



L O V E L Y
P R O F E S S I O N A L
U N I V E R S I T Y

INT-254 Fundamentals Of Machine Learning

C.A. I – Project

Topic – Customer Prediction Through ML

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We made sure that we didn't copy anyone else's work when we finished this job. In closing, we want to express our gratitude to all of our classmates for their invaluable assistance.

Introduction

Artificial Intelligence is the ability of a machine to learn like a human, thus achieving the level of human intelligence and much more.

With advancements in the field of AI, it has led to improvements across several industries like Automation, Supply chain, eCommerce, Manufacturing, and many more.

Understanding customer behavior: -

Customer Behavior, in its broadest sense, is concerned with how customer select, decide, use and dispose of goods and services. It covers individuals, groups, or organizations of any vertical.

It gives a good idea and insights about customer's emotions, attitudes, and preferences which affect buying behavior. Thus, helping marketers to understand the needs of customers, bringing value to the customers, and in return generating revenue for the company.

Predicting the customer behavior: -

Big companies understand that predicting customer behavior fills the gap in the markets and identifies products that are needed, and which could generate bigger revenue.

Objective: -

The objective of this project is to understand the behaviors of your customers based on their purchasing data. This helps the marketing team to understand and plan new strategies accordingly.

Understanding dataset: -

In this dataset, we have information related to customers like:

1. CustomerID - ID of the customer
2. Gender - Gender of the customer
3. Age - Age of the customer
4. AnnualIncome - annual income of the customer
5. SpendingScore - score assigned based on the customer's behavior and their purchasing data

You can download the dataset :-

<https://www.kaggle.com/vjchoudhary7/customer-segmentation-tutorial-in-python>

Customer behavior prediction can be done by:

1. Segmentation: separating customers into smaller groups based on buying behaviors. This helps in the separation of concerns, which in turn helps us identify the region of the market.
2. Predictive Analytics: we use statistical techniques to analyze previous historical data to predict the future behavior of customers.

Customer Prediction Through Machine Learning

Importing Libraries:-

For data exploration, it is mandatory to have a few Python libraries installed

```
In [6]: import numpy as np  
import pandas as pd  
import sklearn  
import matplotlib.pyplot as plt  
import seaborn as sns
```

Importing KMeans algorithm to be used for data analytics

```
In [37]: from sklearn.cluster import KMeans
```

Importing warnings library to clean my further project by ignoring the warnings

```
In [38]: import warnings  
warnings.filterwarnings("ignore")
```

View Dataset:-

To view the dataset we have to import by reading the CSV file as shown below

```
In [39]: df = pd.read_csv('Mall_Customers.csv')  
df.head()
```

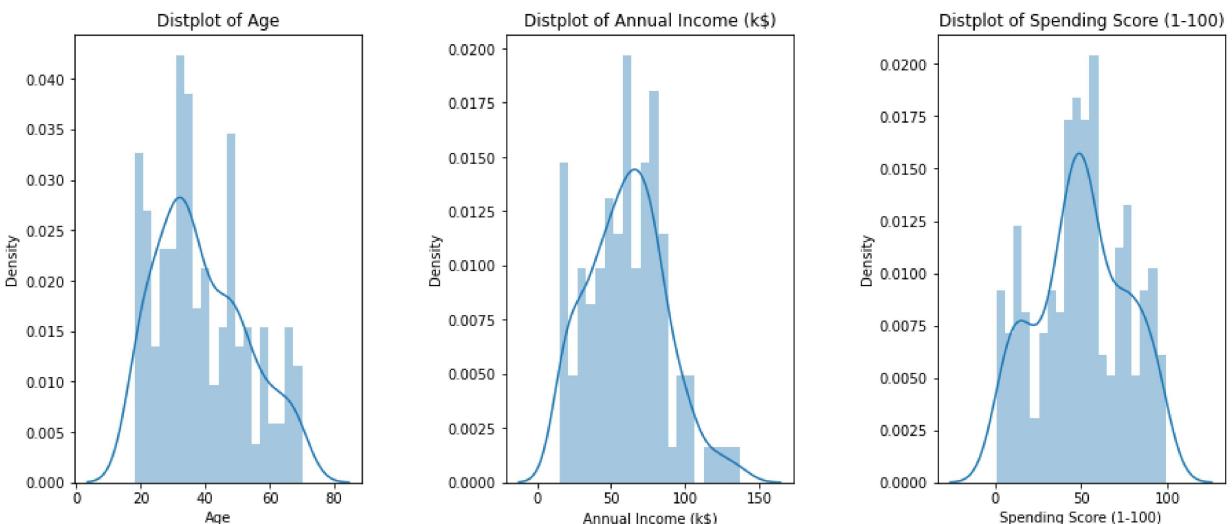
```
Out[39]: CustomerID  Gender  Age  Annual Income (k$)  Spending Score (1-100)  
0          1    Male   19              15                39  
1          2    Male   21              15                81  
2          3  Female   20              16                  6  
3          4  Female   23              16                77  
4          5  Female   31              17                40
```

