Hyperparameter Tuning of KNN Classifier

Saurav Agrawal · Follow

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K-Nearest Neighbor Classifier is a machine learning algorithm used for classification and regression. It works by finding the K nearest points in the training dataset and uses their class to predict the class or value of a new data point.

Need for finding the correct ‘k’ parameter—

> *Larger k= less complex model = can lead to underfitting*
>
> *Smaller k= more complex model = can lead to overfitting*

In the following section we try to fit the KNN model with the correct K.

1. Loading several libraries that will be used in the analysis —

```
import numpy as np
import pandas as pd
from sklearn.neighbors import KNeighborsClassifier
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score
import matplotlib.pyplot as plt
```

2. Importing the dataset and checking for null values —

```
df = pd.read_csv("/kaggle/input/pima-indians-diabetes-database/diabetes.csv")
print(df.head())
print(df.shape)
```

```
   Pregnancies  Glucose  BloodPressure  SkinThickness  Insulin   BMI  \
0            6      148             72             35        0  33.6
1            1       85             66             29        0  26.6
2            8      183             64              0        0  23.3
3            1       89             66             23       94  28.1
4            0      137             40             35      168  43.1

   DiabetesPedigreeFunction  Age  Outcome
0                     0.627   50        1
1                     0.351   31        0
2                     0.672   32        1
3                     0.167   21        0
4                     2.288   33        1
(768, 9)
```

Dataset Head and Shape

```
print(df.isna().sum())
```

```
Pregnancies                 0
Glucose                     0
BloodPressure               0
SkinThickness               0
Insulin                     0
BMI                         0
DiabetesPedigreeFunction    0
Age                         0
Outcome                     0
dtype: int64
```

0 Null values in the dataset

3. Splitting the dataset —

```
X = df.drop("Outcome", axis=1).values
y = df["Outcome"].values
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.20, random
print(X_train.shape)
print(X_test.shape)
print(y_train.shape)
print(y_test.shape)
```

```
(614, 8)
(154, 8)
(614,)
(154,)
```

