER et MIXTURE maintenant sont  mixture    234
other      234
Name: rating, dtype: int64
```

On divise notre grand X en jeu de données d'apprentissage et de test (20% de test).

```
X=dftrain.iloc[0:, 1:3]
print(X)

X_train,X_test,y_train,y_test=train_test_split(X,y,test_size =
0.2,random_state=8)
print("X_train is",X_train)
print("y_train is",y_train)
print("X_test is",X_test)
print("y_test is",y_test)
```

```
                                                   text  \
2236  For immediate release: For more information: J...
2450  Despite recent attempts to paint the United St...
1802  RT America host Rick Sanchez has broken down t...
2359  A blitz on helping people with drink, drug and...
1931  From new funding to support veterans to reduci...
...                                                 ...
1887  By Jim Francesconi As we pass the governance t...
1940  On Tuesday, radio show host John Fredricks sta...
1837  EXCLUSIVE: Third of cases won by terrorists, m...
458   We all need to keep in mind that, except for a...
817   Aung San Suu Kyi Residence Rangoon, Burma 12:3...

                                                  title
2236  COVID-19: ''Abba Kyari Dead Of Coronavirus’ – ...
2450  WHO: United States Among Least Polluting Natio...
1802  Trump Won Two-Thirds of Election Lawsuits Wher...
2359  Addicts and alcoholics cost us £10billion a ye...
1931  Electric Car-Owners Shocked: New Study Confirm...
...                                                 ...
1887  DUP man dating Poots' daughter claims his 'tea...
1940                          Warren Statement on Boeing
1837                  European Court of Killers’ Rights
458   Almost 2,400 people declared 'fit to work' wer...
817                 Fighting Human Trafficking in Texas

[468 rows x 2 columns]
X_train is                                                    text  \
1057  The NHS Long Term Plan, published today, will ...
440   WASHINGTON, DC – The House of Representatives ...
1290  CONTACT: Bryan Kennedy, 414 517-3864  Milwauke...
1137  52% of Americans – including 45% of men and 60...
1518  Cash-strapped schools are spending a record £1...
...                                                 ...
633   TALLAHASSEE, Fla. (WCTV) - Wednesday, Presiden...
2368  GETTY Corbyn proposes to introduce the garden ...
2111  Also on the naughty list were Christmas carols...
164   WHATEVER drama plays out when Republicans meet...
1149  Where in the world do you think the following ...
```

```
                                                    title
1057  NHS Long Term Plan to tackle major killer cond...
440   Carbon dioxide didn't create climate crisis, s...
1290  Flynn campaign: Statement on Walker campaign a...
1137  52% of Americans would feel very comfortable w...
1518  Schools spending £1.3bn on supply teachers as ...
...                                                 ...
633   Florida Senator Rick Scott on Paris Climate Ag...
2368        Imagine what Labour’s garden tax would mean
2111  Principal banned candy canes because 'J' shape...
164         Paul Ryan’s Worst Ally - The New York Times
1149        We won’t let women be second class citizens

[374 rows x 2 columns]
y_train is 1057      other
440     mixture
1290    mixture
1137    mixture
1518    mixture
         ...
633     mixture
2368    mixture
2111      other
164     mixture
1149    mixture
Name: rating, Length: 374, dtype: object
X_test is                                                   text  \
208   This is one in a series of articles taken from...
2245  High earners in professional jobs, such as doc...
263   Biden Has Been Given Debate Questions in Advan...
2081  Aung San Suu Kyi Residence Rangoon, Burma 12:3...
1046  By Jim Francesconi As we pass the governance t...
...                                                 ...
1995  SHARE By of the Waukesha - Frustrated board me...
768   Bois State University told The Daily Wire Thur...
941   It was an accurate and judicious answer, so na...
2385  L ondoners living in the borough of Greenwich ...
1269  Nation  UPDATED 8:23 PM - K A B O O M! Governo...

                                                    title
208   European royals killing naked children for fun...
2245  Joe Biden Is Aiming To End The Federal Use Of ...
263   Biden Has Been Given Debate Questions in Advan...
2081                Fighting Human Trafficking in Texas
1046  DUP man dating Poots' daughter claims his 'tea...
...                                                 ...
1995  Private firms given £9.2bn of NHS budget despi...
768   Billionaire Jeffrey Epstein arrested and accus...
941                                 A 62% Top Tax Rate?
```

```
2385  London's most miserable boroughs revealed to b...
1269  K A B O O M! Governor and Secretary of State i...

[94 rows x 2 columns]
y_test is 208       other
2245      other
263       other
2081    mixture
1046    mixture
         ...
1995    mixture
768       other
941       other
2385      other
1269      other
Name: rating, Length: 94, dtype: object
```

###**Etape 2 : Classification selon la colonne TITRE :**

Tester avec plusieurs classifieurs classiques.

```
from sklearn.datasets import fetch_20newsgroups
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.model_selection import train_test_split, GridSearchCV
from sklearn.pipeline import Pipeline
from sklearn.metrics import accuracy_score
from sklearn.naive_bayes import MultinomialNB
from sklearn.linear_model import LogisticRegression
from sklearn.svm import SVC
from sklearn.naive_bayes import MultinomialNB
import time
import numpy as np

# Utilisez la méthode ravel() pour transformer y_train en un tableau
unidimensionnel
#X_train = np.ravel(X_train)
print("X_train", X_train.shape)
print("y_train", y_train.shape)
np.random.seed(42)  # Set the random seed for NumPy

score = 'accuracy'
seed = 7
allresults = []
results = []
names = []


# Liste des modèles à tester
models = [
```

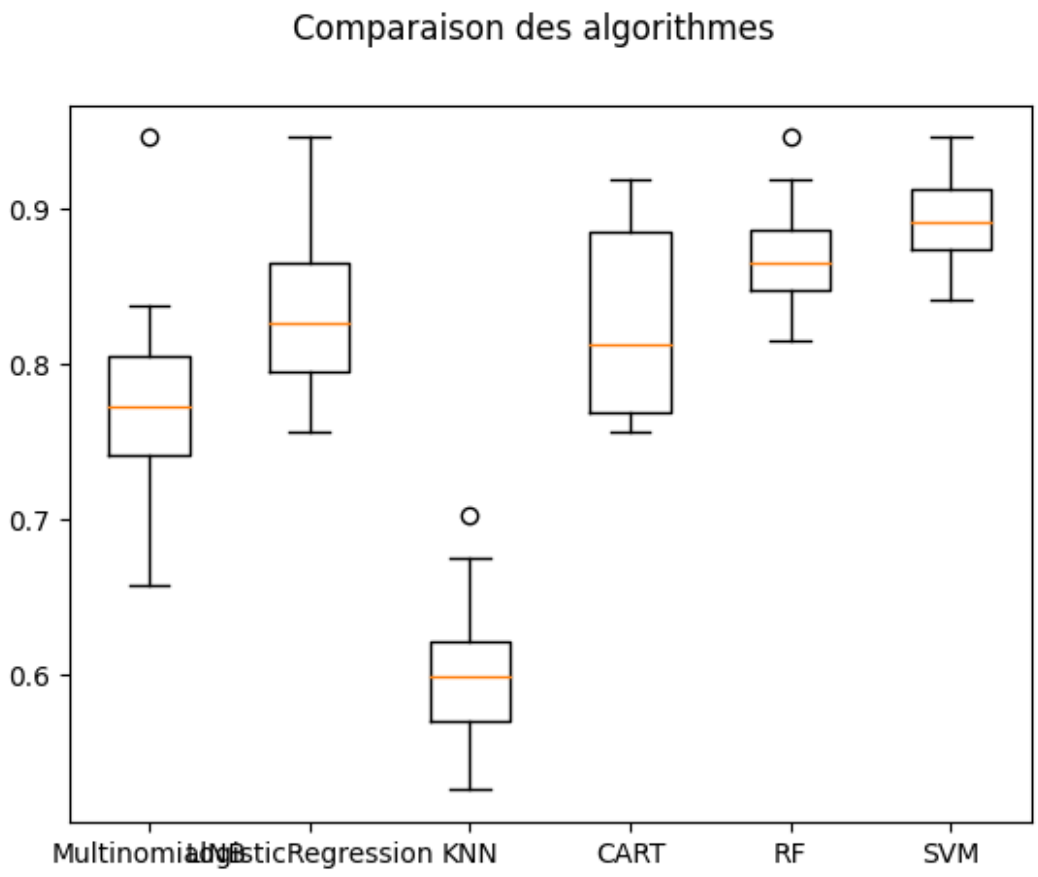
```
    ('MultinomialNB', MultinomialNB()),
    ('LogisticRegression', LogisticRegression(random_state=42))
]


models.append(('KNN', KNeighborsClassifier()))
models.append(('CART', DecisionTreeClassifier(random_state=42)))
models.append(('RF', RandomForestClassifier(random_state=42)))
models.append(('SVM', SVC(random_state=42)))

# Création d'un pipeline pour chaque modèle
pipelines = []
for name,model in models:
    pipeline = Pipeline([
        ('normalize', TextNormalizer()),
        ('tfidf', TfidfVectorizer()),
        (name,model)
    ])
    pipelines.append((name,pipeline))
    #pipeline.fit(X_train,y_train)
all_results=[]
scores=[]
for p in pipelines:
    print(p[1])
    # cross validation en 10 fois
    kfold = KFold(n_splits=10,random_state=seed,shuffle=True)

#    print ("Evaluation de ",p)
    start_time = time.time()
    # application de la classification
    cv_results = cross_val_score(p[1],X_train['title'],y_train,
cv=kfold, scoring=score)
    #print("Pour le classifieur",p[0],"on a un score
de",cv_results.mean(),"et un écart type de",cv_results.std())
    scores.append(cv_results)
    names.append(p[0])

    all_results.append((p[0],cv_results.mean(),cv_results.std()))
    end_time = time.time()


print("all resultats", all_results)

all_results = sorted(all_results, key=lambda x: (-x[1], -x[2]))
print("all resultats", all_results)
    # affichage des résultats
#print ('\nLe meilleur resultat : ',max(results))

X_train (374, 2)
y_train (374,)
```

```
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('MultinomialNB', MultinomialNB())])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('LogisticRegression',
LogisticRegression(random_state=42))])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('KNN', KNeighborsClassifier())])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('CART', DecisionTreeClassifier(random_state=42))])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('RF', RandomForestClassifier(random_state=42))])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('SVM', SVC(random_state=42))])
all resultats [('MultinomialNB', 0.7758179231863443,
0.0776154090711517), ('LogisticRegression', 0.8317211948790897,
0.054478382410327035), ('KNN', 0.6046941678520626,
0.05120001499871293), ('CART', 0.8293741109530585,
0.061129574725021694), ('RF', 0.8719772403982929, 0.0363009961740394),
('SVM', 0.8931721194879089, 0.02873047596131146)]
all resultats [('SVM', 0.8931721194879089, 0.02873047596131146),
('RF', 0.8719772403982929, 0.0363009961740394), ('LogisticRegression',
0.8317211948790897, 0.054478382410327035), ('CART',
0.8293741109530585, 0.061129574725021694), ('MultinomialNB',
0.7758179231863443, 0.0776154090711517), ('KNN', 0.6046941678520626,
0.05120001499871293)]
```

On affiche les accuracy de chaque classifieur, on remarque la médiane (en rouge) de chaque et l'écart type aussi.

