Exploratory Data Analysis - Revisit

Agenda

1. Steps involved in a data analysis project
2. Data analysis packages in Python - How to import and use them?
3. Common statistical measures
    - What is the central tendency of different variables?
    - What is the relationship between the variables?
4. Data Visualisation with Python
    - Why is visualisation important?
    - How to choose plots for Univariate and Bivariate Analysis?
5. FoodHub Project
    - Business Context and Objectives
    - Dataset
    - Submission Guidelines
    - Q/A

Getting started with Data Analysis

EDA is the approach to explore the data in a systematic way and summarize the main characteristics, using different types of visualizations and analytical tools. Steps involved in a data analysis project using Python are provided below -

1 Importing Packages

In this step, we import all the necessary packages such as **numpy**, **pandas**, **matplotlib**, **seaborn** etc.

2 Loading the Dataset

Using **pandas** functions, we load the dataset in a dataframe. For csv files, '**pd.read_csv( )**' is used. For excel files, 'pd.read_excel( )' is used.

3 Exploratory Data Analysis

In this step, we look for the **shape** of the dataset, the different **data types,** check for **anomalous and missing values,** and analyse the attributes individually as well as relationships between them to identify key business insights

Pandas - Data Analysis package

Pandas is used for data manipulation and analysis. Some important functions of the package are provided below.

df.head( )

The **df.head( )** function returns the **first 5 rows** of the dataframe

df.shape

The **df.shape** returns the number of **rows** and **columns** of the dataframe

df.astype( )

The **df.astype( )** function **convert the data type** of an existing column in a dataframe

df.info( )

The **df.info()** function returns information about the dataframe including the **data types** of each column and **memory usage**

df.describe( )

The **df.describe()** function returns the statistical data like percentile, mean, etc. of the dataframe

df.unique( )

The **df.unique()** function returns the unique values present in a dataframe

df.groupby( )

The **df.groupby( )** function function is used to **split** the data **into groups**

df.value_counts( )

The **df.value_counts( )** returns a Series containing the **counts of unique values**.

Common Statistical Measures

Central tendency measures condense the dataset down to one representative value, which is useful for working with large amounts of data. It also allows us to compare one dataset to another.

Measure of Central Tendency

Mean	Median	Mode
The **mean** is the arithmetic average of a set of given numbers.	The **median** is the middle score in a set of given numbers.	The **mode** is the most frequent score in a set of given numbers.
`df['column_name'].mean( )`	`df['column_name'].median( )`	`df['column_name'].mode( )[0]`
The **mean** can be **used to represent the typical value** and therefore serves as a yardstick for all observations.	Since the mean is highly affected by the outliers, the **median** is a better choice for a dataset with extreme values	Mode is the preferred measure when data is categorical.

Common Statistical Measures

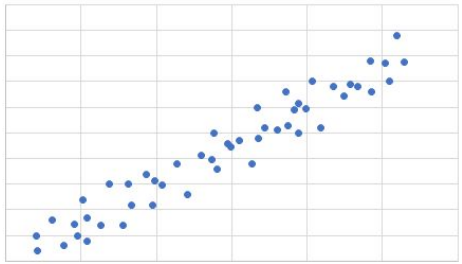
Correlation Coefficient

Correlation is a measure of association between two variables. The **Correlation Coefficient** is a statistical measure of the strength of the relationship between two variables.

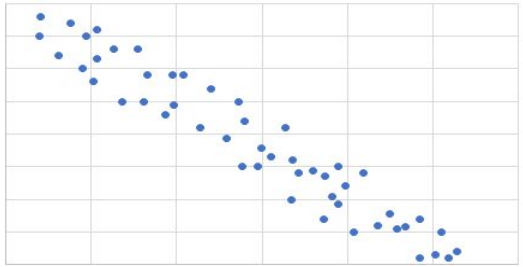
df.corr( )

Based on direction of change in the value of one variable as the value of the other changes, the two variables are said to have a positive relationship, negative relationship, or no relationship at all.