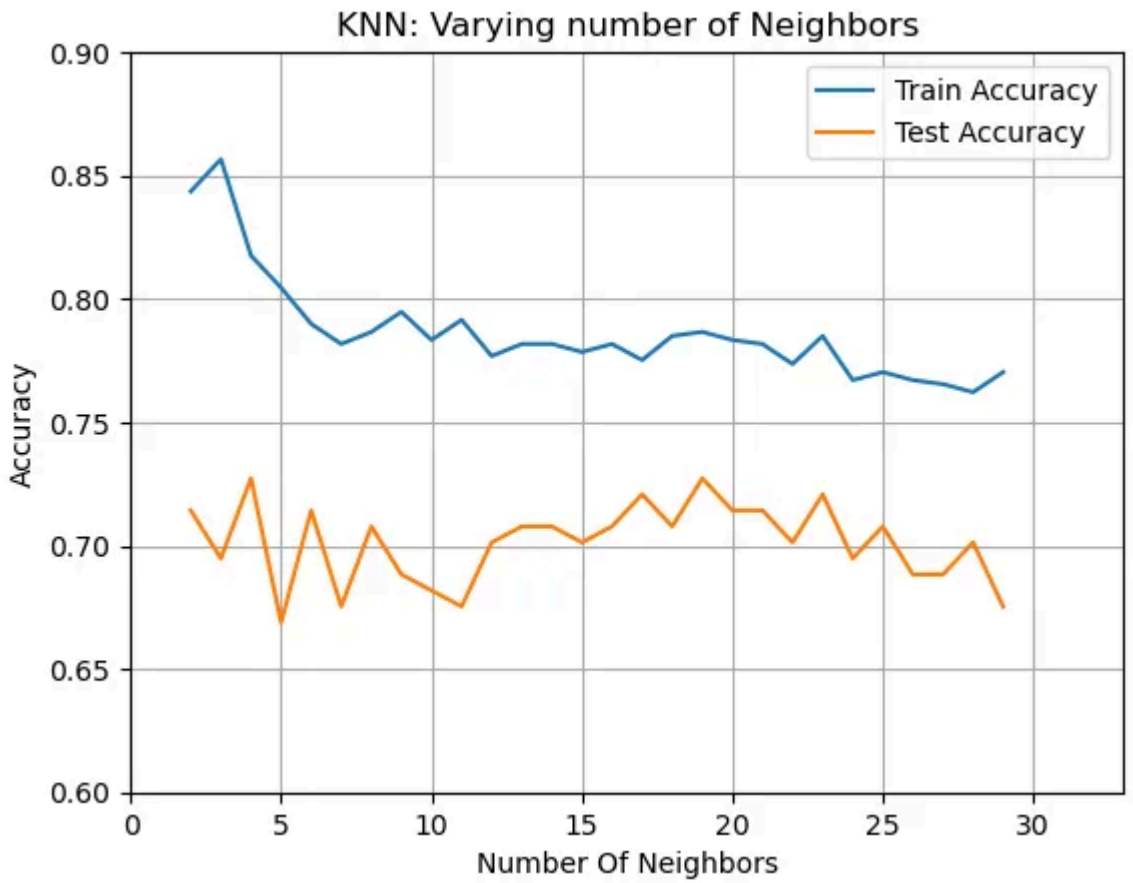
Train and Test Dataset Shape

4. Hyperparameter Tuning the K parameter —

```
train_score = {}
test_score = {}
n_neighbors = np.arange(2, 30, 1)
for neighbor in n_neighbors:
    knn = KNeighborsClassifier(n_neighbors=neighbor)
    knn.fit(X_train, y_train)
    train_score[neighbor]=knn.score(X_train, y_train)
    test_score[neighbor]=knn.score(X_test, y_test)
```

5. Plotting the Train Score and Test Score —


```
plt.plot(n_neighbors, test_score.values(), label="Test Accuracy")
plt.xlabel("Number Of Neighbors")
plt.ylabel("Accuracy")
plt.title("KNN: Varying number of Neighbors")
plt.legend()
plt.xlim(0, 33)
plt.ylim(0.60, 0.90)
plt.grid()
plt.show()
```



Plotting the Train and Test Accuracy on different number of Neighbors.

6. Finding the best param ‘k’ —

```
for key, value in test_score.items():
    if value==max(test_score.values()):
        print(key)
```

```
4
19
```

‘K’ Neighbors with Best Test score

As we can see, n_neighbors shows best accuracy score for 4 neighbors and 19 neighbors. **But the K-NearestNeighbor Classifier will perform differently based on how data is split. This requires Hyperparameter Tuning using GridSearchCV. We can use RandomizedSearchCV too.**

7. Using GridSearchCV to determine the best_params_ for n_neighbors —

```
kf=KFold(n_splits=5,shuffle=True,random_state=42)
parameter={'n_neighbors': np.arange(2, 30, 1)}
knn=KNeighborsClassifier()
knn_cv=GridSearchCV(knn, param_grid=parameter, cv=kf, verbose=1)
knn_cv.fit(X_train, y_train)
print(knn_cv.best_params_)
```

```
Fitting 5 folds for each of 28 candidates, totalling 140 fits
{'n_neighbors': 23}
```

Finding best n_neighbors parameter

8. Using the best parameter from Step 7. to train the model and predict —

```
knn=KNeighborsClassifier(n_neighbors=23)
knn.fit(X_train, y_train)
y_pred=knn.predict(X_test)
accuracy_score=accuracy_score(y_test, y_pred)*100
print("Accuracy for testing dataset after tuning : {:.2f}%".format(accuracy_scor
```

```
Accuracy for testing dataset after tuning : 72.08%
```

Output of KNN model after hyperparameter tuning

In this article, we tried to find the best n_neighbor parameter by plotting the test accuracy score based on one specific subset of dataset. Then we took into account that the model performance changes based on how we split the dataset into train and test dataset. We then used the cross validation to test the model on the entire dataset using GridSearchCV.

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very nicely explained !!

