KNN probability - classification threshold

Attribute Information

- STG (The degree of study time for goal object materails), (input value)
- SCG (The degree of repetition number of user for goal object materails) (input value)
- STR (The degree of study time of user for related objects with goal object) (input value)
- LPR (The exam performance of user for related objects with goal object) (input value)
- PEG (The exam performance of user for goal objects) (input value)
- UNS (The knowledge level of user) (target value)
  - Very Low: 50
  - Low:129
  - Middle: 122
  - High 130

In [125]:
```
% matplotlib inline

from IPython.core.display import display, HTML
display(HTML("<style>.container { width:90% !important; }</style>"))
import numpy as np
import pandas as pd
pd.set_option('display.max_columns', 100)

df = pd.read_csv('User_Knowledge.csv')

df.loc[df.UNS == 'very_low','grade'] = 0
df.loc[df.UNS == 'Low','grade'] = 1
df.loc[df.UNS == 'Middle','grade'] = 2
df.loc[df.UNS == 'High','grade'] = 3

df.loc[df.UNS == 'very_low','vlow'] = 1
df.loc[df.UNS == 'Low','low'] = 1
df.loc[df.UNS == 'Middle','mid'] = 1
df.loc[df.UNS == 'High','high'] = 1

df.fillna(0, inplace=True)
df.sample(5)
```

Out[125]:

	STG	SCG	STR	LPR	PEG	UNS	grade	vlow	low	mid	high
191	0.420	0.700	0.72	0.30	0.80	High	3.0	0.0	0.0	0.0	1.0
165	0.400	0.330	0.12	0.30	0.90	High	3.0	0.0	0.0	0.0	1.0
170	0.420	0.360	0.63	0.04	0.25	Low	1.0	0.0	1.0	0.0	0.0
25	0.090	0.300	0.68	0.18	0.85	High	3.0	0.0	0.0	0.0	1.0
157	0.495	0.276	0.58	0.77	0.83	High	3.0	0.0	0.0	0.0	1.0

In [126]:
```
# defining different labels
y =df.grade
y1 = df.vlow
y2 = df.low
y3 = df.mid
y4 = df.high

# feature selection, dropping SCG
X = df.drop(columns=['SCG']).iloc[:,0:4]

X.sample()
```

Out[126]:

	STG	STR	LPR	PEG
12	0.1	0.52	0.78	0.34

In [127]:
```
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler

X_train, X_test, y_train, y_test = train_test_split(X, y4, test_size=0.33, random_st
ate=0)
sc = StandardScaler()
X_train=sc.fit_transform(X_train)
X_test=sc.transform(X_test)
```

KNN

Classifier implementing the k-nearest neighbors vote

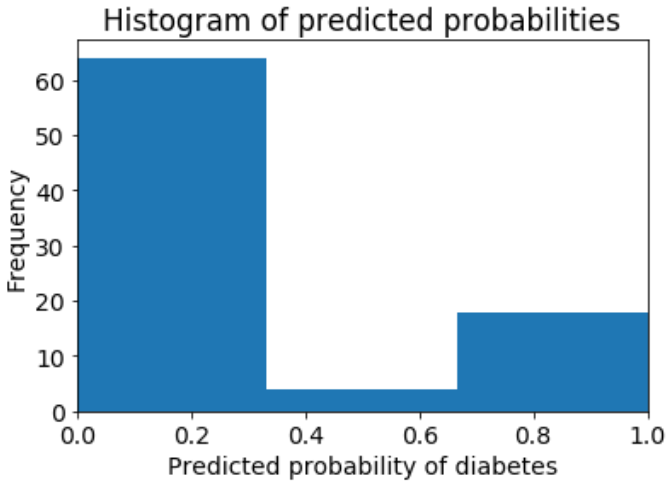
In [128]:
```
from sklearn.neighbors import KNeighborsClassifier
knn = KNeighborsClassifier(n_neighbors=3)
knn_pca = KNeighborsClassifier(n_neighbors=3)

knn.fit(X_train, y_train)
y_pred=knn.predict(X_test)

print("KNN Classfier (y1)",knn.score(X_test,y_test))
```

```
KNN Classfier (y1) 0.988372093023
```

In [129]:
```
y_pred_prob = knn.predict_proba(X_test)[:,1]
```

In [130]:
```
# allow plots to appear in the notebook
%matplotlib inline
import matplotlib.pyplot as plt
plt.rcParams['font.size'] = 14
# histogram of predicted probabilities
plt.hist(y_pred_prob, bins=3)
plt.xlim(0, 1)
plt.title('Histogram of predicted probabilities')
plt.xlabel('Predicted probability of diabetes')
plt.ylabel('Frequency')
```

Out[130]: Text(0,0.5,'Frequency')



In [131]:
```
from sklearn.preprocessing import binarize
y_pred_class = binarize([y_pred_prob], 0.3)

from sklearn import metrics
print(metrics.confusion_matrix(y_test, np.reshape(y_pred_class,(-1,1))))
```

```
[[64  3]
 [ 0 19]]
```

null accuracy

In [132]:
```
max(y_test.mean(), 1-y_test.mean())
```

Out[132]: 0.7790697674418605

In [133]:
```
y_test.value_counts().head(1)/len(y_test)
```

Out[133]:
```
0.0    0.77907
Name: high, dtype: float64
```

In [134]:
```
# IMPORTANT: first argument is true values, second argument is predicted probabiliti
es
fpr, tpr, thresholds = metrics.roc_curve(y_test, y_pred_prob)
plt.plot(fpr, tpr)
plt.xlim([0.0, 1.0])
plt.ylim([0.0, 1.0])
plt.xlabel('False Positive Rate (1 - Specificity)')
plt.ylabel('True Positive Rate (Sensitivity)')
plt.grid(True)
```