A Quick Introduction to K - Nearest Neighbor (KNN) Classification Using Python

BEGINNER CLASSIFICATION MACHINE LEARNING PROJECT PYTHON STRUCTURED DATA SUPERVISED TECHNIQUE USE CASES

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Introduction

This article concerns one of the supervised ML classification algorithm-**KNN(K Nearest Neighbors) algorithm**. It is one of the simplest and widely used classification algorithms in which a new data point is classified based on similarity in the specific group of neighboring data points. This gives a competitive result.

Working

For a given data point in the set, the algorithms find the distances between this and all other **K** numbers of datapoint in the dataset close to the initial point and votes for that category that has the most frequency. Usually, **Euclidean distance** is taking as a measure of distance. Thus the end resultant model is just the labeled data placed in a space. This algorithm is popularly known for various applications like **genetics**, **forecasting**, etc. The algorithm is best when more features are present and out shows SVM in this case.

KNN reducing overfitting is a fact. On the other hand, there is a need to choose the best value for K. So now how do we choose K? Generally we use the Square root of the number of samples in the dataset as value for K. An optimal value has to be found out since lower value may lead to overfitting and higher value may require high computational complication in distance. So using an error plot may help. Another method is the elbow method. You can prefer to take root else can also follow the elbow method.

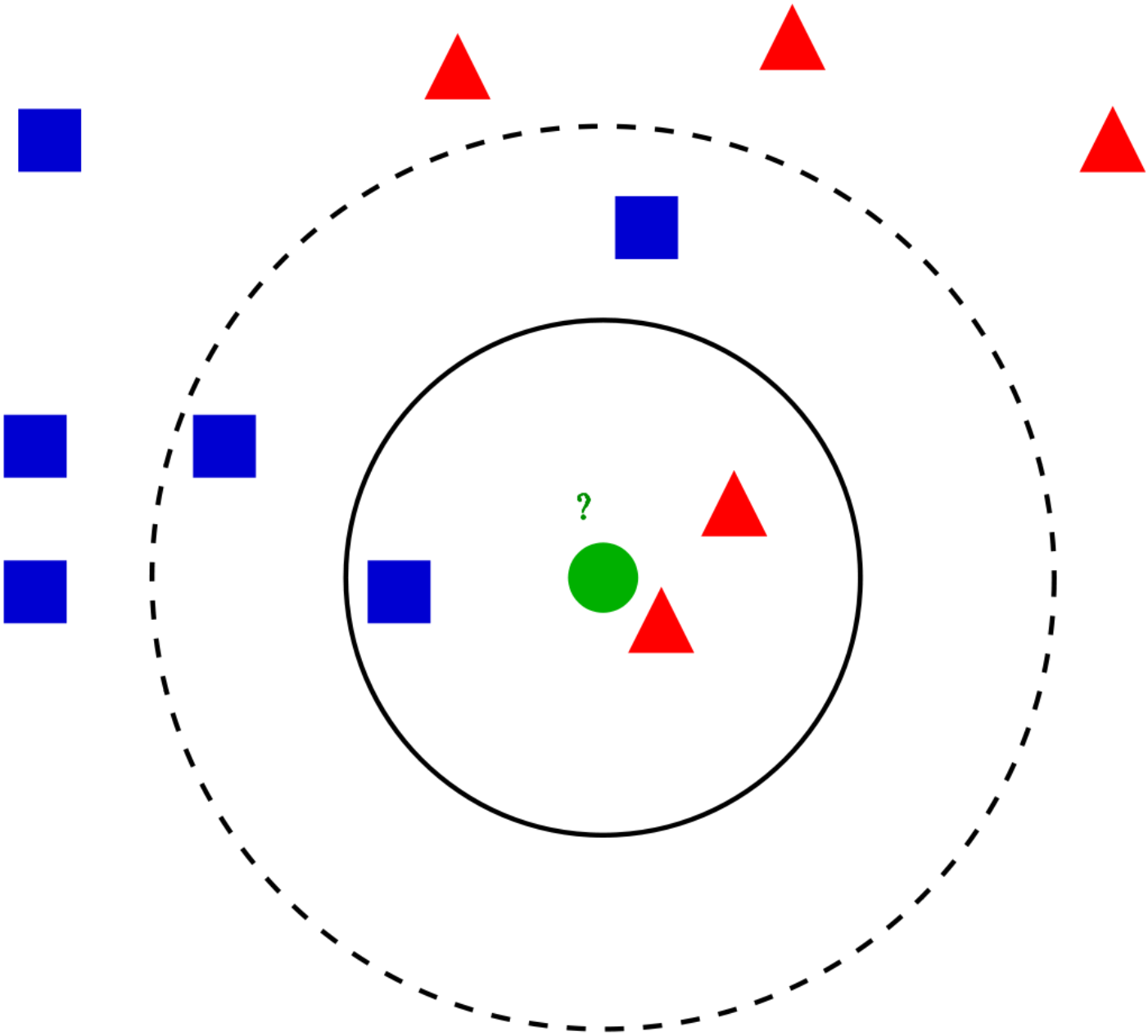
Let's dive deep into the different steps of K-NN for classifying a new data point

Step 1: Select the value of K neighbors(say k=5)

Step 2: Find the K (5) nearest data point for our new data point based on euclidean distance(which we discuss later)

Step 3: Among these K data points count the data points in each category

Step 4: Assign the new data point to the category that has the most neighbors of the new datapoint



Example

Let's go through an example problem for getting a clear intuition on the K -Nearest Neighbor classification. We are using the Social network ad dataset (Download). The dataset contains the details of users in a

social networking site to find whether a user buys a product by clicking the ad on the site based on their salary, age, and gender.