Learnt a lot from it

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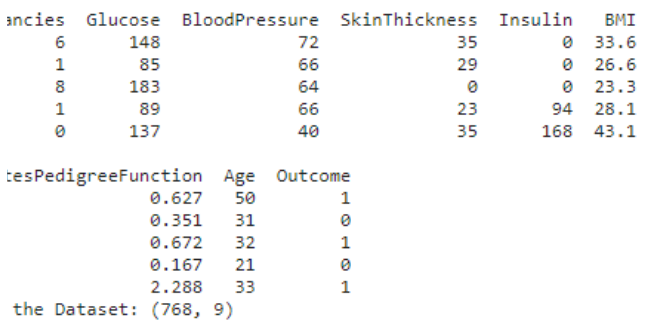

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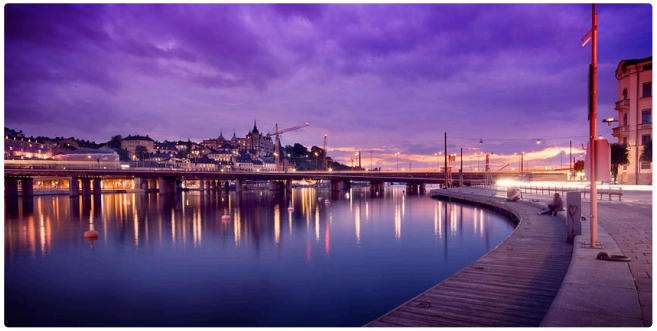

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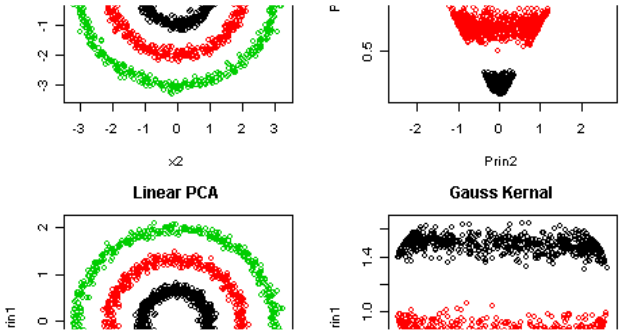

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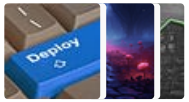

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7	1.239	2.167	2.833	4.255	6.346	9.04	12.02	14.07	18.48
8	1.647	2.733	3.490	5.071	7.344	10.22	13.36	15.51	20.09
9	2.088	3.325	4.168	5.899	8.343	11.39	14.68	16.92	21.67
10	2.558	3.940	4.865	6.737	9.342	12.55	15.99	18.31	23.21
11	3.053	4.575	5.578	7.584	10.341	13.70	17.28	19.68	24.72
12	3.571	5.226	6.304	8.438	11.340	14.85	18.55	21.03	26.22
13	4.107	5.892	7.042	9.299	12.340	15.98	19.81	22.36	27.69
14	4.660	6.571	7.790	10.165	13.339	17.12	21.06	23.68	29.14
15	5.229	7.261	8.547	11.037	14.339	18.25	22.31	25.00	30.58
16	5.812	7.962	9.312	11.912	15.338	19.37	23.54	26.30	32.00
17	6.408	8.672	10.085	12.792	16.338	20.49	24.77	27.59	33.41
18	7.015	9.390	10.865	13.675	17.338	21.60	25.99	28.87	34.80
19	7.633	10.117	11.651	14.562	18.338	22.72	27.20	30.14	36.19
20	8.260	10.851	12.443	15.452	19.337	23.83	28.41	31.41	37.57
22	9.542	12.338	14.041	17.240	21.337	26.04	30.81	33.92	40.29

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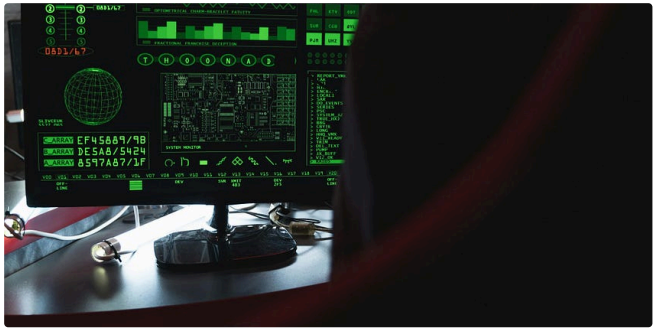

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