```
import matplotlib.pyplot as plt
fig = plt.figure()
fig.suptitle('Comparaison des algorithmes')
ax = fig.add_subplot(111)
plt.boxplot(scores)
ax.set_xticklabels(names)
```

```
[Text(1, 0, 'MultinomialNB'),
 Text(2, 0, 'LogisticRegression'),
 Text(3, 0, 'KNN'),
 Text(4, 0, 'CART'),
 Text(5, 0, 'RF'),
 Text(6, 0, 'SVM')]
```



Choisir les meilleurs paramètres et hyperparamètres pour SVM

On a un pipeline pour chaque prétraitement différent, on essaye pas mal (miniscule, lemmatisation, miniscule + lemmatisation..) et on stocke le fit_transorm de nos X_train, X_test sur les pipelines dans des listes qui vont contenir tous les fit_transform des pipelines pour chaque classifieur, par la suite on parcourt ces listes là, on itère dessus, et chaque élement de la liste (train) va passer par le GridSearch et puis on predict sur son corresapondant dans liste (test).

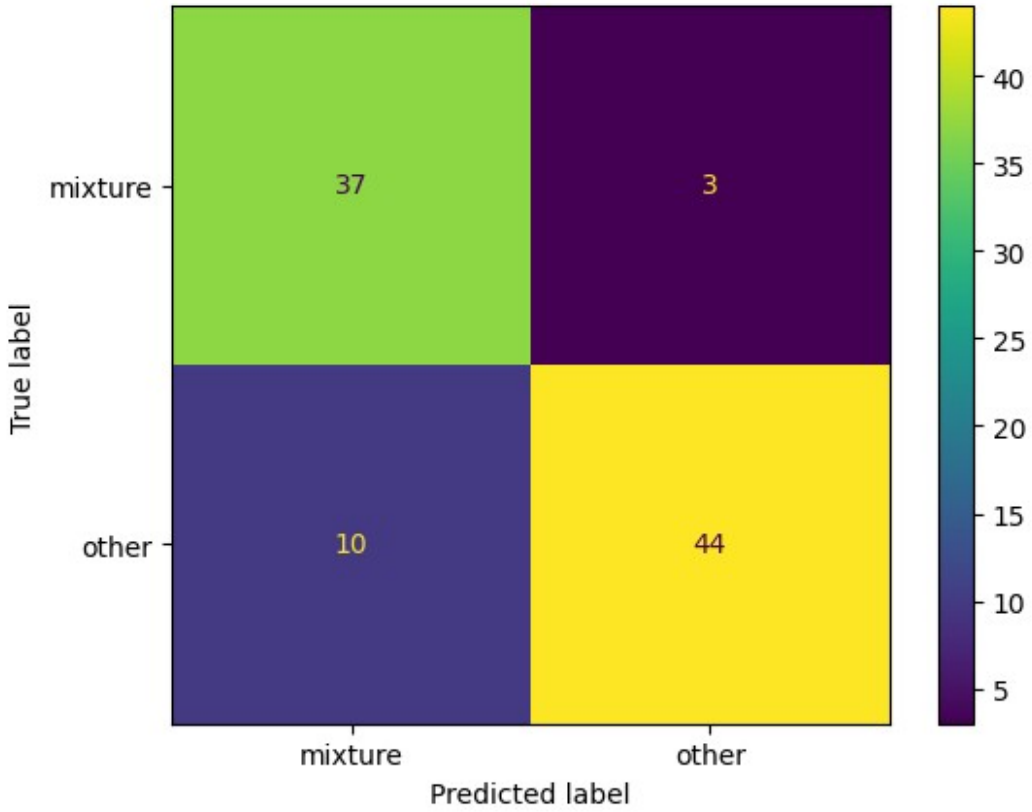
```
np.random.seed(42)  # Set the random seed for NumPy
print("y_train", y_train.shape)
print("y_test", y_test.shape)
print("X_test", X_test.shape)
# le plus simple est de faire un test sur differents pipelines.

# pipeline de l'utilisation de TfidfVectorizer avec differents pre-
traitements
TFIDF_brut = Pipeline ([('cleaner', TextNormalizer()),
                        ('tfidf_vectorizer',
TfidfVectorizer(lowercase=False))])

TFIDF_lowcase = Pipeline([('cleaner',
```

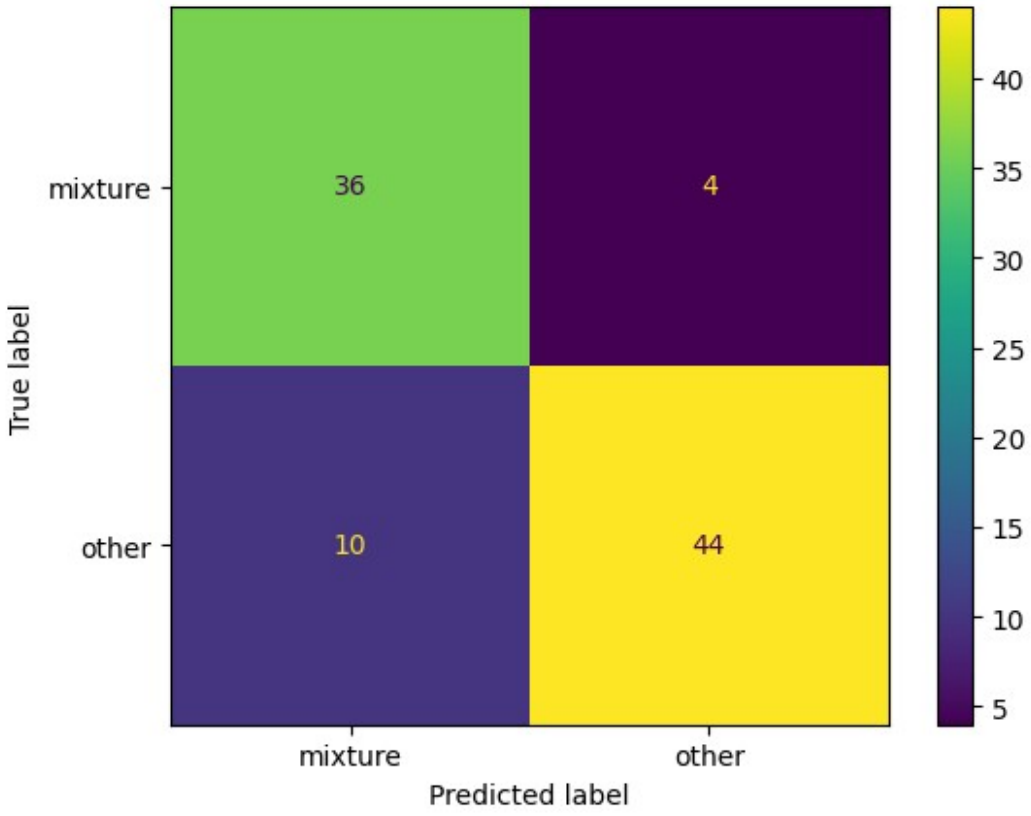
```
TextNormalizer(removestopwords=False,lowercase=True,

getstemmer=False,removedigit=False)),
                    ('tfidf_vectorizer',
TfidfVectorizer(lowercase=False))])
TFIDF_lowStop = Pipeline([('cleaner',
TextNormalizer(removestopwords=True,lowercase=True,

getstemmer=False,removedigit=False)),
                    ('tfidf_vectorizer',
TfidfVectorizer(lowercase=False))])

TFIDF_lowStopstem = Pipeline([('cleaner',
TextNormalizer(removestopwords=True,lowercase=True,

getstemmer=True,removedigit=False)),
                    ('tfidf_vectorizer',
TfidfVectorizer(lowercase=False))])


# Liste de tous les modeles à tester
all_models = [
    ("TFIDF_lowcase", TFIDF_lowcase),
    ("TFIDF_lowStop", TFIDF_lowStop),
    ("TFIDF_lowStopstem",TFIDF_lowStopstem),
    ("TFIDF_brut", TFIDF_brut)
]

X_train_title_SVC = []
X_test_title_SVC = []



for name, pipeline in all_models :

X_train_title_SVC.append(pipeline.fit_transform(X_train['title']).toar
ray())

X_test_title_SVC.append(pipeline.transform(X_test['title']).toarray())




models = {
    'SVC': SVC(random_state=42)
}


params = {'SVC': [{'C': [ 0.1, 1,2]},
```

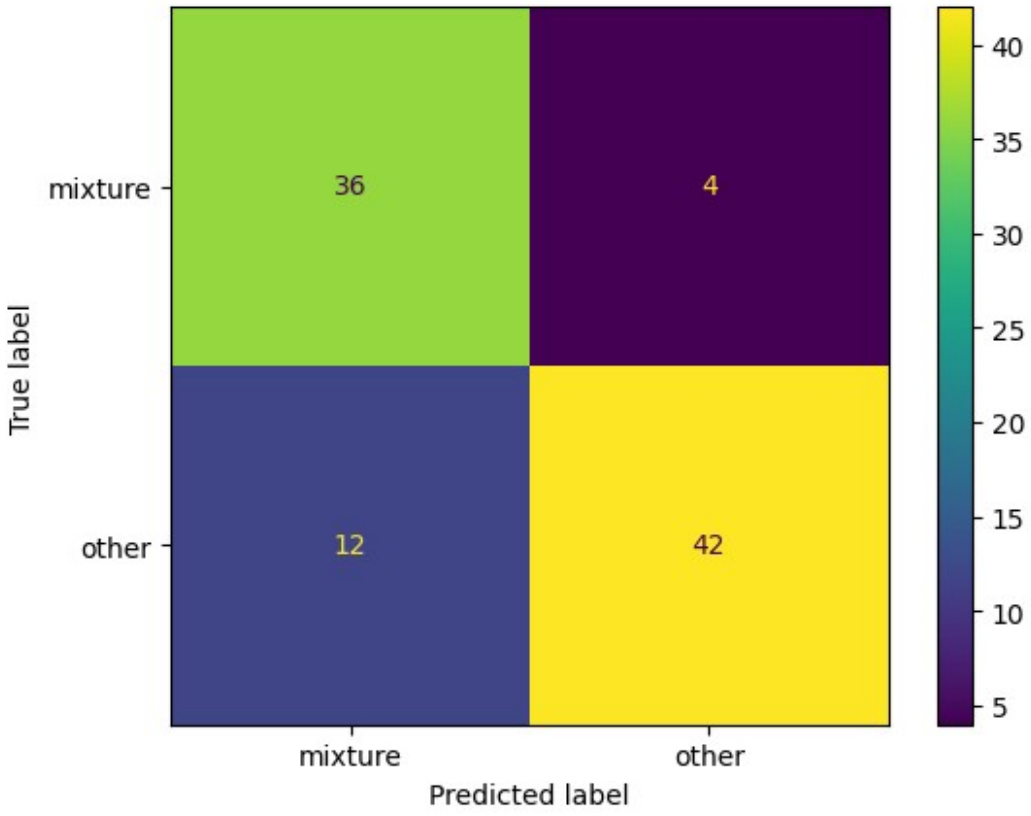
```
            {'gamma': [0.001, 0.01, 0.1,1]},
            {'kernel': ['linear', 'rbf']}]
}

for model_name, model in models.items():
    score='accuracy'
    X_train_title = eval('X_train_title_' + model_name)
    X_test_title = eval('X_test_title_' + model_name)
    for i in range (len(X_train_title)):
      grid_search = GridSearchCV(model, params[model_name], n_jobs=-1,
verbose=1,scoring=score)
      print("grid search fait")
      print("X_train",X_train_title[i].shape)
      print("y_train",y_train.shape)
      grid_search.fit(X_train_title[i],y_train)
      print ('meilleur score %0.3f'%(grid_search.best_score_),'\n')
      print ('meilleur estimateur',grid_search.best_estimator_,'\n')
      y_pred = grid_search.predict(X_test_title[i])
      MyshowAllScores(y_test,y_pred)

      print("Ensemble des meilleurs paramètres :")
      best_parameters = grid_search.best_estimator_.get_params()
      for param_dict in params[model_name]:
        for param_name, param_value in param_dict.items():
            print("\t%s: %r" % (param_name,
best_parameters[param_name]))

y_train (374,)
y_test (94,)
X_test (94, 2)
grid search fait
X_train (374, 2564)
y_train (374,)
Fitting 5 folds for each of 9 candidates, totalling 45 fits
meilleur score 0.839

meilleur estimateur SVC(C=1, random_state=42)

Accuracy : 0.862
Classification Report
              precision    recall  f1-score   support

     mixture    0.78723   0.92500   0.85057        40
       other    0.93617   0.81481   0.87129        54

    accuracy                        0.86170        94
   macro avg    0.86170   0.86991   0.86093        94
weighted avg    0.87279   0.86170   0.86247        94

