```
import pandas as pd
from sklearn.model_selection import train_test_split,cross_val_score
from sklearn.neighbors import KNeighborsClassifier
from sklearn.preprocessing import StandardScaler
from sklearn.metrics import accuracy_score,precision_score,recall_score,f1_score,classification_report
import matplotlib.pyplot as plt
```

```
df = pd.read_csv('breast cancer.csv')
```

```
print(df.head())
```

```
         id diagnosis  radius_mean  texture_mean  perimeter_mean  area_mean  \
0    842302         M        17.99         10.38          122.80     1001.0   
1    842517         M        20.57         17.77          132.90     1326.0   
2  84300903         M        19.69         21.25          130.00     1203.0   
3  84348301         M        11.42         20.38           77.58      386.1   
4  84358402         M        20.29         14.34          135.10     1297.0   

   smoothness_mean  compactness_mean  concavity_mean  concave_points_mean  \
0          0.11840           0.27760          0.3001              0.14710   
1          0.08474           0.07864          0.0869              0.07017   
2          0.10960           0.15990          0.1974              0.12790   
3          0.14250           0.28390          0.2414              0.10520   
4          0.10030           0.13280          0.1980              0.10430   

   ...  radius_worst  texture_worst  perimeter_worst  area_worst  \
0  ...         25.38          17.33           184.60      2019.0   
1  ...         24.99          23.41           158.80      1956.0   
2  ...         23.57          25.53           152.50      1709.0   
3  ...         14.91          26.50            98.87       567.7   
4  ...         22.54          16.67           152.20      1575.0   

   smoothness_worst  compactness_worst  concavity_worst  concave_points_worst  \
0            0.1622             0.6656           0.7119                0.2654   
1            0.1238             0.1866           0.2416                0.1860   
2            0.1444             0.4245           0.4504                0.2430   
3            0.2098             0.8663           0.6869                0.2575   
4            0.1374             0.2050           0.4000                0.1625   

   symmetry_worst  fractal_dimension_worst  
0          0.4601                  0.11890  
1          0.2750                  0.08902  
2          0.3613                  0.08758  
3          0.6638                  0.17300  
4          0.2364                  0.07678  

[5 rows x 32 columns]
```

```
print(df.tail())
```

```
         id diagnosis  radius_mean  texture_mean  perimeter_mean  area_mean  \
564  926424         M        21.56         22.39          142.00     1479.0   
565  926682         M        20.13         28.25          131.20     1261.0   
566  926954         M        16.60         28.08          108.30      858.1   
567  927241         M        20.60         29.33          140.10     1265.0   
568   92751         B         7.76         24.54           47.92      181.0   

     smoothness_mean  compactness_mean  concavity_mean  concave_points_mean  \
564          0.11100           0.11590         0.24390              0.13890   
565          0.09780           0.10340         0.14400              0.09791   
566          0.08455           0.10230         0.09251              0.05302   
567          0.11780           0.27700         0.35140              0.15200   
568          0.05263           0.04362         0.00000              0.00000   

     ...  radius_worst  texture_worst  perimeter_worst  area_worst  \
564  ...        25.450          26.40           166.10      2027.0   
565  ...        23.690          38.25           155.00      1731.0   
566  ...        18.980          34.12           126.70      1124.0   
567  ...        25.740          39.42           184.60      1821.0   
568  ...         9.456          30.37            59.16       268.6   

     smoothness_worst  compactness_worst  concavity_worst  \
564           0.14100            0.21130           0.4107   
565           0.11660            0.19220           0.3215   
566           0.11390            0.30940           0.3403   
567           0.16500            0.86810           0.9387   