Data Visualizations:-

Correlation between Age, Income and Spending scores

Analyzing the spending patterns is the better strategy for marketing. Here, we will try to analyze and find how the age, annual incomes and spending scores of the customers are.

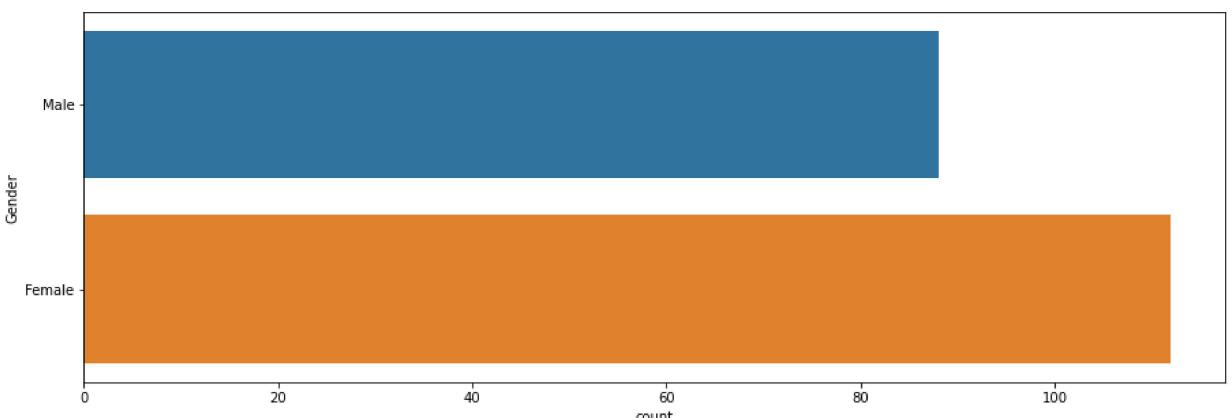
```
In [40]: plt.figure(1 , figsize = (15 , 6)) # sets the dimensions of image
n = 0
for x in ['Age' , 'Annual Income (k$)' , 'Spending Score (1-100)']:
    n += 1
    plt.subplot(1 , 3 , n) # creates 3 different sub-plots
    plt.subplots_adjust(hspace = 0.5 , wspace = 0.5)
    sns.distplot(df[x] , bins = 20) # creates a distribution plot
    plt.title('Distplot of {}'.format(x)) # sets title for each plot
plt.show() # displays all the plots
```



Gender Analysis:-

The second most important thing in deciding the strategy is to analyze the spending patterns based on Gender. Here, we find that Females tend to purchase more than Males do.

```
In [41]: plt.figure(1 , figsize = (15 , 5))
sns.countplot(y = 'Gender' , data = df)
plt.show()
```



Customer segmentation:-

Segmentation helps in dividing a set of large data into groups of smaller observations that are similar in specific ways relevant to marketing. Each group contains individuals that are similar in-between themselves, and different from individuals from the other groups.

Segmentation is widely used as a marketing tool to create a clusters of clients and adapt a relevant strategy for each of them.