Ensemble des meilleurs paramètres :
```

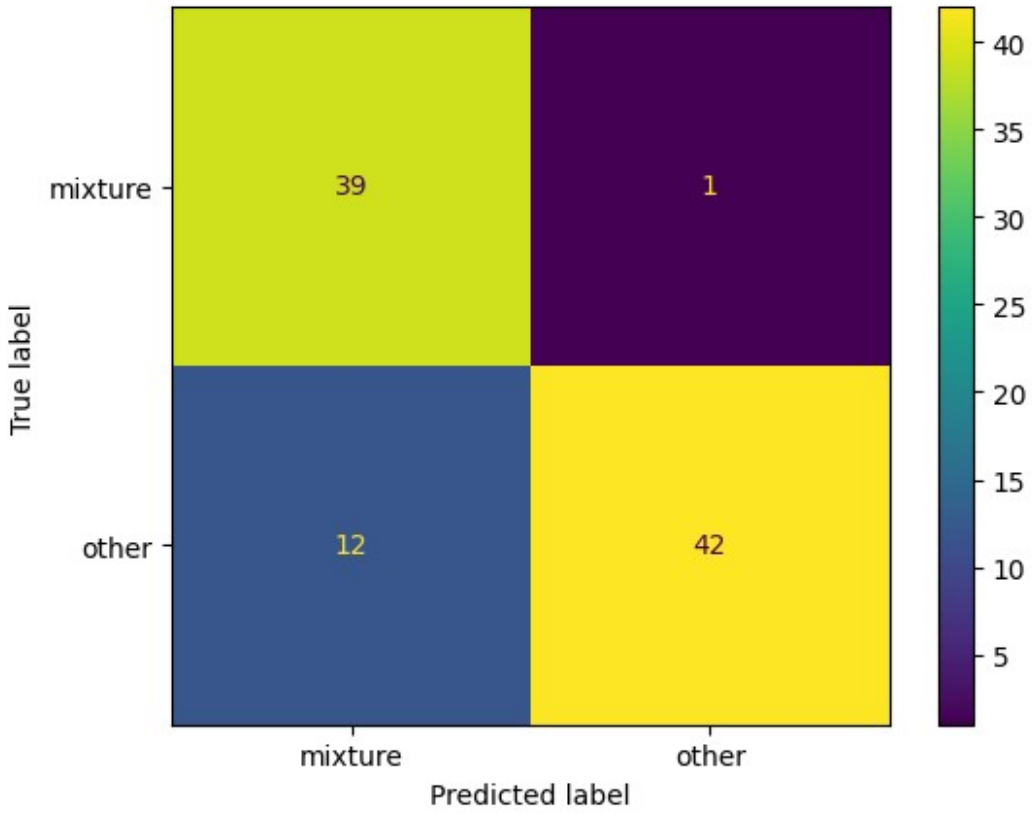
```
     C: 1
     gamma: 'scale'
     kernel: 'rbf'
grid search fait
X_train (374, 2445)
y_train (374,)
Fitting 5 folds for each of 9 candidates, totalling 45 fits
meilleur score 0.837

meilleur estimateur SVC(C=1, random_state=42)

Accuracy : 0.851
Classification Report
              precision    recall  f1-score   support

     mixture    0.78261   0.90000   0.83721        40
       other    0.91667   0.81481   0.86275        54

    accuracy                        0.85106        94
   macro avg    0.84964   0.85741   0.84998        94
weighted avg    0.85962   0.85106   0.85188        94

Ensemble des meilleurs paramètres :
     C: 1
     gamma: 'scale'
     kernel: 'rbf'
grid search fait
X_train (374, 2040)
y_train (374,)
Fitting 5 folds for each of 9 candidates, totalling 45 fits
meilleur score 0.842

meilleur estimateur SVC(C=1, random_state=42)

Accuracy : 0.830
Classification Report
              precision    recall  f1-score   support

     mixture    0.75000   0.90000   0.81818        40
       other    0.91304   0.77778   0.84000        54

    accuracy                        0.82979        94
   macro avg    0.83152   0.83889   0.82909        94
weighted avg    0.84366   0.82979   0.83072        94

Ensemble des meilleurs paramètres :
     C: 1
     gamma: 'scale'
     kernel: 'rbf'
```

```
grid search fait
X_train (374, 2928)
y_train (374,)
Fitting 5 folds for each of 9 candidates, totalling 45 fits
meilleur score 0.839

meilleur estimateur SVC(C=1, random_state=42)

Accuracy : 0.862
Classification Report
              precision    recall  f1-score   support

     mixture    0.76471   0.97500   0.85714        40
       other    0.97674   0.77778   0.86598        54

    accuracy                        0.86170        94
   macro avg    0.87073   0.87639   0.86156        94
weighted avg    0.88652   0.86170   0.86222        94

Ensemble des meilleurs paramètres :
     C: 1
     gamma: 'scale'
     kernel: 'rbf'
```




mixture
other
True label
36
4
10
44
mixture
other
Predicted label
40
35
30
25
20
15
10
5


mixture
other
True label
36
4
12
42
mixture
other
Predicted label
40
35
30
25
20
15
10
5



###**Etape 3 : Classification selon la colonne TEXTE:**

Ici, c'est une étape importante, on va tester différents classifieurs, pour chacun des classifieurs, on va appliquer le prétraitement + Vectorisation TfIdf, et on applique une cross_val_score avec un Kfold de 10 fois, par la suite on stocke dans une liste all_results la moyenne des accuracy + l'écart type et on la trie par ordre décroissant de moyenne d'accuracy et d'écart type. on remarque que les 2 meilleurs sont SVM et RF qu'on va séléctionner pour leur appliquer le GridSearch sur les paramètres des prétraitements + leurs hyperparamètres pour pouvoir choisir le meilleur.

```
score = 'accuracy'
seed = 7
allresults = []
results = []
names = []
```

```
X_train_text=X_train['text']
X_train_text.reset_index(drop = True, inplace = True)
```

```
# Liste des modèles à tester
models = [
```

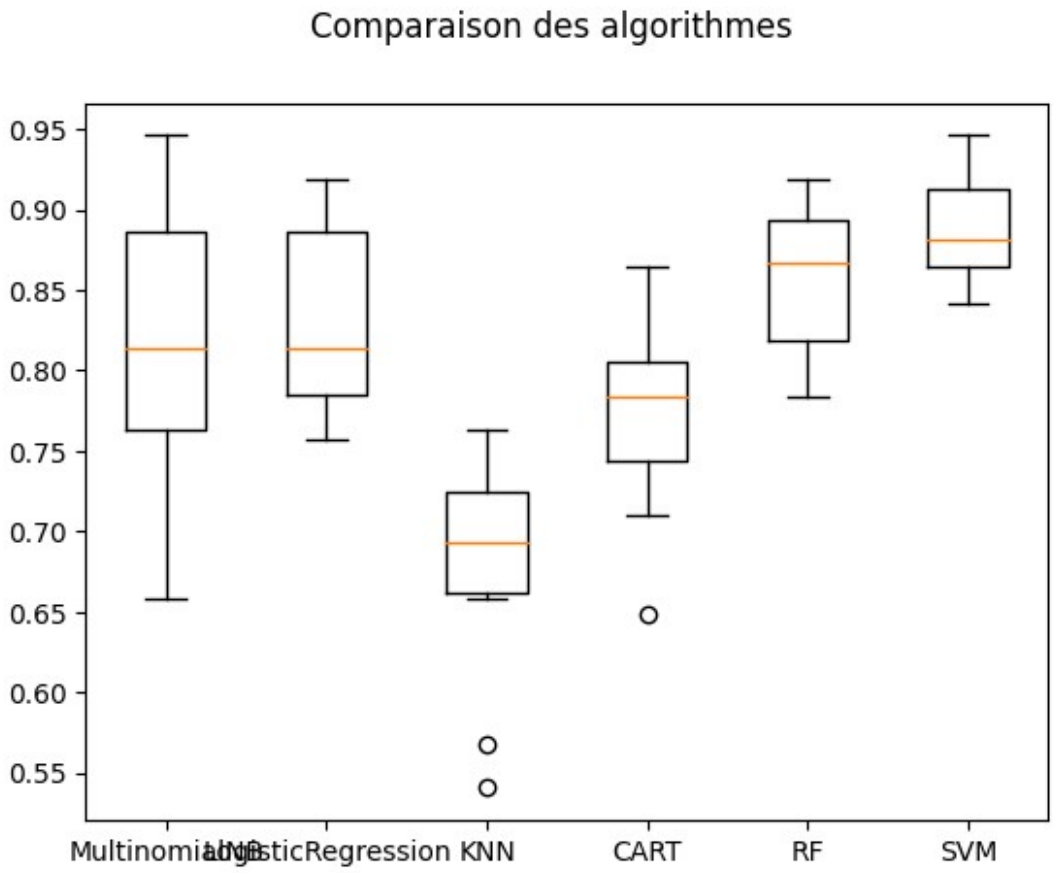
```
    ('MultinomialNB', MultinomialNB()),
    ('LogisticRegression', LogisticRegression(random_state=42))
]


models.append(('KNN', KNeighborsClassifier()))
models.append(('CART', DecisionTreeClassifier()))
models.append(('RF', RandomForestClassifier()))
models.append(('SVM', SVC()))


# Création d'un pipeline pour chaque modèle
pipelines = []
for name,model in models:
    pipeline = Pipeline([
        ('normalize', TextNormalizer()),
        ('tfidf', TfidfVectorizer()),
        (name,model)
    ])
    pipelines.append((name,pipeline))
    #pipeline.fit(X_train_text,y_train)
all_results=[]
scores=[]
for p in pipelines:
    print(p[1])
    # cross validation en 10 fois
    kfold = KFold(n_splits=10,random_state=seed,shuffle=True)

#    print ("Evaluation de ",p)
    start_time = time.time()
    # application de la classification
    cv_results = cross_val_score(p[1],X_train_text,y_train, cv=kfold,
scoring=score)
    #print("Pour le classifieur",p[0],"on a un score
de",cv_results.mean(),"et un écart type de",cv_results.std())
    scores.append(cv_results)
    names.append(p[0])

    all_results.append((p[0],cv_results.mean(),cv_results.std()))
    end_time = time.time()

all_results = sorted(all_results, key=lambda x: (-x[1], -x[2]))
print("all resultats", all_results)
    # affichage des résultats
#print ('\nLe meilleur resultat : ',max(results))

Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('MultinomialNB', MultinomialNB())])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
```

```
TfidfVectorizer()),
                ('LogisticRegression',
LogisticRegression(random_state=42))])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('KNN', KNeighborsClassifier())])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('CART', DecisionTreeClassifier())])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('RF', RandomForestClassifier())])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('SVM', SVC())])
all resultats [('SVM', 0.8905405405405405, 0.034340991473749326),
('RF', 0.8583926031294453, 0.04770538077042521),
('LogisticRegression', 0.8288051209103839, 0.05796655874052694),
('MultinomialNB', 0.8160028449502134, 0.08184799267920276), ('CART',
0.7702702702702704, 0.05700736481141925), ('KNN', 0.678805120910384,
0.07053038398537378)]
```

On affiche les accuracy de chaque classifieur, on remarque la médiane (en rouge) de chaque et l'écart type aussi.

```
import matplotlib.pyplot as plt
fig = plt.figure()
fig.suptitle('Comparaison des algorithmes')
ax = fig.add_subplot(111)
plt.boxplot(scores)
ax.set_xticklabels(names)
```

```
[Text(1, 0, 'MultinomialNB'),
 Text(2, 0, 'LogisticRegression'),
 Text(3, 0, 'KNN'),
 Text(4, 0, 'CART'),
 Text(5, 0, 'RF'),
 Text(6, 0, 'SVM')]
```



Choisir les meilleurs paramètres pour SVM et RF :

On a un pipeline pour chaque prétraitement différent, on essaye pas mal (miniscule, lemmatisation, miniscule + lemmatisation..) et on stocke le fit_transorm de nos X_train, X_test sur les pipelines dans des listes qui vont contenir tous les fit_transform des pipelines pour chaque classifieur, par la suite on parcourt ces listes là, on itère dessus, et chaque élement de la liste (train) va passer par le GridSearch et puis on predict sur son corresapondant dans liste (test).

