tu19_MachineLearning_HW

April 11, 2023

1 Machine Learning I Homework

1.0.1 1. (Fake) Titanic Data Classification.

The file 'titanicMachLearn.csv' contains (fake) data showing an SES (socioeconomic status) measure, fare paid for the ticket, and whether the person survived or not.

1a. Do a k=3 nearest neighbor classification on the data using an 80/20 training/test split. Summarize the performance of the classifier.

[1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.datasets import make_regression              # for simulating data
from sklearn.model_selection import train_test_split      # splitting training␣
 ↪and test data
from sklearn.linear_model import LinearRegression         # making the linear␣
 ↪predictor model
from sklearn.metrics import mean_squared_error, r2_score  # compute some␣
 ↪diagnostics
```

[2]:
```
titanic = pd.read_csv('titanicMachLearn.csv')
titanic.head()
```

[2]:

	SES	Fare	Survived
0	39	15	0
1	83	33	1
2	98	25	1
3	67	33	1
4	36	14	0

[56]:
```
X = np.array(titanic.iloc[:, [0,1]])  # Predictor
y = np.array(titanic.iloc[:, 2])      # Target
```

[59]:
```
# Split the data into training and testing sets
x_train, x_test, y_train, y_test = train_test_split(X, y, test_size=0.2,␣
 ↪random_state=42)
```

[60]:
```
print('x_train:',x_train.shape)
print('x_test:', x_test.shape)
print('y_train:', y_train.shape)
print('y_test:', y_test.shape)
```

```
x_train: (712, 2)
x_test: (179, 2)
y_train: (712,)
y_test: (179,)
```

[61]:
```
from sklearn.neighbors import KNeighborsClassifier

# Create the K-Nearest Neighbors classifier with k=3
k = 3
knn = KNeighborsClassifier(n_neighbors=k)
```

[62]:
```
# KNN fit
knn.fit(x_train,y_train)
```

[62]:
```
KNeighborsClassifier(n_neighbors=3)
```

[63]:
```
# Create KNN Predictor
y_pred = knn.predict(x_test)
```

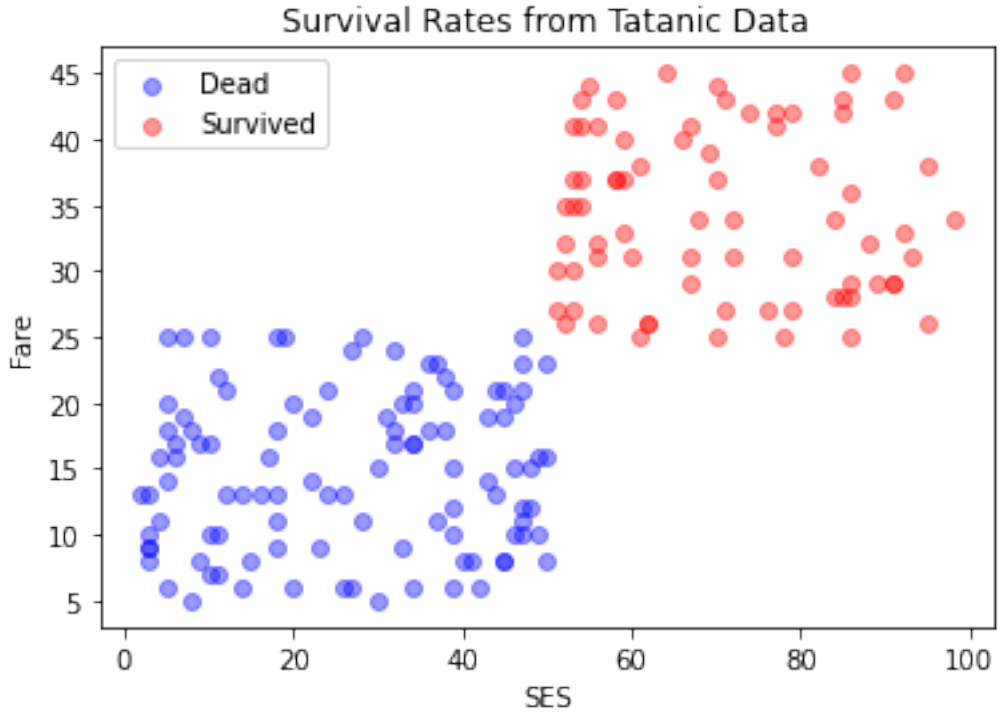
[65]:
```
# Classifier Performance
from sklearn.metrics import classification_report
cls_report = classification_report(y_test, y_pred)
print(cls_report)
```

