In [1]:
```
import csv
import pandas as pd
import numpy as np
from sklearn.naive_bayes import GaussianNB
from sklearn.model_selection import train_test_split
from sklearn import metrics
from sklearn.metrics import confusion_matrix, f1_score, roc_curve, auc
import matplotlib.pyplot as plt
from itertools import cycle
```

In [2]:
```
# reading CSV using Pandas and storing in dataframe
```

In [3]:
```
training_x=df.iloc[1:df.shape[0],0:13]
#print(training_set)

training_y=df.iloc[1:df.shape[0],13:14]
#print(testing_set)


# converting dataframe into arrays
x=np.array(training_x)
```

In [6]:
```
    z=0
    print("\n\n\nTest Train Split no. ",z+1,"\n\n\n")
    x_train,x_test,y_train,y_test = train_test_split(x,y,test_size=0.25,random
    # Gaussian function of sklearn
    gnb = GaussianNB()
    gnb.fit(x_train, y_train.ravel())
    y_pred = gnb.predict(x_test)

    print("\n\nGaussian Naive Bayes model accuracy(in %):", metrics.accuracy_s
```

```
Test Train Split no.  1



Gaussian Naive Bayes model accuracy(in %): 63.1578947368421
```

In [12]:
```
 # convert 2D array to 1D array
y1=y_test.ravel()
y_pred1=y_pred.ravel()

print("\n\n\n\nConfusion Matrix")
cf_matrix=confusion_matrix(y1,y_pred1)
print(cf_matrix)

print("\n\n\n\nF1 Score")
f_score=f1_score(y1,y_pred1,average='weighted')
print(f_score)

# Matrix from 1D array
y2=np.zeros(shape=(len(y1),5))
y3=np.zeros(shape=(len(y_pred1),5))
for i in range(len(y1)):
    y2[i][int(y1[i])]=1

for i in range(len(y_pred1)):
    y3[i][int(y_pred1[i])]=1


# ROC Curve generation
n_classes = 5

fpr = dict()
tpr = dict()
roc_auc = dict()
for i in range(n_classes):
    fpr[i], tpr[i], _ = roc_curve(y2[:, i], y3[:, i])
    roc_auc[i] = auc(fpr[i], tpr[i])

# Compute micro-average ROC curve and ROC area
fpr["micro"], tpr["micro"], _ = roc_curve(y2.ravel(), y3.ravel())
roc_auc["micro"] = auc(fpr["micro"], tpr["micro"])

# Compute macro-average ROC curve and ROC area
print("\n\n\n\nROC Curve")
# First aggregate all false positive rates
lw=2
all_fpr = np.unique(np.concatenate([fpr[i] for i in range(n_classes)]))

# Then interpolate all ROC curves at this points
mean_tpr = np.zeros_like(all_fpr)
for i in range(n_classes):
    mean_tpr += interp(all_fpr, fpr[i], tpr[i])

# Finally average it and compute AUC
mean_tpr /= n_classes

fpr["macro"] = all_fpr
tpr["macro"] = mean_tpr
roc_auc["macro"] = auc(fpr["macro"], tpr["macro"])

# Plot all ROC curves
```