```
from sklearn.model_selection import GridSearchCV
```

```
from sklearn.datasets import fetch_20newsgroups
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.model_selection import train_test_split, GridSearchCV
from sklearn.pipeline import Pipeline
from sklearn.metrics import accuracy_score
from sklearn.naive_bayes import MultinomialNB
from sklearn.linear_model import LogisticRegression
from sklearn.svm import SVC
from sklearn.naive_bayes import MultinomialNB
from tabulate import tabulate
```

```
import numpy as np



# le plus simple est de faire un test sur differents pipelines.
# pipeline de l'utilisation de TfidfVectorizer avec differents pre-
traitements
TFIDF_brut = Pipeline ([('cleaner', TextNormalizer()),
                    ('tfidf_vectorizer',
TfidfVectorizer(lowercase=False))])

TFIDF_lowcase = Pipeline([('cleaner',
TextNormalizer(removestopwords=False,lowercase=True,

getstemmer=False,removedigit=False)),
                    ('tfidf_vectorizer',
TfidfVectorizer(lowercase=False))])
TFIDF_lowStop = Pipeline([('cleaner',
TextNormalizer(removestopwords=True,lowercase=True,

getstemmer=False,removedigit=False)),
                    ('tfidf_vectorizer',
TfidfVectorizer(lowercase=False))])

TFIDF_lowStopstem = Pipeline([('cleaner',
TextNormalizer(removestopwords=True,lowercase=True,

getstemmer=True,removedigit=False)),
                    ('tfidf_vectorizer',
TfidfVectorizer(lowercase=False))])


# Liste de tous les modeles à tester
all_models = [
    ("TFIDF_lowcase", TFIDF_lowcase),
    ("TFIDF_lowStop", TFIDF_lowStop),
    ("TFIDF_lowStopstem",TFIDF_lowStopstem),
    ("TFIDF_brut", TFIDF_brut)
]

X_train_text_SVC = []
X_test_text_SVC = []



for name, pipeline in all_models :

X_train_text_SVC.append(pipeline.fit_transform(X_train['text']).toarra
```

```
y())

X_test_text_SVC.append(pipeline.transform(X_test['text']).toarray())
```

```
models = {
    'SVC': SVC(random_state=42)
}
```

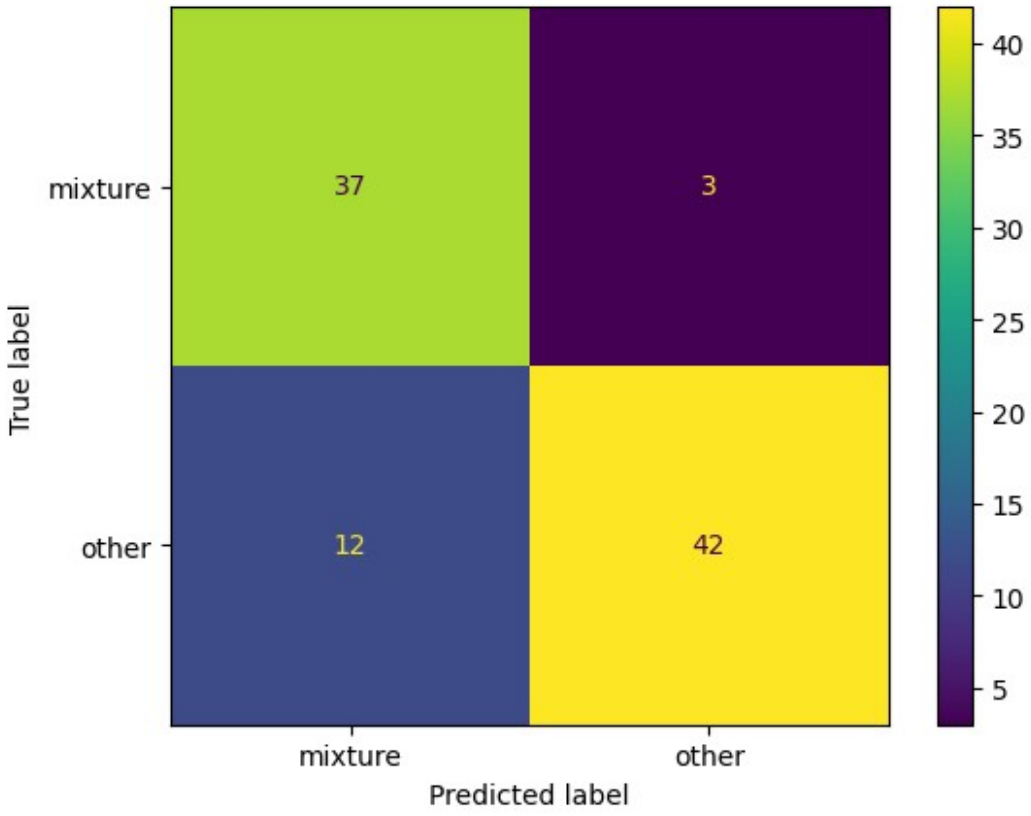
```
params = {'SVC': [{'C': [0.01, 0.1, 1,2]},
             {'gamma': [0.01, 0.1,0.2,1]},
             {'kernel': ['linear', 'rbf']}]
}
```

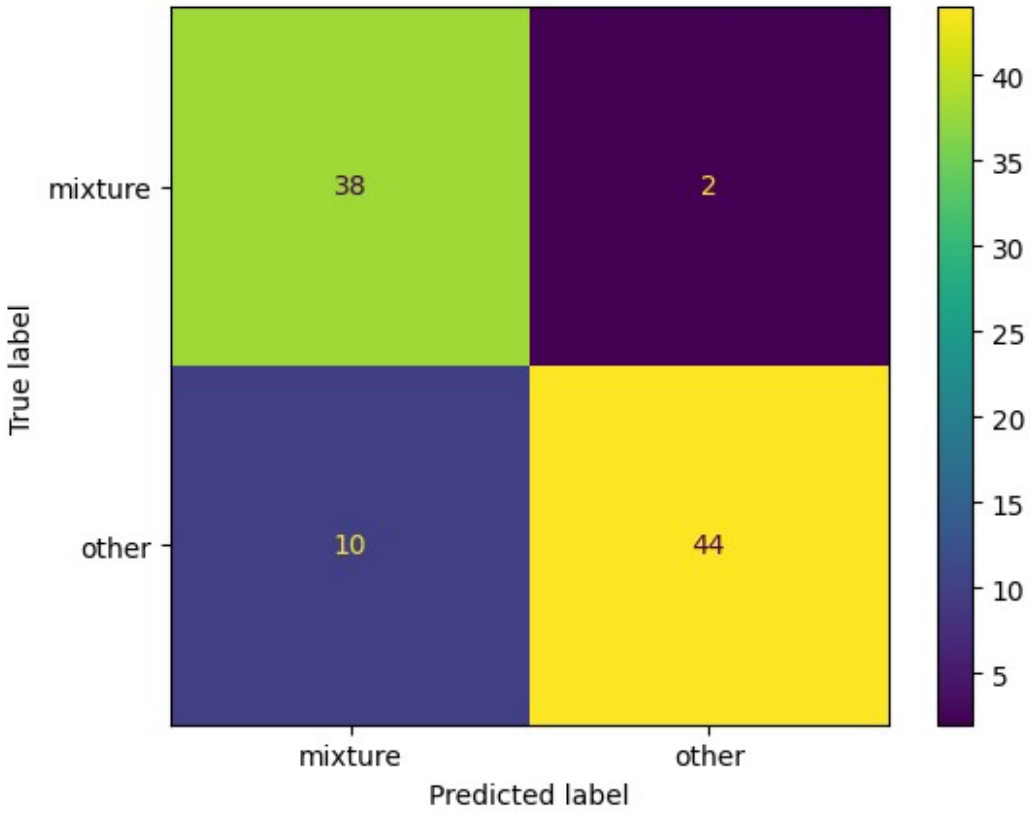
```
for model_name, model in models.items():
    score='accuracy'
    X_train_text = eval('X_train_text_' + model_name)
    X_test_text = eval('X_test_text_' + model_name)
    for i in range (len(X_train_text)):
      grid_search = GridSearchCV(model, params[model_name], n_jobs=-1,
verbose=1,scoring=score)
      print("grid search fait")
      print("X_train",X_train_text[i].shape)
      print("y_train",y_train.shape)
      grid_search.fit(X_train_text[i],y_train)
      print ('meilleur score %0.3f'%(grid_search.best_score_),'\n')
      print ('meilleur estimateur',grid_search.best_estimator_,'\n')
      y_pred = grid_search.predict(X_test_text[i])
      MyshowAllScores(y_test,y_pred)

      print("Ensemble des meilleurs paramètres :")
      best_parameters = grid_search.best_estimator_.get_params()
      for param_dict in params[model_name]:
        for param_name, param_value in param_dict.items():
            print("\t%s: %r" % (param_name,
best_parameters[param_name]))
```

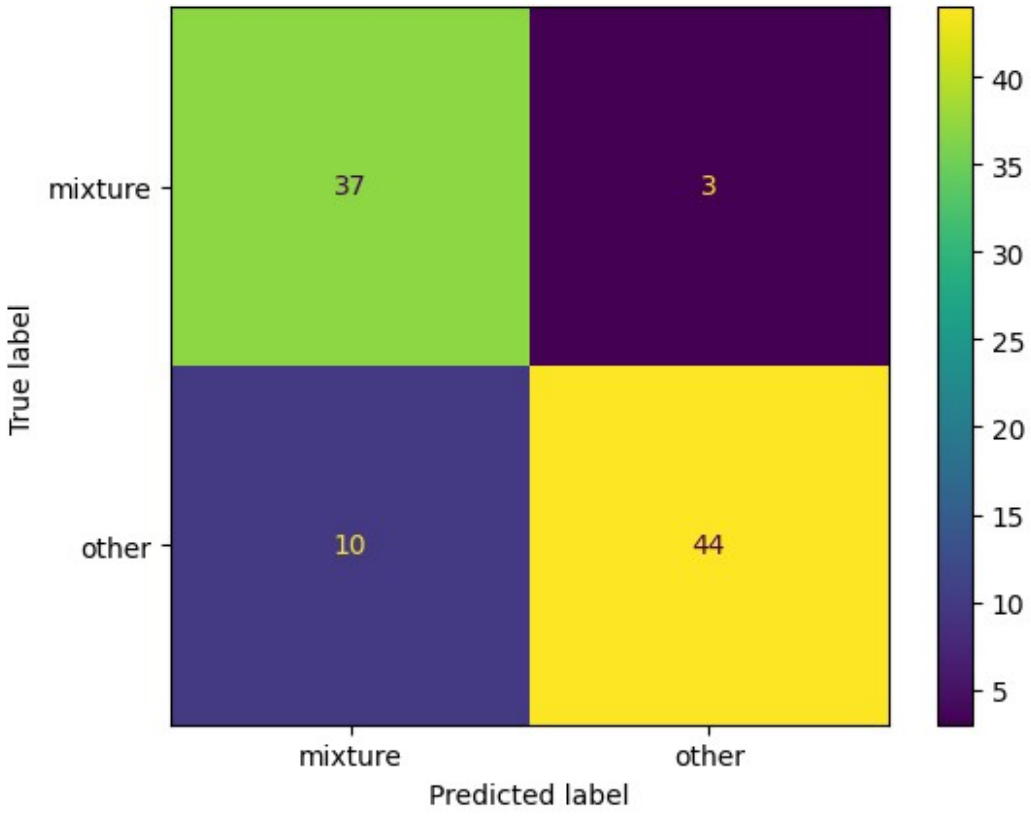
```
grid search fait
X_train (374, 15380)
y_train (374,)
Fitting 5 folds for each of 10 candidates, totalling 50 fits
meilleur score 0.855

meilleur estimateur SVC(C=1, random_state=42)
```

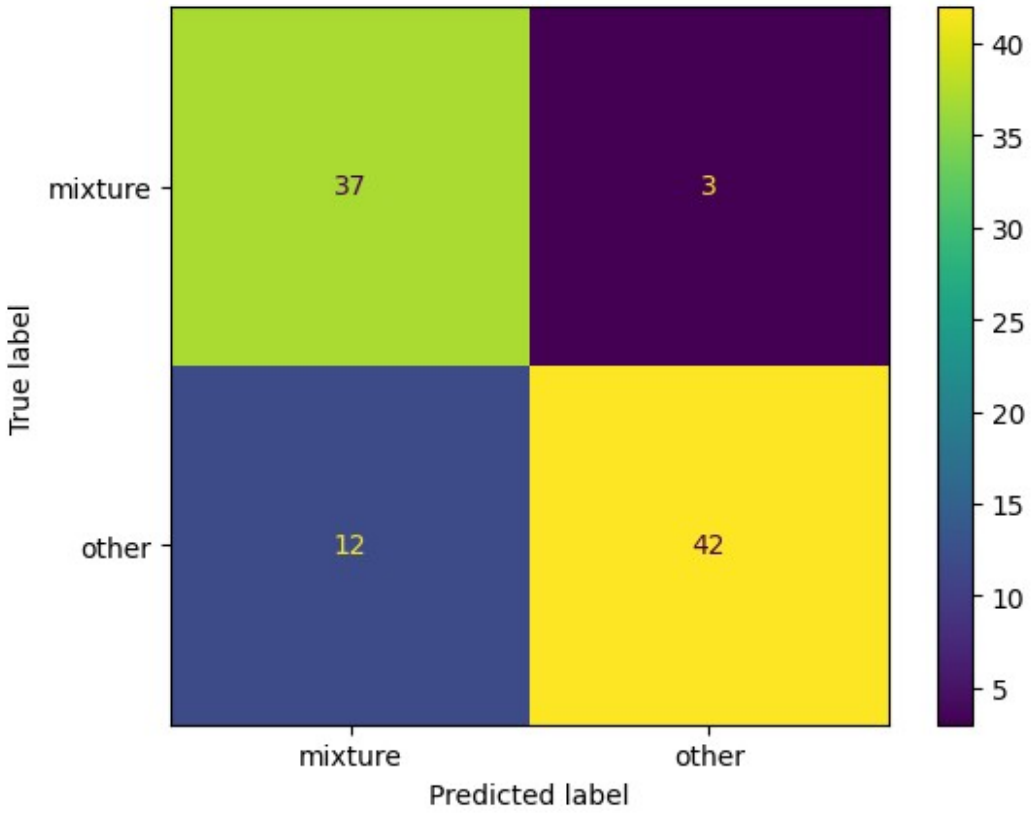
```
Accuracy : 0.840
Classification Report
              precision    recall  f1-score   support

     mixture    0.75510   0.92500   0.83146        40
       other    0.93333   0.77778   0.84848        54

    accuracy                        0.84043        94
   macro avg    0.84422   0.85139   0.83997        94
weighted avg    0.85749   0.84043   0.84124        94