568           0.08996            0.06444           0.0000   

     concave_points_worst  symmetry_worst  fractal_dimension_worst  
```

```
564                0.2216          0.2060                   0.07115
565                0.1628          0.2572                   0.06637
566                0.1418          0.2218                   0.07820
567                0.2650          0.4087                   0.12400
568                0.0000          0.2871                   0.07039

[5 rows x 32 columns]
```

```
print(df.isnull().sum())
```

```
id                         0
diagnosis                  0
radius_mean                0
texture_mean               0
perimeter_mean             0
area_mean                  0
smoothness_mean            0
compactness_mean           0
concavity_mean             0
concave_points_mean        0
symmetry_mean              0
fractal_dimension_mean     0
radius_se                  0
texture_se                 0
perimeter_se               0
area_se                    0
smoothness_se              0
compactness_se             0
concavity_se               0
concave_points_se          0
symmetry_se                0
fractal_dimension_se       0
radius_worst               0
texture_worst              0
perimeter_worst            0
area_worst                 0
smoothness_worst           0
compactness_worst          0
concavity_worst            0
concave_points_worst       0
symmetry_worst             0
fractal_dimension_worst    0
dtype: int64
```

```
from sklearn.model_selection import train_test_split
X = df.drop(columns = ['diagnosis','id'])
Y = df['diagnosis']
X_train,X_test,Y_train,Y_test = train_test_split(X,Y,test_size=0.2,random_state=42)
```

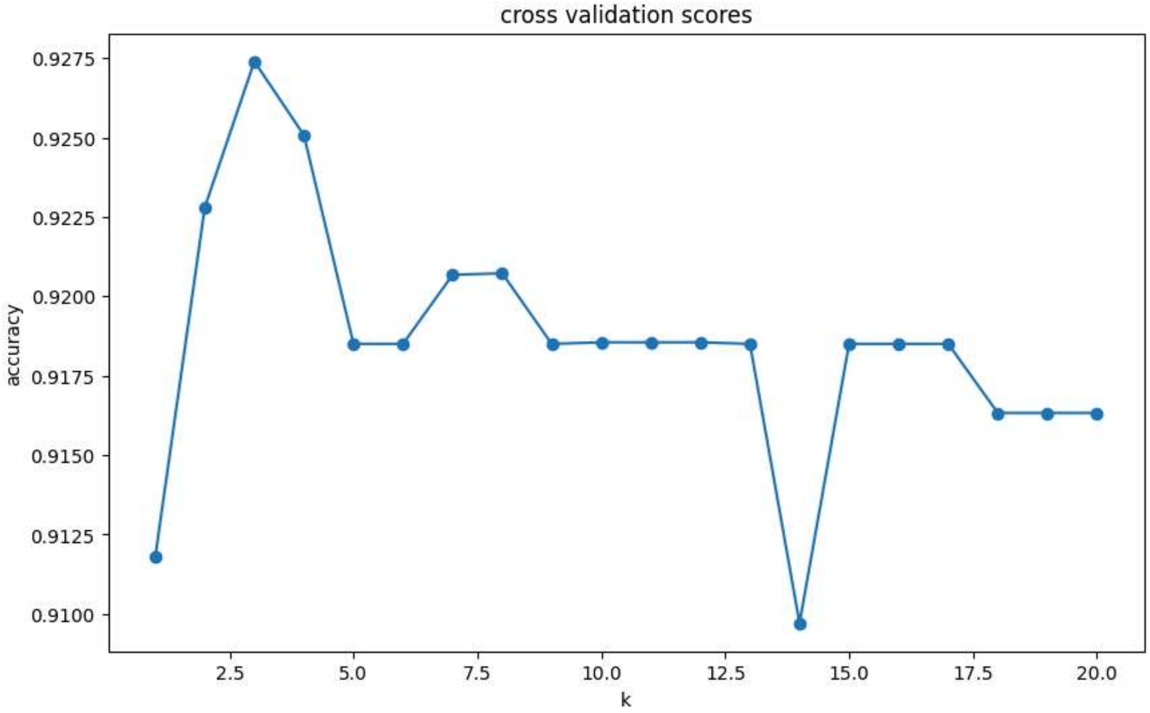
```
print("training feature set shape",X_train.shape)
print("training target set shape",Y_train.shape)
print("testing feature set shape",X_test.shape)
print("testing target set shape",Y_test.shape)
```

```
training feature set shape (455, 30)
training target set shape (455,)
testing feature set shape (114, 30)
testing target set shape (114,)
```

```
X = df.drop(columns=['diagnosis', 'id'])
Y = df['diagnosis']
X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size=0.2, random_state=42)
k_values = range(1, 21)
cv_scores = []
```

```
for k in k_values :
    knn = KNeighborsClassifier(n_neighbors=k)
    scores = cross_val_score(knn, X_train, Y_train, cv=10, scoring='accuracy')
    cv_scores.append(scores.mean())
```

```
plt.figure(figsize=(10,6))
plt.plot(k_values,cv_scores,marker='o')
plt.xlabel('k')
plt.ylabel('accuracy')
plt.title('cross validation scores')
plt.show()
```



```
best_k = k_values[cv_scores.index(max(cv_scores))]
print(f"The best k value is: {best_k}")

knn = KNeighborsClassifier(n_neighbors=best_k)
knn.fit(X_train, Y_train)

train_accuracy = knn.score(X_train, Y_train)
print(f"Training set accuracy: {train_accuracy:.4f}")

test_accuracy = knn.score(X_test, Y_test)
print(f"Testing set accuracy: {test_accuracy:.4f}")
```

```
The best k value is: 3
Training set accuracy: 0.9495
Testing set accuracy: 0.9298
```

```
#Evaluate the model on the testing set
Y_pred = knn.predict(X_test)
test_accuracy = accuracy_score(Y_test, Y_pred)
precision = precision_score(Y_test, Y_pred, pos_label='M')
recall = recall_score(Y_test, Y_pred, pos_label='M')
f1 = f1_score(Y_test, Y_pred, pos_label='M')


# Print the evaluation metrics
print(f"Testing set accuracy: {test_accuracy:.4f}")
print(f"Precision: {precision:.4f}")
print(f"Recall: {recall:.4f}")
print(f"F1 Score: {f1:.4f}")
```

```
Testing set accuracy: 0.9298
Precision: 0.9268
Recall: 0.8837
F1 Score: 0.9048
```

```
# Print the classification report
print("\nClassification Report:")
print(classification_report(Y_test, Y_pred, target_names=['B', 'M']))
```

```

Classification Report:
              precision    recall  f1-score   support

           B       0.93      0.96      0.94        71
           M       0.93      0.88      0.90        43
```

```
    accuracy                           0.93       114
   macro avg       0.93      0.92      0.92       114
weighted avg       0.93      0.93      0.93       114
```

Start coding or generate with AI.