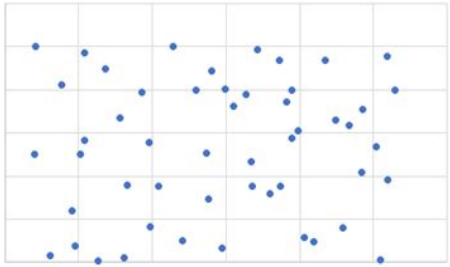
Positive Correlation



Negative Correlation



Zero Correlation



Significance of Data Visualization

Data visualization gives us a **better idea of the information stored in data by giving it visual context through various plots**.

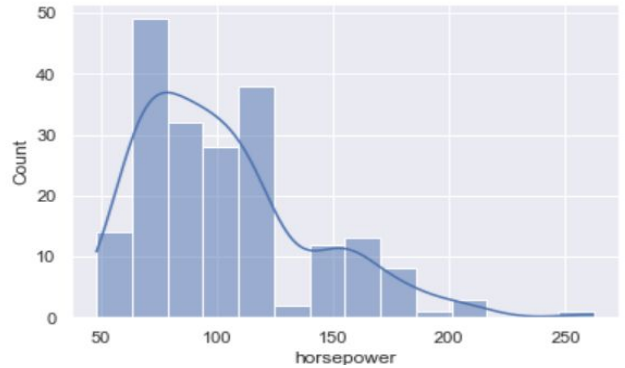
- Using graphic representations, we can visualize large volumes of data in an understandable and coherent way, which in turn helps us comprehend the information and draw conclusions and insights
- Data storytelling is a medium that enables us to easily create a narrative through graphics and diagrams, through which, with the help of visual analytics, we can uncover new insights and engage others.
- It also enables us to **identify relationships and patterns within data,** since discerning trends in the data gives us a competitive advantage

How to choose plots for Univariate Analysis (numerical)?

When to use a Histogram

When **the data is numeric** and **you want to see the shape of the data distribution**, determine whether the data is distributed approximately normally (bell shaped) or not

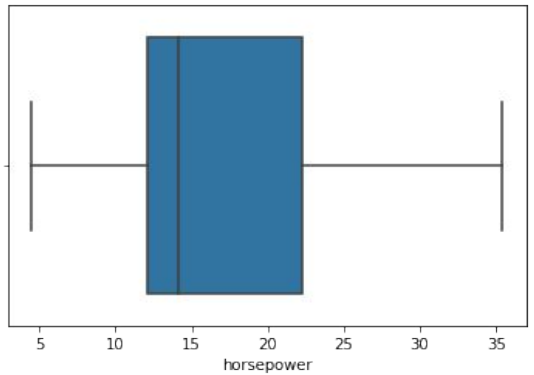
sns.histplot(data = , x = ‘ ‘, kde = True)



When to use Boxplot

When **the data is numeric** and **you want to understand the centre, spread, and presence of outliers**

sns.boxplot(data = , x = ‘ ‘)

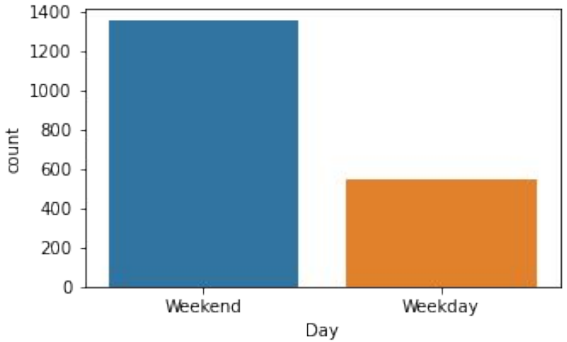


How to choose plots for Univariate Analysis (categorical)?