Ensemble des meilleurs paramètres :
      C: 1
      gamma: 'scale'
      kernel: 'rbf'
grid search fait
X_train (374, 15242)
y_train (374,)
Fitting 5 folds for each of 10 candidates, totalling 50 fits
meilleur score 0.850

meilleur estimateur SVC(C=1, random_state=42)

Accuracy : 0.872
Classification Report
              precision    recall  f1-score   support

     mixture    0.79167   0.95000   0.86364        40
       other    0.95652   0.81481   0.88000        54

    accuracy                        0.87234        94
   macro avg    0.87409   0.88241   0.87182        94
weighted avg    0.88637   0.87234   0.87304        94

Ensemble des meilleurs paramètres :
      C: 1
      gamma: 'scale'
      kernel: 'rbf'
grid search fait
X_train (374, 10422)
y_train (374,)
Fitting 5 folds for each of 10 candidates, totalling 50 fits
meilleur score 0.853

meilleur estimateur SVC(C=2, random_state=42)

Accuracy : 0.862
Classification Report
              precision    recall  f1-score   support
```

```
     mixture    0.78723   0.92500   0.85057        40
       other    0.93617   0.81481   0.87129        54

    accuracy                        0.86170        94
   macro avg    0.86170   0.86991   0.86093        94
weighted avg    0.87279   0.86170   0.86247        94

Ensemble des meilleurs paramètres :
     C: 2
     gamma: 'scale'
     kernel: 'rbf'
grid search fait
X_train (374, 17931)
y_train (374,)
Fitting 5 folds for each of 10 candidates, totalling 50 fits
meilleur score 0.858

meilleur estimateur SVC(C=1, random_state=42)

Accuracy : 0.840
Classification Report
              precision    recall  f1-score   support

     mixture    0.75510   0.92500   0.83146        40
       other    0.93333   0.77778   0.84848        54

    accuracy                        0.84043        94
   macro avg    0.84422   0.85139   0.83997        94
weighted avg    0.85749   0.84043   0.84124        94

Ensemble des meilleurs paramètres :
     C: 1
     gamma: 'scale'
     kernel: 'rbf'
```


mixture
other
True label
37
3
12
42
mixture
other
Predicted label
40
35
30
25
20
15
10
5


mixture
other
True label
38
2
10
44
mixture
other
Predicted label
40
35
30
25
20
15
10
5


mixture
other
True label
37
3
10
44
mixture
other
Predicted label
40
35
30
25
20
15
10
5


mixture
other
True label
37
3
12
42
mixture
other
Predicted label
40
35
30
25
20
15
10
5

###**Etape 4 : Classification selon le TITRE ET TEXT ENSEMBLE (Concaténés):**

- On va à partir de X_train concaténer les 2 colonnes TEXT et TITLE en mettant un espace entre les deux
- Vu qu'on va travailler sur la colonne text_titre qu'on vient de créer, on va séléctionner cette dernière depuis le X_train et X_test pour apprendre et tester après.

```
#concaténation
X_train=X_train.apply(lambda row: ' '.join([str(val) for val in row]),
axis=1)
X_test=X_test.apply(lambda row: ' '.join([str(val) for val in row]),
axis=1)
```

```
from sklearn.datasets import fetch_20newsgroups
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.model_selection import train_test_split, GridSearchCV
from sklearn.pipeline import Pipeline
from sklearn.metrics import accuracy_score
from sklearn.naive_bayes import MultinomialNB
from sklearn.linear_model import LogisticRegression
from sklearn.svm import SVC
from sklearn.naive_bayes import MultinomialNB
import time
import numpy as np
```

```
score = 'accuracy'
seed = 7
allresults = []
results = []
names = []
```

```
# Liste des modèles à tester
models = [
    ('MultinomialNB', MultinomialNB()),
    ('LogisticRegression', LogisticRegression(random_state=42))
]
```

```
#models.append(('LR', LogisticRegression(solver='lbfgs')))
models.append(('KNN', KNeighborsClassifier()))
models.append(('CART', DecisionTreeClassifier(random_state=42)))
models.append(('RF', RandomForestClassifier(random_state=42)))
models.append(('SVM', SVC(random_state=42)))
```

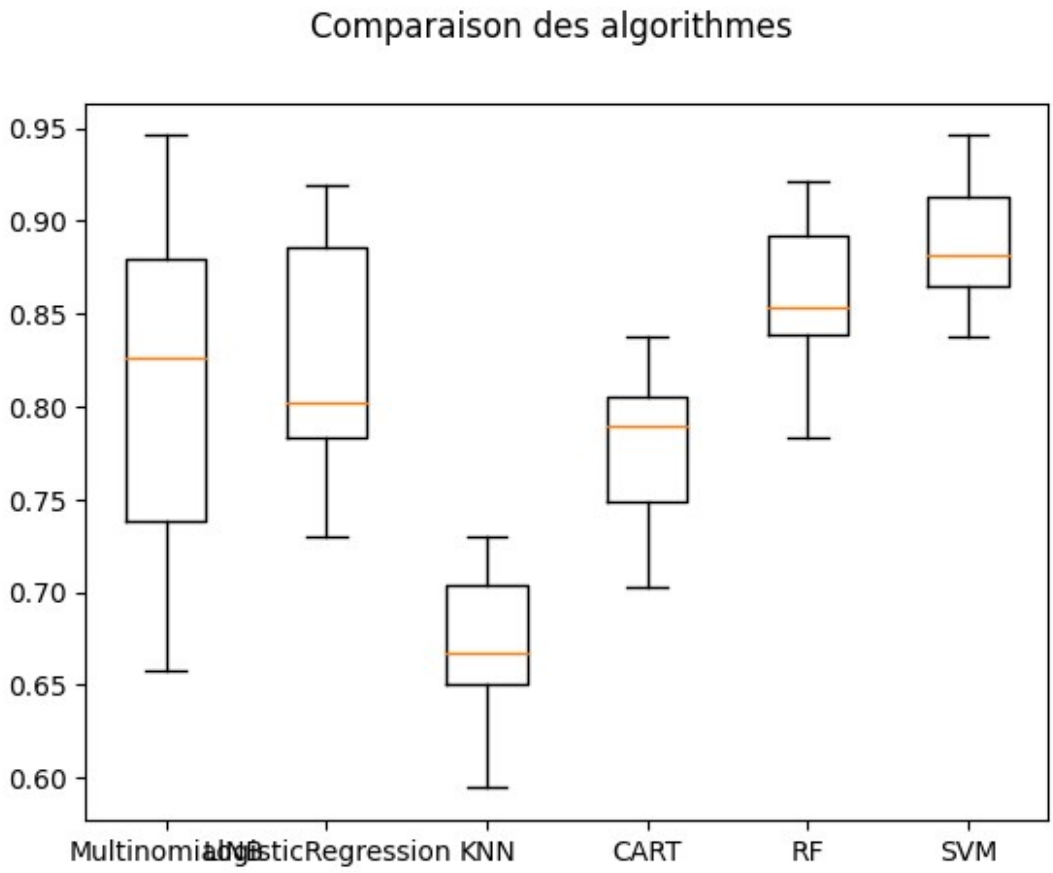
```
# Création d'un pipeline pour chaque modèle
pipelines = []
for name,model in models:
    pipeline = Pipeline([
        ('normalize', TextNormalizer()),
        ('tfidf', TfidfVectorizer()),
        (name,model)
    ])
    pipelines.append((name,pipeline))

all_results=[]
scores=[]
for p in pipelines:
    print(p[1])
    # cross validation en 10 fois
    kfold = KFold(n_splits=10,random_state=seed,shuffle=True)

#    print ("Evaluation de ",p)
    start_time = time.time()
    # application de la classification
    cv_results = cross_val_score(p[1],X_train,y_train, cv=kfold,
scoring=score)
    scores.append(cv_results)
    names.append(p[0])
    all_results.append((p[0],cv_results.mean(),cv_results.std()))
    end_time = time.time()


print("all resultats", all_results)

all_results = sorted(all_results, key=lambda x: (-x[1], -x[2]))
print("all resultats", all_results)
    # affichage des résultats
#print ('\nLe meilleur resultat : ',max(results))

Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('MultinomialNB', MultinomialNB())])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('LogisticRegression',
LogisticRegression(random_state=42))])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('KNN', KNeighborsClassifier())])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('CART', DecisionTreeClassifier(random_state=42))])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
```

```
                ('RF', RandomForestClassifier(random_state=42))])
Pipeline(steps=[('normalize', TextNormalizer()), ('tfidf',
TfidfVectorizer()),
                ('SVM', SVC(random_state=42))])
all resultats [('MultinomialNB', 0.8105263157894737,
0.08495297157527221), ('LogisticRegression', 0.8233285917496443,
0.062043563685130185), ('KNN', 0.6683499288762447,
0.04594071596039143), ('CART', 0.7780938833570412,
0.039819141154403895), ('RF', 0.8610241820768136,
0.04259261988126618), ('SVM', 0.8851351351351351,
0.03369682602271237)]
all resultats [('SVM', 0.8851351351351351, 0.03369682602271237),
('RF', 0.8610241820768136, 0.04259261988126618),
('LogisticRegression', 0.8233285917496443, 0.062043563685130185),
('MultinomialNB', 0.8105263157894737, 0.08495297157527221), ('CART',
0.7780938833570412, 0.039819141154403895), ('KNN', 0.6683499288762447,
0.04594071596039143)]
```

On affiche les accuracy de chaque classifieur, on remarque la médiane (en rouge) de chaque et l'écart type aussi.

```
import matplotlib.pyplot as plt
fig = plt.figure()
fig.suptitle('Comparaison des algorithmes')
ax = fig.add_subplot(111)
plt.boxplot(scores)
ax.set_xticklabels(names)
```

```
[Text(1, 0, 'MultinomialNB'),
 Text(2, 0, 'LogisticRegression'),
 Text(3, 0, 'KNN'),
 Text(4, 0, 'CART'),
 Text(5, 0, 'RF'),
 Text(6, 0, 'SVM')]
```



Choisir les meilleurs paramètres pour SVM et RF :

On a un pipeline pour chaque prétraitement différent, on essaye pas mal (miniscule, lemmatisation, miniscule + lemmatisation..) et on stocke le fit_transorm de nos X_train, X_test sur les pipelines dans des listes qui vont contenir tous les fit_transform des pipelines pour chaque classifieur, par la suite on parcourt ces listes là, on itère dessus, et chaque élement de la liste (train) va passer par le GridSearch et puis on predict sur son corresapondant dans liste (test).