	User ID	Gender	Age	EstimatedSalary	Purchased
0	15624510	Male	19	19000	0
1	15810944	Male	35	20000	0
2	15668575	Female	26	43000	0
3	15603246	Female	27	57000	0
4	15804002	Male	19	76000	0
5	15728773	Male	27	58000	0
6	15598044	Female	27	84000	0
7	15694829	Female	32	150000	1
8	15600575	Male	25	33000	0
9	15727311	Female	35	65000	0

Let’s start the programming by importing essential libraries

```
import numpy as np import matplotlib.pyplot as plt import pandas as pd import sklearn
```

Importing of the dataset and slicing it into independent and dependent variables

```
dataset = pd.read_csv('Social_Network_Ads.csv') X = dataset.iloc[:, [1, 2, 3]].values y = dataset.iloc[:, -1].values
```

Since our dataset containing character variables we have to encode it using LabelEncoder

```
from sklearn.preprocessing import LabelEncoder le = LabelEncoder() X[:,0] = le.fit_transform(X[:,0])
```

We are performing a train test split on the dataset. We are providing the test size as 0.20, that means our training sample contains 320 training set and test sample contains 80 test set

```
from sklearn.model_selection import train_test_split X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.20, random_state = 0)
```

Next, we are doing feature scaling to the training and test set of independent variables for reducing the size to smaller values

```
from sklearn.preprocessing import StandardScaler sc = StandardScaler() X_train = sc.fit_transform(X_train) X_test = sc.transform(X_test)
```

Now we have to create and train the K Nearest Neighbor model with the training set

```
from sklearn.neighbors import KNeighborsClassifier classifier = KNeighborsClassifier(n_neighbors = 5, metric = 'minkowski', p = 2) classifier.fit(X_train, y_train)
```

We are using 3 parameters in the model creation. n_neighbors is setting as 5, which means 5 neighborhood points are required for classifying a given point. The distance metric we are using is Minkowski, the equation for it is given below

As per the equation, we have to select the p-value also.
p = 1 , Manhattan Distance
p = 2 , Euclidean Distance
p = infinity , Cheybchev Distance
In our problem, we are choosing the p as 2 (also u can choose the metric as “euclidean”)
Our Model is created, now we have to predict the output for the test set

```
y_pred = classifier.predict(X_test)
```

Comparing true and predicted value :

y_test

```
array([0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 1, 0, 1, 0, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 1, 0, 1, 1, 0, 0, 0, 1, 1, 0, 0, 1, 0, 0, 1, 0, 1, 0, 1, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 1, 1, 1, 0, 0, 0, 1, 1, 0, 1, 1, 0, 0, 1, 0, 0, 0, 1, 0, 1, 1, 1], dtype=int64)
```

y_pred

```
array([0, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0,
0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 1, 0, 0, 1, 0, 0, 1, 0, 1, 0, 1, 0, 0, 0, 0,
1, 0, 0, 1, 0, 0, 0, 0, 1, 1, 1, 1, 0, 0, 1, 0, 0, 1, 1, 0, 0, 1, 0, 0, 0, 0, 0, 1, 1, 1], dtype=int64)
```

We can evaluate our model using the confusion matrix and accuracy score by comparing the predicted and actual test values

```
from sklearn.metrics import confusion_matrix,accuracy_score cm = confusion_matrix(y_test, y_pred) ac = accuracy_score(y_test,y_pred)
```

confusion matrix –

```
[[64 4] [ 3 29]]
```

accuracy is 0.95

Our model is performing well. The full code for the problem is given below.

```
# Importing the libraries import numpy as np import matplotlib.pyplot as plt import pandas as pd # Importing the dataset dataset = pd.read_csv('Social_Network_Ads.csv') X = dataset.iloc[:, [2, 3]].values y = dataset.iloc[:, -1].values # Splitting the dataset into the Training set and Test set from sklearn.model_selection import train_test_split X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.20, random_state = 0) # Feature Scaling from sklearn.preprocessing import StandardScaler sc = StandardScaler() X_train = sc.fit_transform(X_train) X_test = sc.transform(X_test) # Training the K-NN model on the Training set from sklearn.neighbors import KNeighborsClassifier classifier = KNeighborsClassifier(n_neighbors = 5, metric = 'minkowski', p = 2) classifier.fit(X_train, y_train) # Predicting the Test set results y_pred = classifier.predict(X_test) # Making the Confusion Matrix from sklearn.metrics import confusion_matrix, accuracy_score cm = confusion_matrix(y_test, y_pred) ac = accuracy_score(y_test, y_pred)
```

Conclusion

We covered the main concepts behind the K Nearest Neighbor algorithm. Take different datasets and get familiar with this algorithm. In the upcoming articles, we can discuss more algorithms.

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BasilB2S