When to use a Count plot

When **the data is categorical** and you want to show the **counts of observations in each categorical** bin

sns.countplot(data = , x = ‘ ‘)

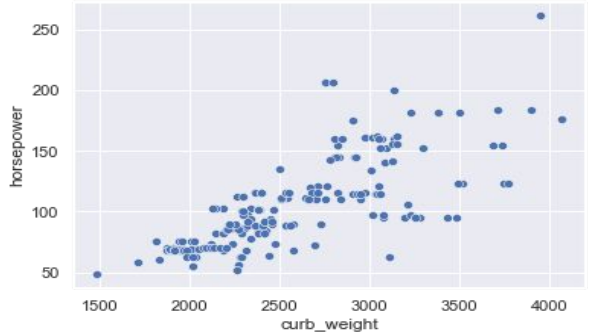


How to choose plots for Bivariate Analysis?

When to use a scatter plot

When **the data is numeric** and **you want to** determine whether the two variables are related, and see if it's a positive or negative correlation.

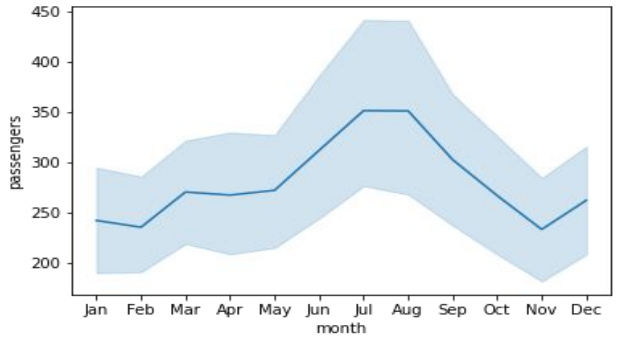
sns.scatterplot(data = , x = ‘ ‘, y = ‘ ‘)



When to use a line chart

When **the data is continuous** and **you want to see the** how the value of something changes over short and long periods of time.

sns.lineplot(data = , x = ‘ ‘, y = ‘ ‘)



FoodHub - Business Context and Objective

- The number of restaurants in New York is increasing day by day. Lots of students and busy professionals rely on those restaurants due to their hectic lifestyles. Online food delivery service is a great option for them. It provides them with good food from their favorite restaurants. A food aggregator company FoodHub offers access to multiple restaurants through a single smartphone app.
- The app allows the restaurants to receive a direct online order from a customer. The app assigns a delivery person from the company to pick up the order after it is confirmed by the restaurant. The delivery person then uses the map to reach the restaurant and waits for the food package.
- Once the food package is handed over to the delivery person, he/she confirms the pick-up in the app and travels to the customer's location to deliver the food. The delivery person confirms the drop-off in the app after delivering the food package to the customer. The customer can rate the order in the app. The food aggregator earns money by collecting a fixed margin of the delivery order from the restaurants.
- The food aggregator company has stored the data of the different orders made by the registered customers in their online portal. They want to analyze the data to get a fair idea about the demand of different restaurants which will help them in enhancing their customer experience. Suppose you are hired as a Data Scientist in this company and the Data Science team has shared some of the key questions that need to be answered. Perform the data analysis to find answers to these questions that will help the company to improve the business.

FoodHub - Dataset

- The data contains the different data related to a food order. The detailed data dictionary is given below.
- Data Dictionary
    - **order_id**: Unique ID of the order
    - **customer_id**: ID of the customer who ordered the food
    - **restaurant_name**: Name of the restaurant
    - **cuisine_type**: Cuisine ordered by the customer
    - **cost**: Cost of the order
    - **day_of_the_week**: Indicates whether the order is placed on a weekday or weekend (The weekday is from Monday to Friday and the weekend is Saturday and Sunday)
    - **rating**: Rating given by the customer out of 5
    - **food_preparation_time**: Time (in minutes) taken by the restaurant to prepare the food. This is calculated by taking the difference between the timestamps of the restaurant's order confirmation and the delivery person's pick-up confirmation.
    - **delivery_time**: Time (in minutes) taken by the delivery person to deliver the food package. This is calculated by taking the difference between the timestamps of the delivery person's pick-up confirmation and drop-off information

