Homework 6.2 - Grant Jackson_REDO

November 5, 2024

[1]:

```
# Import necessary libraries
import pandas as pd
from sklearn.model_selection import GridSearchCV, train_test_split
from sklearn.neighbors import KNeighborsClassifier
from sklearn.metrics import make_scorer, precision_score
import matplotlib.pyplot as plt
```

[2]:

```
# Load the Default dataset
import os
os.chdir('C:\\Users\gmoor\Documents\Economic Analytics 1\Data')

raw0 = pd.read_csv('Default.csv')
raw0.dropna(inplace=True)

raw0
```

[2]:

```
      Unnamed: 0 default student      balance        income
0              1      No      No   729.526495  44361.625074
1              2      No     Yes   817.180407  12106.134700
2              3      No      No  1073.549164  31767.138947
3              4      No      No   529.250605  35704.493935
4              5      No      No   785.655883  38463.495879
…            …     …      …          …             …
9995        9996      No      No   711.555020  52992.378914
9996        9997      No      No   757.962918  19660.721768
9997        9998      No      No   845.411989  58636.156984
9998        9999      No      No  1569.009053  36669.112365
9999       10000      No     Yes   200.922183  16862.952321

[10000 rows x 5 columns]
```

[3]:

```
# Convert columns to dummy variables
raw0.default=(raw0.default=='Yes')*1
raw0.student=(raw0.student=='Yes')*1

raw0
```

```
[3]:       Unnamed: 0  default  student      balance        income
     0              1        0        0   729.526495  44361.625074
     1              2        0        1   817.180407  12106.134700
     2              3        0        0  1073.549164  31767.138947
     3              4        0        0   529.250605  35704.493935
     4              5        0        0   785.655883  38463.495879
     …            …       …       …           …            …
     9995        9996        0        0   711.555020  52992.378914
     9996        9997        0        0   757.962918  19660.721768
     9997        9998        0        0   845.411989  58636.156984
     9998        9999        0        0  1569.009053  36669.112365
     9999       10000        0        1   200.922183  16862.952321

     [10000 rows x 5 columns]
```

```
[4]: # Prepare features and target
     X = raw0[['balance', 'income', 'student']]
     y = raw0['default']
```

```
[5]: X
```

```
[5]:           balance        income  student
     0      729.526495  44361.625074        0
     1      817.180407  12106.134700        1
     2     1073.549164  31767.138947        0
     3      529.250605  35704.493935        0
     4      785.655883  38463.495879        0
     …             …             …       …
     9995   711.555020  52992.378914        0
     9996   757.962918  19660.721768        0
     9997   845.411989  58636.156984        0
     9998  1569.009053  36669.112365        0
     9999   200.922183  16862.952321        1

     [10000 rows x 3 columns]
```

```
[6]: y
```

```
[6]: 0       0
     1       0
     2       0
     3       0
     4       0
            ..
     9995    0
     9996    0
     9997    0
```

```
9998    0
9999    0
Name: default, Length: 10000, dtype: int32
```

[7]:
```
# Split the data into train and test sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,␣
 ↪random_state=10)
```

[8]:
```
# Define the KNN model
knn = KNeighborsClassifier()
```

[9]:
```
# Set up the parameter grid to search the number of neighbor
param_grid = {'n_neighbors': [2, 3, 4, 5, 6, 7, 8]}

param_grid
```

[9]:
```
{'n_neighbors': [2, 3, 4, 5, 6, 7, 8]}
```

[10]:
```
# Define precision as the scoring metric
scorer = make_scorer(precision_score, zero_division=1)
```

[11]:
```
# Create GridSearchCV object
grid_search = GridSearchCV(estimator=knn, param_grid=param_grid,␣
 ↪scoring=scorer, cv=5)
```

[12]:
```
# Fit the model
grid_search.fit(X_train, y_train)
```

[12]:
```
GridSearchCV(cv=5, estimator=KNeighborsClassifier(),
             param_grid={'n_neighbors': [2, 3, 4, 5, 6, 7, 8]},
             scoring=make_scorer(precision_score, zero_division=1))
```

[13]:
```
# Get the best parameters and best precision score
best_params = grid_search.best_params_
best_precision = grid_search.best_score_
print("Best Parameters:", best_params)
print("Best Precision Score:", best_precision)
```

```
Best Parameters: {'n_neighbors': 4}
Best Precision Score: 0.6476190476190476
```