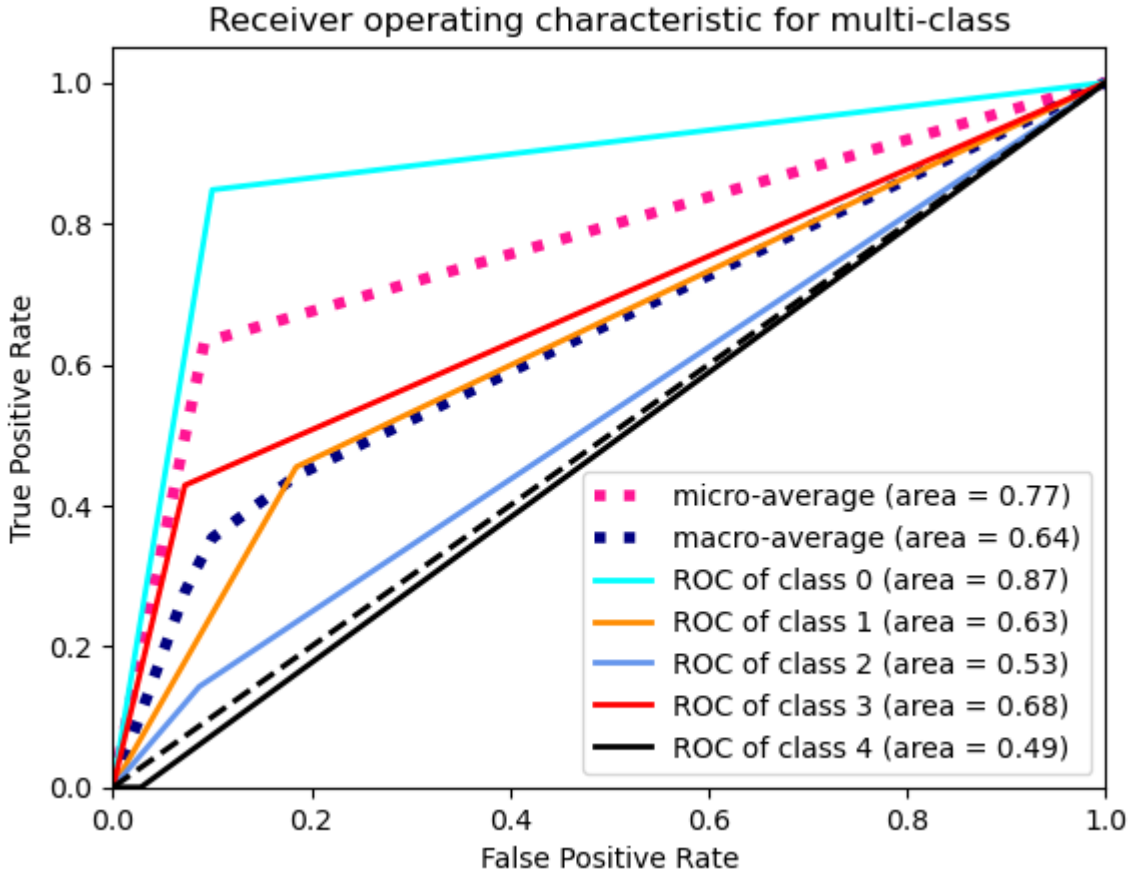
```
plt.figure()
plt.plot(fpr["micro"], tpr["micro"],
         label='micro-average (area = {0:0.2f})'
               ''.format(roc_auc["micro"]),
         color='deeppink', linestyle=':', linewidth=4)

plt.plot(fpr["macro"], tpr["macro"],
         label='macro-average (area = {0:0.2f})'
               ''.format(roc_auc["macro"]),
         color='navy', linestyle=':', linewidth=4)

colors = cycle(['aqua', 'darkorange', 'cornflowerblue','red','black'])
for i, color in zip(range(n_classes), colors):
    plt.plot(fpr[i], tpr[i], color=color, lw=lw,
             label='ROC of class {0} (area = {1:0.2f})'
             ''.format(i, roc_auc[i]))

plt.plot([0, 1], [0, 1], 'k--', lw=lw)
plt.xlim([0.0, 1.0])
plt.ylim([0.0, 1.05])
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('Receiver operating characteristic for multi-class')
plt.legend(loc="lower right")
plt.show()
```

```
Confusion Matrix
[[39  4  2  0  1]
 [ 3  5  2  1  0]
 [ 0  3  1  2  1]
 [ 0  3  1  3  0]
 [ 0  2  1  2  0]]
```

```
F1 Score
0.6381749829118251
```

```
ROC Curve
```

```
C:\Users\Asus\AppData\Local\Temp\ipykernel_3436\1429646610.py:46: Deprecation
Warning: scipy.interp is deprecated and will be removed in SciPy 2.0.0, use n
umpy.interp instead
  mean_tpr += interp(all_fpr, fpr[i], tpr[i])
```


Receiver operating characteristic for multi-class
True Positive Rate
False Positive Rate
0.0
0.2
0.4
0.6
0.8
1.0
micro-average (area = 0.77)
macro-average (area = 0.64)
ROC of class 0 (area = 0.87)
ROC of class 1 (area = 0.63)
ROC of class 2 (area = 0.53)
ROC of class 3 (area = 0.68)
ROC of class 4 (area = 0.49)

In [ ]: