

Group A

Assignment

No: 10

Contents for Theory:

- 1. Seaborn Library Basics**
- 2. Know your Data**
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- 4. Data Visualization III Download the Iris flower dataset or any other dataset into a DataFrame. (e.g., <https://archive.ics.uci.edu/ml/datasets/Iris>). Scan the dataset and give the inference as:**
 - 1. List down the features and their types (e.g., numeric, nominal) available in the dataset.** -----
 - 2. Create a histogram for each feature in the dataset to illustrate the feature distributions.**
 - 3. Create a boxplot for each feature in the dataset. 4. Compare distributions and identify outliers** -----
 - 4. Compare distributions and identify outliers**

Theory:

Data Visualisation plays a very important role in Data mining. Various data scientists spent their time exploring data through visualisation. To accelerate this process we need to have a well-documented of all the plots.

Even plenty of resources can't be transformed into valuable goods without planning and architecture

1. Seaborn Library Basics

Seaborn is a Python data visualisation library based on matplotlib. It provides a high-level interface for drawing attractive and informative statistical graphics.

For the installation of Seaborn, you may run any of the following in your command line.

```
pip install seaborn
conda install seaborn
```

To import seaborn you can run the following command.

```
import seaborn as sns
```

2. Know your data

The dataset that we are going to use to draw our plots will be the Titanic dataset, which is downloaded by default with the Seaborn library. All you have to do is use the `load_dataset` function and pass it the name of the dataset.

Let's see what the Titanic dataset looks like. Execute the following script:

```
import pandas as pd

import numpy as np

import matplotlib.pyplot as plt

import seaborn as sns

dataset = sns.load_dataset('iris')

dataset.head()
```

3. Finding patterns of data.

Patterns of data can be find out with the help of different types of plots

Types of plots are:

A. Distribution Plots

- a. Dist-Plot
- b. Joint Plot
- d. Rug Plot

B. Categorical Plots

- a. Bar Plot
- b. Count Plot
- c. Box Plot
- d. Violin Plot

C. Advanced Plots

- a. Strip Plot
- b. Swarm Plot

D. Matrix Plots

- a. Heat Map
- b. Cluster Map

A. Distribution Plots:

These plots help us to visualise the distribution of data. We can use these plots to understand the mean, median, range, variance, deviation, etc of the data.

a. Distplot

- Dist plot gives us the histogram of the selected continuous variable.
- It is an example of a univariate analysis.
- We can change the number of bins i.e. number of vertical bars in a histogram

b. Joint Plot

- It is the combination of the distplot of two variables.
- It is an example of bivariate analysis.
- We additionally obtain a scatter plot between the variables to reflect their linear relationship. We can customise the scatter plot into a hexagonal plot, where, the more the colour intensity, the more will be the number of observations.

c. The Rug Plot

a. The `rugplot()` is used to draw small bars along the x-axis for each point in the dataset. To plot a rug plot, you need to pass the name of the column. Let's plot a rug plot for fare. These are some of the most commonly used distribution plots offered by the Python's Seaborn Library. Let's see some of the categorical plots in the Seaborn library.

2. Categorical Plots

Categorical plots, as the name suggests, are normally used to plot categorical data. The categorical plots plot the values in the categorical column against another categorical column or a numeric column. Let's see some of the most commonly used categorical data.

b. The Bar Plot

The `barplot()` is used to display the mean value for each value in a categorical column, against a numeric column. The first parameter is the categorical column, the second parameter is the numeric column while the third parameter is the dataset.

From the output, you can clearly see that the average age of male passengers is just less than 40 while the average age of female passengers is around 33.

In addition to finding the average, the bar plot can also be used to calculate other aggregate values for each category. To do so, you need to pass the aggregate function to the estimator. For instance, you can calculate the standard deviation for the age of each gender as follows:

c. The Count Plot

The count plot is similar to the bar plot, however it displays the count of the categories in a specific column. For instance, if we want to count the number of males and women passenger we can do so using count plot as follows:

d. The Box Plot

The box plot is used to display the distribution of the categorical data in the form of quartiles. The centre of the box shows the median value. The value from the lower whisker to the bottom of the box shows the first quartile. From the bottom of the box to the middle of the box lies the second quartile. From the middle of the box to the top of the box lies the third quartile and finally from the top of the box to the top whisker lies the last quartile.

e. The Violin Plot

The violin plot is similar to the box plot, however, the violin plot allows us to display all the components that actually correspond to the data point. The `violinplot()` function is used to plot the violin plot. Like the box plot, the first parameter is the categorical column, the second

parameter is the numeric column while the third parameter is the dataset.

Now you can see a lot of information on the violin plot. For instance, if you look at the bottom of the violin plot for the males who survived (left-orange), you can see that it is thicker than the bottom of the violin plot for the males who didn't survive (left-blue). This means that the number of young male passengers who survived is greater than the number of young male passengers who did not survive

Advanced Plots:

a. The Strip Plot

The strip plot draws a scatter plot where one of the variables is categorical. We have seen scatter plots in the joint plot and the pair plot sections where we had two numeric variables. The strip plot is different in a way that one of the variables is categorical in this case, and for each category in the categorical variable, you will see a scatter plot with respect to the numeric column.

b. The Swarm Plot

The swarm plot is a combination of the strip and the violin plots. In the swarm plots, the points are adjusted in such a way that they don't overlap. Let's plot a swarm plot for the distribution of age against gender. The `swarmplot()` function is used to plot the violin plot. Like the box plot, the first parameter is the categorical column, the second parameter is the numeric column while the third parameter is the dataset. Look at the following script:

You can clearly see that the above plot contains scattered data points like the strip plot and the data points are not overlapping. Rather they are arranged to give a view similar to that of a violin plot.

1. Matrix Plots

Matrix plots are the type of plots that show data in the form of rows and columns. Heat maps are the prime examples of matrix plots.

a. Heat Maps

Heat maps are normally used to plot correlation between numeric columns in the form of a matrix. It is important to mention here that to draw matrix plots, you need to have meaningful information on rows as well as columns. Let's plot the first five rows of the Titanic dataset to see if both the rows and column headers have meaningful information. Execute the following script:

From the output, you can see that the column headers contain useful information such as passengers surviving, their age, fare etc. However the row headers only contain indexes 0, 1, 2, etc. To plot matrix plots, we need useful information on both columns and row headers. One way to do this is to call the `corr()` method on the dataset. The `corr()` function returns the correlation between all the numeric columns of the dataset. Execute the following script:

Now to create a heat map with these correlation values, you need to call the `heatmap()` function and pass it your correlation dataframe.

From the output, it can be seen that what heatmap essentially does is that it plots a box for every combination of rows and column value. The colour of the box depends upon the gradient. For instance, in the above image if there is a high correlation between two features, the corresponding cell or the box is white, on the other hand if there is no correlation, the corresponding cell remains black.

The correlation values can also be plotted on the heatmap by passing `True` for the `annot` parameter. Execute the following script to see this in action:

b. Cluster Map:

In addition to the heat map, another commonly used matrix plot is the cluster map. The cluster map basically uses Hierarchical Clustering to cluster the rows and columns of the matrix.

Conclusion-

Seaborn is an advanced data visualisation library built on top of Matplotlib library. In this assignment, we looked at how we can draw distributional and categorical plots using the Seaborn library. We have seen how to plot matrix plots in Seaborn. We also saw how to change plot styles and use grid functions to manipulate subplots.

Assignment Questions

- 1. List out different types of plot to find patterns of data**
- 2. Explain when you will use distribution plots and when you will use categorical plots.**
- 3. Write the conclusion from the following swarm plot (consider titanic dataset)**
- 4. Which parameter is used to add another categorical variable to the violin plot, Explain with syntax and example.**