```
from sklearn.model_selection import GridSearchCV
```

```
from sklearn.datasets import fetch_20newsgroups
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.model_selection import train_test_split, GridSearchCV
from sklearn.pipeline import Pipeline
from sklearn.metrics import accuracy_score
from sklearn.naive_bayes import MultinomialNB
from sklearn.linear_model import LogisticRegression
from sklearn.svm import SVC
from sklearn.naive_bayes import MultinomialNB
from tabulate import tabulate
```

```
import numpy as np



# pipeline de l'utilisation de TfidfVectorizer avec differents pre-
traitements
TFIDF_brut = Pipeline ([('cleaner', TextNormalizer()),
                    ('tfidf_vectorizer',
TfidfVectorizer(lowercase=False))])

TFIDF_lowcase = Pipeline([('cleaner',
TextNormalizer(removestopwords=False,lowercase=True,

getstemmer=False,removedigit=False)),
                    ('tfidf_vectorizer',
TfidfVectorizer(lowercase=False))])
TFIDF_lowStop = Pipeline([('cleaner',
TextNormalizer(removestopwords=True,lowercase=True,

getstemmer=False,removedigit=False)),
                    ('tfidf_vectorizer',
TfidfVectorizer(lowercase=False))])

TFIDF_lowStopstem = Pipeline([('cleaner',
TextNormalizer(removestopwords=True,lowercase=True,

getstemmer=True,removedigit=False)),
                    ('tfidf_vectorizer',
TfidfVectorizer(lowercase=False))])


# Liste de tous les modeles à tester
all_models = [
    ("TFIDF_lowcase", TFIDF_lowcase),
    ("TFIDF_lowStop", TFIDF_lowStop),
    ("TFIDF_lowStopstem",TFIDF_lowStopstem),
    ("TFIDF_brut", TFIDF_brut)
]

X_train_title_text_SVC = []
X_test_title_text_SVC = []




for name, pipeline in all_models :

X_train_title_text_SVC.append(pipeline.fit_transform(X_train).toarray(
))
```

```
    X_test_title_text_SVC.append(pipeline.transform(X_test).toarray())
```

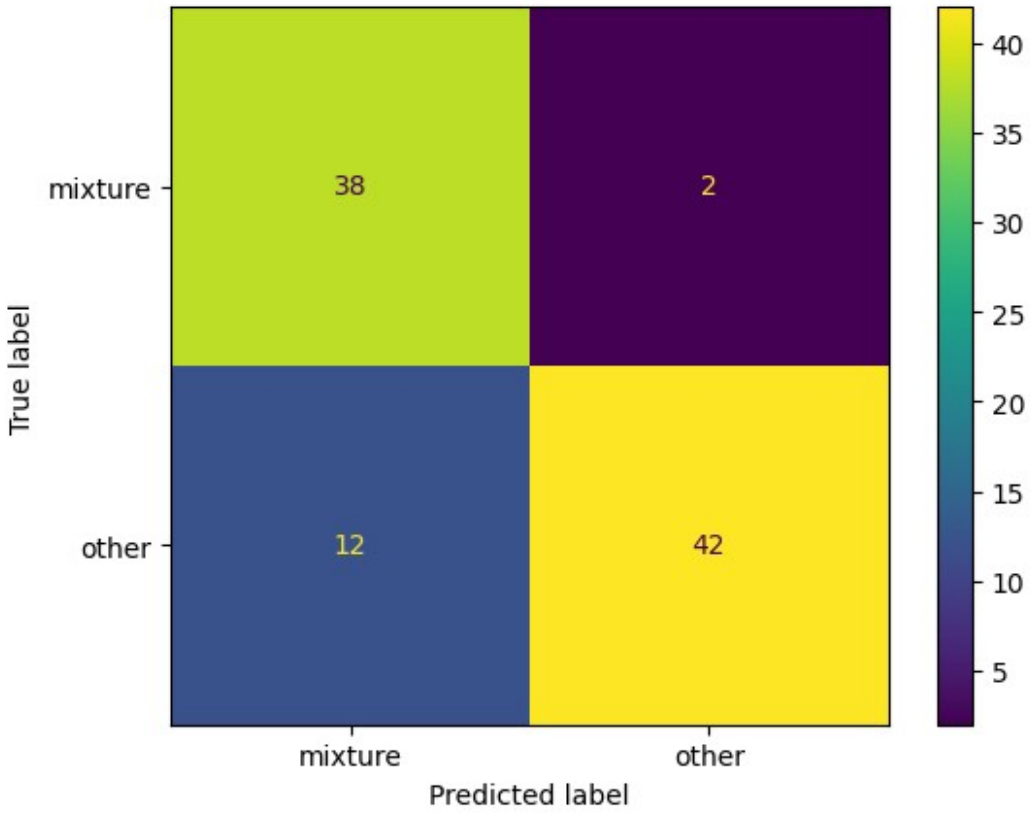
```
models = {
    'SVC': SVC(random_state=42)
}
```

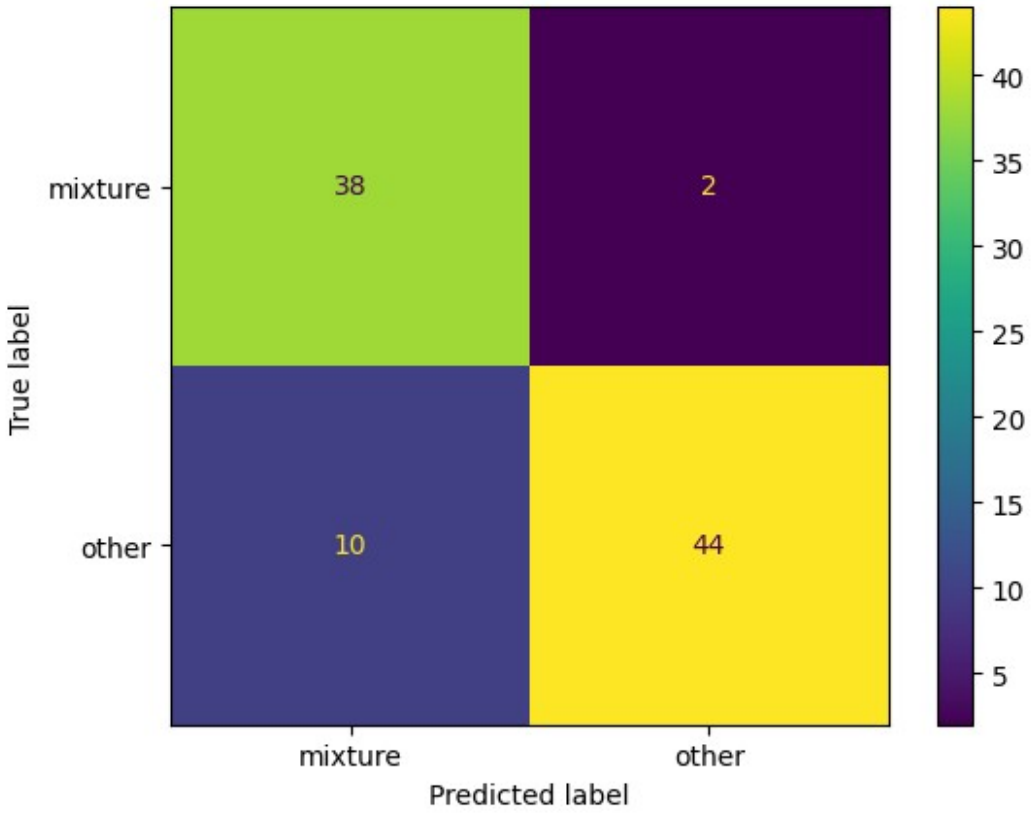
```
params = {'SVC': [{'C': [0.01, 0.1, 1,2]},
             {'gamma': [0.001, 0.01, 0.1,1]},
             {'kernel': ['linear', 'rbf']}]
}

for model_name, model in models.items():
    score='accuracy'
    X_train_title_text = eval('X_train_title_text_' + model_name)
    X_test_title_text = eval('X_test_title_text_' + model_name)
    for i in range (len(X_train_title_text)):
      grid_search = GridSearchCV(model, params[model_name], n_jobs=-1,
verbose=1,scoring=score)
      print("grid search fait")
      print("X_train_title_text",X_train_title_text[i].shape)
      print("y_train",y_train.shape)
      grid_search.fit(X_train_title_text[i],y_train)
      print ('meilleur score %0.3f'%(grid_search.best_score_),'\n')
      print ('meilleur estimateur',grid_search.best_estimator_,'\n')
      y_pred = grid_search.predict(X_test_title_text[i])
      MyshowAllScores(y_test,y_pred)

      print("Ensemble des meilleurs paramètres :")
      best_parameters = grid_search.best_estimator_.get_params()
      for param_dict in params[model_name]:
        for param_name, param_value in param_dict.items():
            print("\t%s: %r" % (param_name,
best_parameters[param_name]))
```

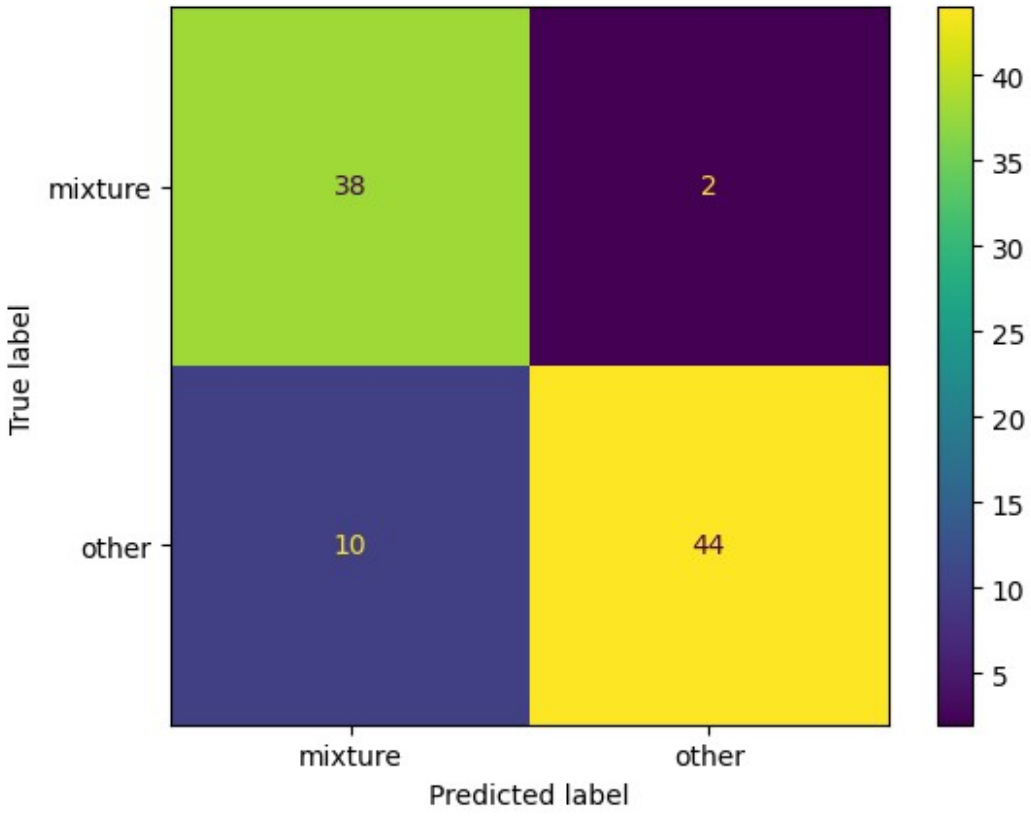
```
grid search fait
X_train_title_text (374, 15727)
y_train (374,)
Fitting 5 folds for each of 10 candidates, totalling 50 fits
meilleur score 0.850

meilleur estimateur SVC(C=1, random_state=42)