Segmentation using Age and Spending Score:-

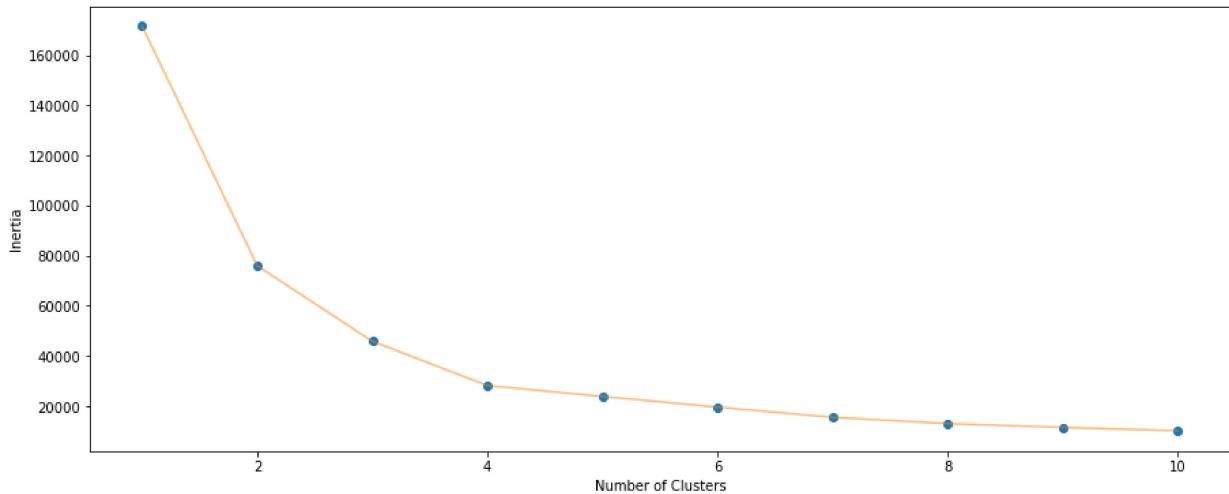
Here we will be segmenting the customers based on their age and their spending scores. This will help us to understand the age category of the customers, which could possibly improve spending score, thereby increasing the revenue for the company.

In this case, we have to decide the possible number of clusters(segments) that would return the best results. To do that, we loop through 1 to 11, and find which customer would be the right choice.

```
In [42]: X_age_spending = df[['Age' , 'Spending Score (1-100)']].iloc[:, :].values # extracts
inertia = []
for n in range(1 , 11):
    model_1 = (KMeans(n_clusters = n , init='k-means++' , n_init = 10 , max_iter=300,
                      tol=0.0001, random_state= 111 , algorithm='elkan')) # use pr
    model_1.fit(X_age_spending) # fit the data into the model
    inertia.append(model_1.inertia_)
```

After using segmentation on the dataset, we need to visualize this by plotting the graph:-

```
In [43]: plt.figure(1 , figsize = (15 ,6)) # set dimension of image
plt.plot(np.arange(1 , 11) , inertia , 'o') # Mark the points with a solid circle
plt.plot(np.arange(1 , 11) , inertia , '-' , alpha = 0.5) # connect remaining points w
plt.xlabel('Number of Clusters') , plt.ylabel('Inertia') # Label the x and y axes
plt.show() # display
```



After cluster 4 , the line graph starts becoming stable. This is known as Elbow Method.

```
In [34]: model_2 = (KMeans(n_clusters = 4 ,init='k-means++' , n_init = 10 ,max_iter=300,
                      tol=0.0001, random_state= 111 , algorithm='elkan') ) # set random state
model_2.fit(X_age_spending) # fit the model
labels1 = model_2.labels_
centroids1 = model_2.cluster_centers_
```