```
              precision    recall  f1-score   support

           0       1.00      1.00      1.00       105
           1       1.00      1.00      1.00        74

    accuracy                           1.00       179
   macro avg       1.00      1.00      1.00       179
weighted avg       1.00      1.00      1.00       179
```

1b. Make a scatter plot of the data with color showing the survival status. Does the plot intuitivly agree with the performance of your classifier?

[67]:
```
colors = ['blue', 'red']
survival = ['Dead', 'Survived']

for i, color, target_name in zip(range(3), colors, survival):
    plt.scatter(x_test[y_pred == i, 0], x_test[y_pred == i, 1],
                color = color, label = target_name, alpha = 0.4)
```

```
plt.xlabel("SES")
plt.ylabel("Fare")
plt.legend(loc="upper left")
plt.title('Survival Rates from Tatanic Data')
plt.show()
```



1.0.2 2. Iris Data Classification.

Do a nearest neighbors classification on the iris data using the 2 variables you think would work best based on the pair-pair plot we did in class (i.e. don't use the exact same variables we used in the in-class tutorial).

Compare the results with the results we got in class using the first two variables.

[73]:
```
import seaborn as sns
from sklearn.datasets import load_iris
iris = load_iris()
```

[74]:
```
iris.target_names
```

[74]:
```
array(['setosa', 'versicolor', 'virginica'], dtype='<U10')
```

[75]:
```
X = iris.data     # predictor matrix
y = iris.target   # target vector
```

[87]:
```
X = iris.data[:, 1:3]  # Use only the `sepal width` and `petal length`
y = iris.target
```

[88]:
```
# Split the data into training and testing sets
x_train, x_test, y_train, y_test = train_test_split(X, y, test_size=0.2,␣
 ↪random_state=42)
```

[89]:
```
print('x_train:',x_train.shape)
print('x_test:', x_test.shape)
print('y_train:', y_train.shape)
print('y_test:', y_test.shape)
```

```
x_train: (120, 2)
x_test: (30, 2)
y_train: (120,)
y_test: (30,)
```

[90]:
```
# Create the K-Nearest Neighbors classifier with k=3
k = 3
knn = KNeighborsClassifier(n_neighbors=k)

# KNN fit
knn.fit(x_train,y_train)
```

[90]:
```
KNeighborsClassifier(n_neighbors=3)
```

[91]:
```
# Create KNN Predictor
y_pred = knn.predict(x_test)
```

[92]:
```
from sklearn.metrics import classification_report
cls_report = classification_report(y_test, y_pred)
print(cls_report)
```

```
              precision    recall  f1-score   support

           0       1.00      1.00      1.00        10
           1       0.89      0.89      0.89         9
           2       0.91      0.91      0.91        11

    accuracy                           0.93        30
   macro avg       0.93      0.93      0.93        30
weighted avg       0.93      0.93      0.93        30
```

[98]:
```
colors = ['green', 'black', 'orange']
species = iris.target_names

for i, color, target_name in zip(range(3), colors, species):
    plt.scatter(x_test[y_pred == i, 0], x_test[y_pred == i, 1],
                color=color, label=target_name, alpha = 0.4)

plt.xlabel(iris.feature_names[3]) # Sepal width
plt.ylabel(iris.feature_names[2]) # petal length
plt.legend(loc= 'lower left')
plt.title('Iris Dataset: Petal length vs. Sepal width')
plt.show()
```