Accuracy : 0.851
Classification Report
              precision    recall  f1-score   support
```

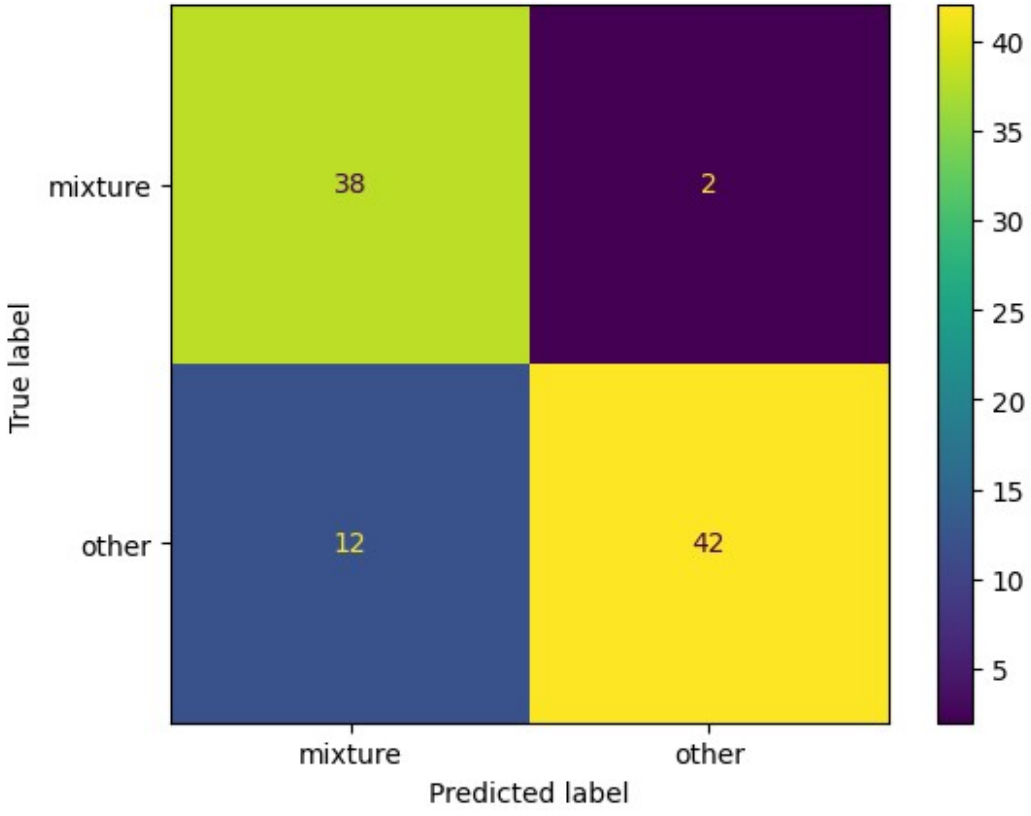
```
     mixture    0.76000   0.95000   0.84444        40
       other    0.95455   0.77778   0.85714        54

    accuracy                        0.85106        94
   macro avg    0.85727   0.86389   0.85079        94
weighted avg    0.87176   0.85106   0.85174        94

Ensemble des meilleurs paramètres :
     C: 1
     gamma: 'scale'
     kernel: 'rbf'
grid search fait
X_train_title_text (374, 15589)
y_train (374,)
Fitting 5 folds for each of 10 candidates, totalling 50 fits
meilleur score 0.853

meilleur estimateur SVC(C=1, random_state=42)

Accuracy : 0.872
Classification Report
              precision    recall  f1-score   support

     mixture    0.79167   0.95000   0.86364        40
       other    0.95652   0.81481   0.88000        54

    accuracy                        0.87234        94
   macro avg    0.87409   0.88241   0.87182        94
weighted avg    0.88637   0.87234   0.87304        94

Ensemble des meilleurs paramètres :
     C: 1
     gamma: 'scale'
     kernel: 'rbf'
grid search fait
X_train_title_text (374, 10636)
y_train (374,)
Fitting 5 folds for each of 10 candidates, totalling 50 fits
meilleur score 0.855

meilleur estimateur SVC(C=1, random_state=42)

Accuracy : 0.872
Classification Report
              precision    recall  f1-score   support

     mixture    0.79167   0.95000   0.86364        40
       other    0.95652   0.81481   0.88000        54
```

```
    accuracy                           0.87234        94
   macro avg    0.87409   0.88241   0.87182        94
weighted avg    0.88637   0.87234   0.87304        94

Ensemble des meilleurs paramètres :
     C: 1
     gamma: 'scale'
     kernel: 'rbf'
grid search fait
X_train_title_text (374, 18509)
y_train (374,)
Fitting 5 folds for each of 10 candidates, totalling 50 fits
meilleur score 0.858

meilleur estimateur SVC(C=1, random_state=42)

Accuracy : 0.851
Classification Report
              precision    recall  f1-score   support

     mixture    0.76000   0.95000   0.84444        40
       other    0.95455   0.77778   0.85714        54

    accuracy                           0.85106        94
   macro avg    0.85727   0.86389   0.85079        94
weighted avg    0.87176   0.85106   0.85174        94

Ensemble des meilleurs paramètres :
     C: 1
     gamma: 'scale'
     kernel: 'rbf'
```


mixture
other
True label
38
2
12
42
mixture
other
Predicted label
40
35
30
25
20
15
10
5


mixture
other
True label
38
2
10
44
mixture
other
Predicted label
40
35
30
25
20
15
10
5


mixture
other
True label
38
2
10
44
mixture
other
Predicted label
40
35
30
25
20
15
10
5


mixture
other
True label
38
2
12
42
mixture
other
Predicted label
40
35
30
25
20
15
10
5

Classification de Other/Mixture avec les meilleurs prétraitements et meilleurs paramètres

```
dftrain = dftrainbase.loc[dftrainbase['rating'].isin(['other',
'mixture'])]
y=dftrain.iloc[0:,-2]
print(y)
print("les valeurs de MIXTURE et OTHER maintenant sont
" ,y.value_counts())
```

```
1       mixture
2       mixture
5         other
10      mixture
13      mixture
         ...
2517    mixture
2518    mixture
2519    mixture
2520    mixture
2522      other
Name: rating, Length: 950, dtype: object
les valeurs de MIXTURE et OTHER maintenant sont  mixture    716
other      234
Name: rating, dtype: int64
```

```
# Compter le nombre d'observations dans chaque catégorie
mixture_count = dftrain['rating'].value_counts()['mixture']
other_count = dftrain['rating'].value_counts()['other']

# Trouver le nombre minimum d'observations parmi les catégories
min_count = min( mixture_count, other_count)

# Sous-échantillonner les catégories pour équilibrer les quantités
mixture_sampled = dftrain[dftrain['rating'] ==
'mixture'].sample(min_count, random_state=42)
other_sampled = dftrain[dftrain['rating'] ==
'other'].sample(min_count, random_state=42)


# Concaténer les échantillons pour obtenir un nouveau dataframe
équilibré
dftrain = pd.concat([mixture_sampled,other_sampled])

# Mélanger aléatoirement les données
dftrain = dftrain.sample(frac=1, random_state=42)
X_text=dftrain["text"]
X_title=dftrain["title"]
y=dftrain.iloc[0:,-2]
print("\n")
print("la taille de y_train est " ,y.shape)
```

```
print("\n")
print("les valeurs de OTHER et MIXTURE maintenant sont
" ,y.value_counts())
```

```
la taille de y_train est  (468,)
```

```
les valeurs de OTHER et MIXTURE maintenant sont  mixture    234
other      234
Name: rating, dtype: int64
```

```
X=dftrain["title"]
print(X)

X_train,X_test,y_train,y_test=train_test_split(X,y,test_size =
0.2,random_state=8)
print("X_train is",X_train)
print("y_train is",y_train)
print("X_test is",X_test)
print("y_test is",y_test)
y_test_2 = y_test
```

```
2236    COVID-19: ''Abba Kyari Dead Of Coronavirus' – ...
2450    WHO: United States Among Least Polluting Natio...
1802    Trump Won Two-Thirds of Election Lawsuits Wher...
2359    Addicts and alcoholics cost us £10billion a ye...
1931    Electric Car-Owners Shocked: New Study Confirm...
                              ...
1887    DUP man dating Poots' daughter claims his 'tea...
1940                           Warren Statement on Boeing
1837                     European Court of Killers' Rights
458     Almost 2,400 people declared 'fit to work' wer...
817                     Fighting Human Trafficking in Texas
Name: title, Length: 468, dtype: object
X_train is 1057    NHS Long Term Plan to tackle major killer cond...
440     Carbon dioxide didn't create climate crisis, s...
1290    Flynn campaign: Statement on Walker campaign a...
1137    52% of Americans would feel very comfortable w...
1518    Schools spending £1.3bn on supply teachers as ...
                              ...
633     Florida Senator Rick Scott on Paris Climate Ag...
2368          Imagine what Labour's garden tax would mean
2111    Principal banned candy canes because 'J' shape...
164           Paul Ryan's Worst Ally - The New York Times
1149          We won't let women be second class citizens
Name: title, Length: 374, dtype: object
y_train is 1057      other
440     mixture
```

```
1290    mixture
1137    mixture
1518    mixture
         ...
633     mixture
2368    mixture
2111      other
164     mixture
1149    mixture
Name: rating, Length: 374, dtype: object
X_test is 208     European royals killing naked children for fun...
2245    Joe Biden Is Aiming To End The Federal Use Of ...
263     Biden Has Been Given Debate Questions in Advan...
2081                 Fighting Human Trafficking in Texas
1046    DUP man dating Poots' daughter claims his 'tea...
                              ...
1995    Private firms given £9.2bn of NHS budget despi...
768     Billionaire Jeffrey Epstein arrested and accus...
941                                  A 62% Top Tax Rate?
2385    London's most miserable boroughs revealed to b...
1269    K A B O O M! Governor and Secretary of State i...
Name: title, Length: 94, dtype: object
y_test is 208       other
2245      other
263       other
2081    mixture
1046    mixture
         ...
1995    mixture
768       other
941       other
2385      other
1269      other
Name: rating, Length: 94, dtype: object
```

```
# création du pipeline en ajoutant le classifier
pipe = Pipeline([('cleaner',
TextNormalizer(removestopwords=False,lowercase=True,

getstemmer=False,removedigit=False)),
                    ('tfidf_vectorizer',
TfidfVectorizer(lowercase=False)),
                    ("SVM", SVC(C=2, gamma='scale', kernel='rbf',
random_state=42))])


pipetexte=pipe.fit(X_train,y_train)
print("à présent",y)
```

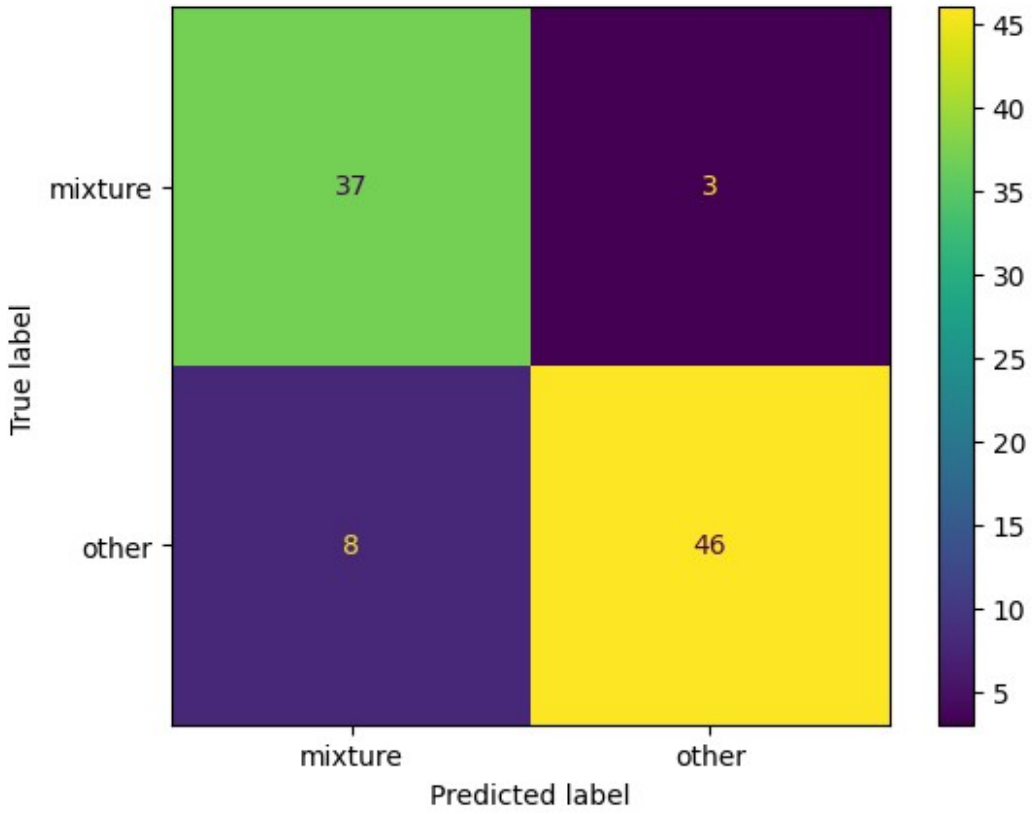
```
#save pipe
print("pipeline créé")
```

```
à présent 2236    mixture
2450    mixture
1802    mixture
2359      other
1931    mixture
         ...
1887    mixture
1940      other
1837      other
458       other
817     mixture
Name: rating, Length: 468, dtype: object
pipeline créé
```

Résultats de la classification selon Mixture et Other

```
X_test_text=X_test
print(X_test_text)
y_pred_2=pipetexte.predict(X_test_text)
MyshowAllScores(y_test,y_pred_2)
```