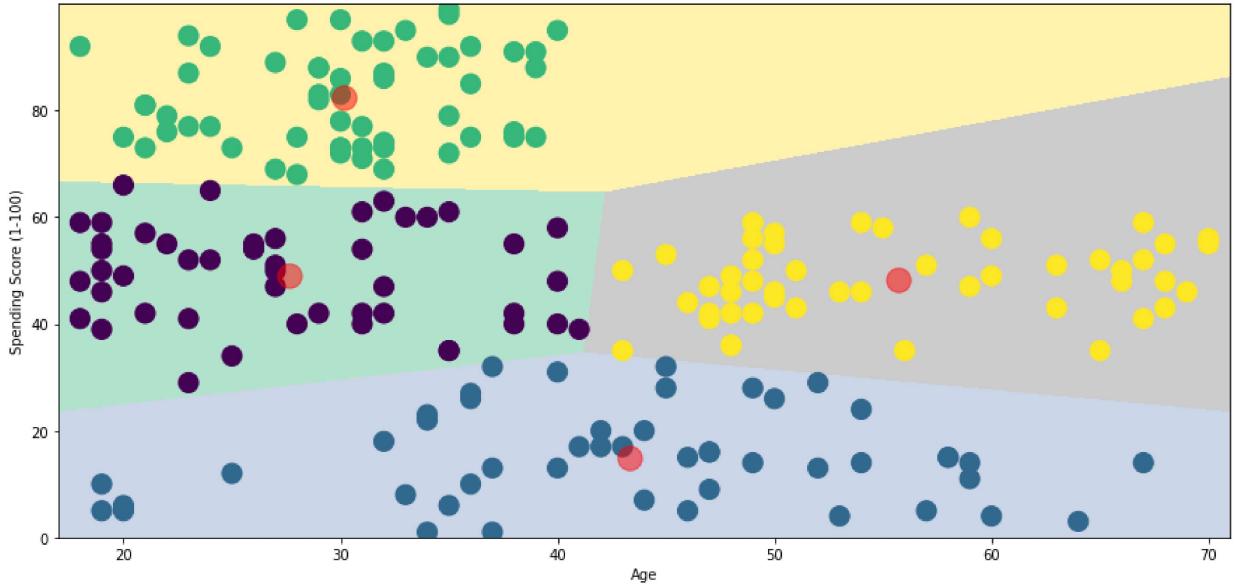
Some prerequisites for plotting a graph - max and min ranges of values, initialising a meshgrid(), and so on:-

```
In [35]: h = 0.02
x_min, x_max = X_age_spending[:, 0].min() - 1, X_age_spending[:, 0].max() + 1
y_min, y_max = X_age_spending[:, 1].min() - 1, X_age_spending[:, 1].max() + 1
xx, yy = np.meshgrid(np.arange(x_min, x_max, h), np.arange(y_min, y_max, h))
Z = model_2.predict(np.c_[xx.ravel(), yy.ravel()]) # returns flattened 1D array
```

Plotting the graph:-

```
In [46]: plt.figure(1 , figsize = (15 , 7) )
plt.clf()
Z = Z.reshape(xx.shape)
plt.imshow(Z , interpolation='nearest',
           extent=(xx.min(), xx.max(), yy.min(), yy.max()),
           cmap = plt.cm.Pastel2, aspect = 'auto', origin='lower')

plt.scatter( x = 'Age' ,y = 'Spending Score (1-100)' , data = df , c = labels1 ,
            s = 200 )
plt.scatter(x = centroids1[:, 0] , y = centroids1[:, 1] , s = 300 , c = 'red' , alpha=0.5)
plt.ylabel('Spending Score (1-100)' , plt.xlabel('Age')
plt.show()
```



K-Means with 4 clusters

(Graph includes Four clusters with the Red Points referring to the centroids of the respective clusters)

So now we can deduce the following information about the spending patterns:

1. The average spending score irrespective of age would be around 20.
2. In the topmost cluster, Customers below age 40 has the highest spending scores. The cluster is less sparse.
3. Above age 40, the spending score remains consistently within the range of 30 - 60.

Conclusion

Data is an essential part of any enterprise or business. It is critical to collect, process, and analyze data flow in a timely and accurate manner to discover information useful for decision making in business.

The data science industry is rapidly expanding. Data volume can be large, making information handling difficult and time-consuming.

As we learned from the above simple case-study, we find that AI has played a significant role in almost all the industries. With the rise in the trend of data analysis, the customers behavior is being continuously monitored for improving strategies and taking better decisions.