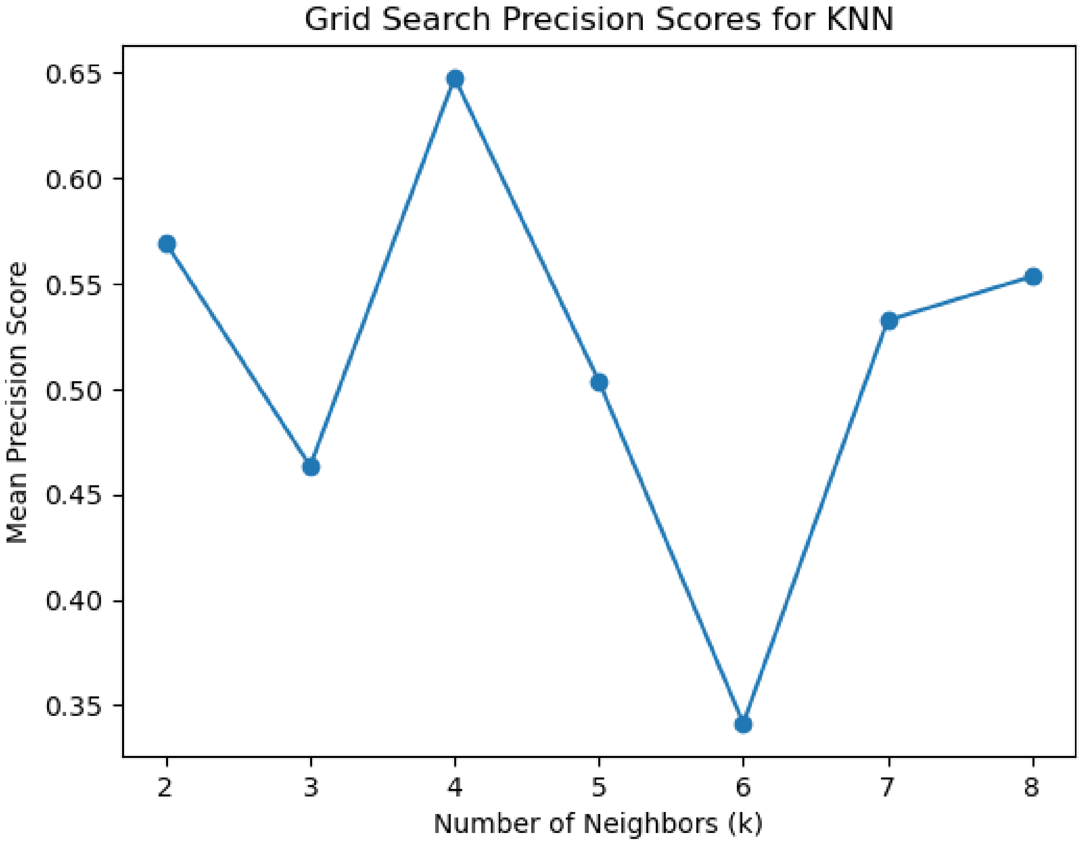
[14]:
```
# Results from GridSearchCV
results = pd.DataFrame(grid_search.cv_results_)
print("\nGrid Search Results:")
print(results[['param_n_neighbors', 'mean_test_score', 'std_test_score',␣
 ↪'rank_test_score']])
```

```

Grid Search Results:
  param_n_neighbors  mean_test_score  std_test_score  rank_test_score
0                 2         0.569238        0.237082                2
1                 3         0.463347        0.139197                6
2                 4         0.647619        0.207239                1
3                 5         0.503525        0.132536                5
4                 6         0.341270        0.178880                7
5                 7         0.532493        0.122260                4
6                 8         0.553333        0.245493                3
```

[15]:

```
# Visualization of precision scores for each number of neighbors
plt.plot(results['param_n_neighbors'], results['mean_test_score'], marker='o')
plt.xlabel("Number of Neighbors (k)")
plt.ylabel("Mean Precision Score")
plt.title("Grid Search Precision Scores for KNN")
plt.show()
```


Grid Search Precision Scores for KNN
Mean Precision Score
Number of Neighbors (k)