```
208     European royals killing naked children for fun...
2245    Joe Biden Is Aiming To End The Federal Use Of ...
263     Biden Has Been Given Debate Questions in Advan...
2081                 Fighting Human Trafficking in Texas
1046    DUP man dating Poots' daughter claims his 'tea...
                            ...
1995    Private firms given £9.2bn of NHS budget despi...
768     Billionaire Jeffrey Epstein arrested and accus...
941                                  A 62% Top Tax Rate?
2385    London's most miserable boroughs revealed to b...
1269    K A B O O M! Governor and Secretary of State i...
Name: title, Length: 94, dtype: object
Accuracy : 0.883
Classification Report
              precision    recall  f1-score   support

     mixture    0.82222   0.92500   0.87059        40
       other    0.93878   0.85185   0.89320        54

    accuracy                        0.88298        94
   macro avg    0.88050   0.88843   0.88190        94
weighted avg    0.88918   0.88298   0.88358        94
```



##Classification sur True vs False

```
dftrain = dftrainbase.loc[dftrainbase['rating'].isin(['TRUE',
'FALSE'])]
y=dftrain.iloc[0:,-2]
print("les valeurs de TRUE et FALSE maintenant sont
" ,y.value_counts())
```

```
les valeurs de TRUE et FALSE maintenant sont  FALSE    1156
TRUE      422
Name: rating, dtype: int64
```

```
# Compter le nombre d'observations dans chaque catégorie
df_true = dftrain[dftrain['rating']=="TRUE"]
df_false = dftrain[dftrain['rating']=="FALSE"]

# Sous-échantillonner la classe majoritaire (FALSE) pour obtenir un
nombre égal d'échantillons pour chaque classe
df_false_subsampled = df_false.sample(n=len(df_true), random_state=42)

# Concaténer les deux dataframes
dftrain = pd.concat([df_false_subsampled, df_true])

# Mélanger aléatoirement les données
dftrain = dftrain.sample(frac=1, random_state=42)
```

```
X_text=dftrain["text"]
X_title=dftrain["title"]
print("La taille de X_text",X_text.shape)
y=dftrain.iloc[0:,-2]
print(y)
print("\n")
print("la taille de y est " ,y.shape)
print("\n")
print("les valeurs de TRUE et FALSE maintenant sont
" ,y.value_counts())
```

```
La taille de X_text (844,)
615      TRUE
1303    FALSE
1232     TRUE
2022     TRUE
287     FALSE
        ...
1006    FALSE
1543    FALSE
853     FALSE
296      TRUE
1325    FALSE
Name: rating, Length: 844, dtype: object


la taille de y est  (844,)


les valeurs de TRUE et FALSE maintenant sont  TRUE     422
FALSE    422
Name: rating, dtype: int64
```

```
X=dftrain.iloc[0:, 1:3]
print(X)

X_train,X_test,y_train,y_test=train_test_split(X,y,test_size =
0.2,random_state=8)
print("X_train is",X_train)
print("y_train is",y_train)
print("X_test is",X_test)
print("y_test is",y_test)
y_test_1=y_test
```

```
                                                  text  \
615   It’s been a long time coming, but finally we h...
```

```
1303  Constitutional Attorney Matthew DePerno is an ...
1232  The United States is witnessing a massive, dan...
2022  After three decades on the bench, Sarah Parker...
287   Based on actual results and accounting for sta...
...                                                 ...
1006  5 Million Muslim Children In Yemen Died due to...
1543  The bombshell claim comes from over 20 hours o...
853   BILL GATES EXPLAINS THAT THE COVID VACCINE WIL...
296   Let our journalists help you make sense of the...
1325  Though the whole world relies on RT-PCR to “di...

                                                  title
615   JK Rowling Confirms Stance Against Transgender...
1303  MI Sec of State Official Caught On Video Telli...
1232  What science can tell us about the links betwe...
2022        Sarah Parker leaves legacy on Supreme Court
287   Current Actual Election Result Update: Preside...
...                                                 ...
1006  Re: Meeting the need for isolation space for h...
1543  Breaking: Breonna Taylor’s boyfriend says SHE ...
853   A quote from Politifact: Gates never said that...
296   Before This Election, Newt Gingrich Believed t...
1325   COVID19 PCR Tests are Scientifically Meaningless

[844 rows x 2 columns]
X_train is                                                  text  \
1867  (CNN) From the moment a child is born, its gen...
1540  During the Republican National convention, Pre...
2495  A large research synthesis, published in one o...
1197  Global warming could be far worse than predict...
788   Nearly 40,000 Wisconsinites would lose benefit...
...                                                 ...
2224  TIJUANA, Mexico — It’s the image from the unfo...
2424  The scale of Antarctica is startling. Miles of...
2038  An 18-year-old United States citizen has been ...
1295  It is absolutely right that across this House ...
1890  Justine Greening resigned from the government ...

                                                  title
1867   Trump's Tariffs Look Like a Self-Inflicted Wound
1540      Biden Says the Second Amendment is ‘Obsolete’
2495  Scientists have just detected a major change t...
1197  Global warming could be far worse than predict...
788   "Anyone raising concern about the safety of Co...
...                                                 ...
2224  A discussion of ‘smokers’ black lungs’ started...
2424               Miles of Ice Collapsing Into the Sea
2038                                                NaN
1295                            Wednesday 25 April 2018
1890  CLARKSBURG — When Jared Henry and Maddie Manse...
```

```
[675 rows x 2 columns]
y_train is 1867     TRUE
1540    FALSE
2495     TRUE
1197     TRUE
788      TRUE
        ...
2224     TRUE
2424     TRUE
2038     TRUE
1295     TRUE
1890     TRUE
Name: rating, Length: 675, dtype: object
X_test is                                                        text  \
360   Then-Secretary of State Hillary Clinton respon...
1216  Story highlights Global sea level is on the ri...
2466  Australia’s Great Barrier Reef has worst coral...
1757  News| [email protected] “If you won’t lead, th...
1387  For once, it’s not President Trump making head...
...                                                 ...
2435  The oldest and thickest sea ice in the Arctic ...
523   A coalition of civil society groups has descri...
2127  A coalition of civil society groups has descri...
247   With merchants in Democrat-run cities boarding...
615   It’s been a long time coming, but finally we h...

                                                  title
360          Coverup on Benghazi does make a difference
1216  Observations show sea levels rising, and clima...
2466  Australia’s Great Barrier Reef has worst coral...
1757  IT'S OFFICIAL: Brexit Britain WILL thrive out ...
1387  Marco Rubio Just Publicly Shamed His Own Const...
...                                                 ...
2435  Arctic’s strongest sea ice breaks up for first...
523   Tesco food waste rose to equivalent of 119m me...
2127                                                NaN
247   Antifa gearing up for false flag violence disg...
615   JK Rowling Confirms Stance Against Transgender...

[169 rows x 2 columns]
y_test is 360      TRUE
1216     TRUE
2466     TRUE
1757    FALSE
1387    FALSE
        ...
2435     TRUE
523      TRUE
2127     TRUE
```

```
247     FALSE
615      TRUE
Name: rating, Length: 169, dtype: object
```

```
# création du pipeline en ajoutant le classifier
pipe = Pipeline([('cleaner',
TextNormalizer(removestopwords=True,lowercase=True,

getstemmer=True,removedigit=False)),
                    ('tfidf_vectorizer',
TfidfVectorizer(lowercase=False)),
                    ("SVM", SVC(C=2, gamma='scale', kernel='rbf',
random_state=42))])
pipetexte=pipe.fit(X_train["text"],y_train)
print("à présent",y_train)

#save pipe
print("pipeline créé")
```

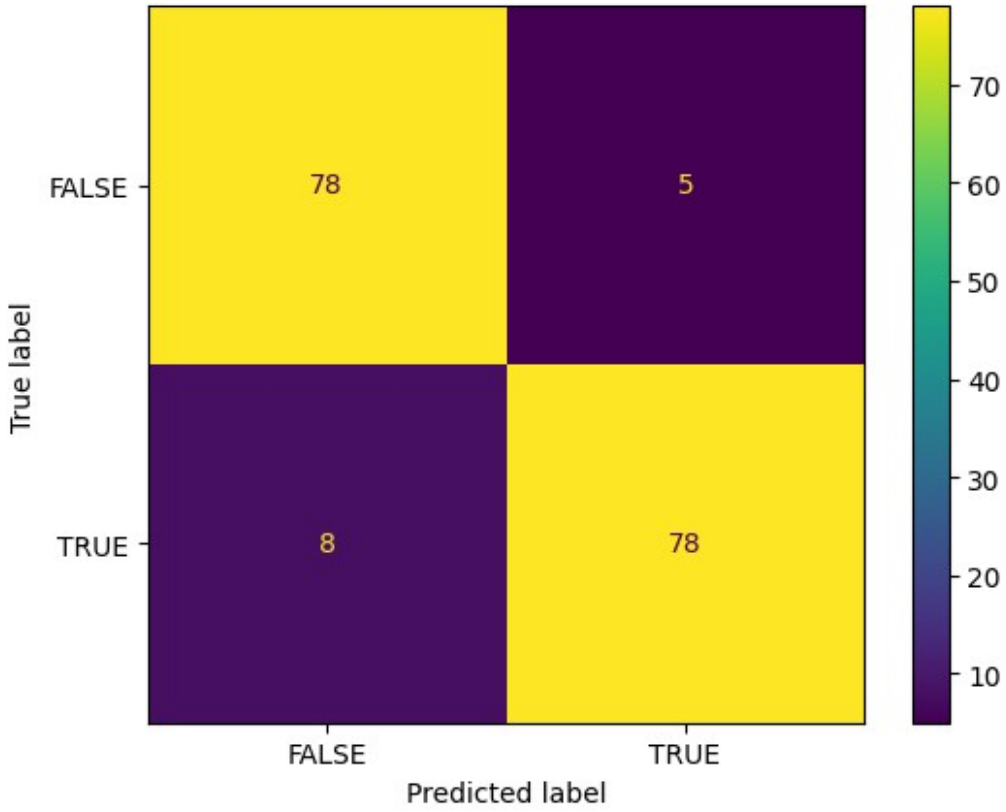
```
à présent 1867     TRUE
1540    FALSE
2495     TRUE
1197     TRUE
788      TRUE
        ...
2224     TRUE
2424     TRUE
2038     TRUE
1295     TRUE
1890     TRUE
Name: rating, Length: 675, dtype: object
pipeline créé
```

Résultats de la classification selon True et False

```
X_test_text=X_test['text']
print(X_test_text)
y_pred_1=pipetexte.predict(X_test_text)
MyshowAllScores(y_test,y_pred_1)
```

```
360     Then-Secretary of State Hillary Clinton respon...
1216    Story highlights Global sea level is on the ri...
2466    Australia’s Great Barrier Reef has worst coral...
1757    News| [email protected] “If you won’t lead, th...
1387    For once, it’s not President Trump making head...
                              ...
2435    The oldest and thickest sea ice in the Arctic ...
523     A coalition of civil society groups has descri...
2127    A coalition of civil society groups has descri...
247     With merchants in Democrat-run cities boarding...
615     It’s been a long time coming, but finally we h...
```

```
Name: text, Length: 169, dtype: object
Accuracy : 0.923
Classification Report
              precision    recall  f1-score   support

       FALSE    0.90698   0.93976   0.92308        83
        TRUE    0.93976   0.90698   0.92308        86

    accuracy                        0.92308       169
   macro avg    0.92337   0.92337   0.92308       169
weighted avg    0.92366   0.92308   0.92308       169
```



##Concaténons les résultats des deux classifications

```
# Conversion de tableaux NumPy en objets Series Pandas
y_pred_1 = pd.Series(y_pred_1)
y_pred_2 = pd.Series(y_pred_2)
#concat
y_pred_final = pd.concat([y_pred_1, y_pred_2], ignore_index=True)
y_test_final = pd.concat([y_test_1, y_test_2], ignore_index=True)
#dernier test
MyshowAllScores(y_test_final,y_pred_final)
```

Accuracy : 0.909
Classification Report

	precision	recall	f1-score	support
FALSE	0.90698	0.93976	0.92308	83
TRUE	0.93976	0.90698	0.92308	86
mixture	0.82222	0.92500	0.87059	40
other	0.93878	0.85185	0.89320	54
accuracy			0.90875	263
macro avg	0.90193	0.90590	0.90249	263
weighted avg	0.91134	0.90875	0.90896	263