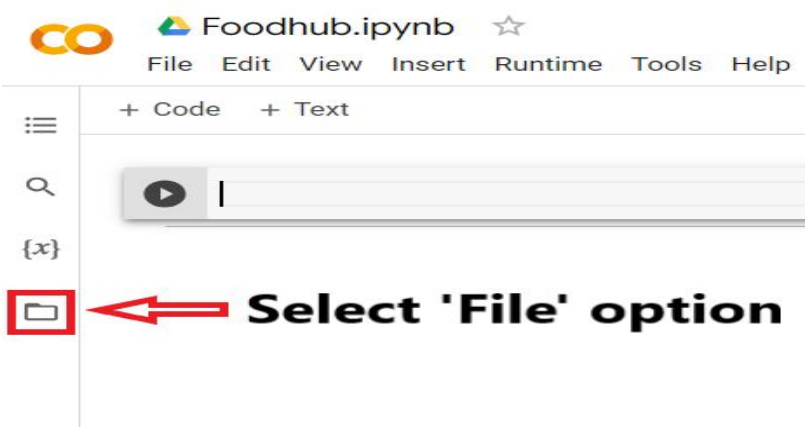
How to Load Dataset in Google Colab

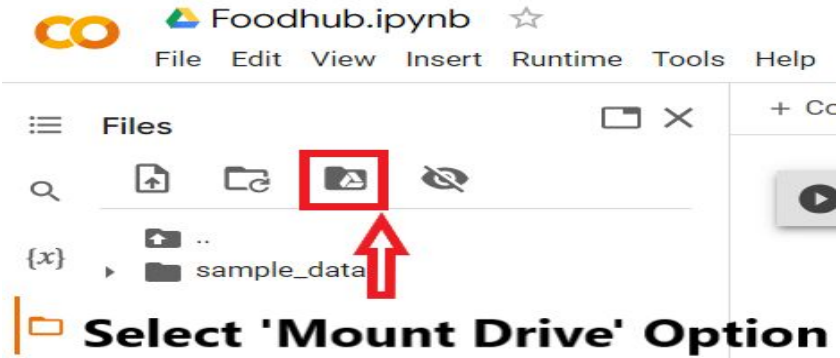
- **Step 1**: Upload the csv file in the Google Drive
- **Step 2**: Create a new notebook / open an existing notebook
- **Step 3**: Import pandas library into the notebook. The following code can be used for the same

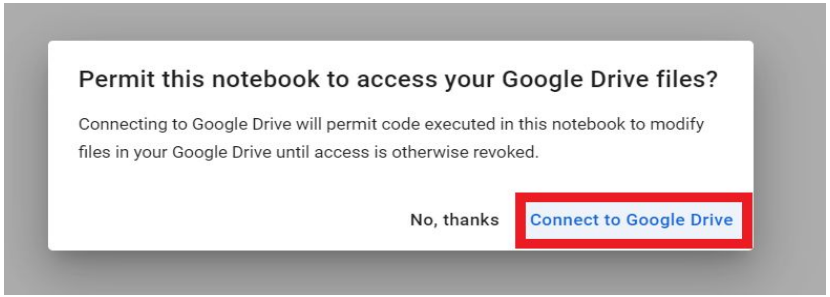
```
import pandas as pd
```

- **Step 4**: Mount Google Drive in the notebook. This can be done via two approaches:
    - Approach 1
        - Click on the *Files* option on the left
        - Select the *Mount Drive* option
        - In the pop-up that appears, select *Connect to Google Drive* option

How to Load Dataset in Google Colab







How to Load Dataset in Google Colab

- Approach 2
  - Run the following command in the notebook

```
from google.colab import drive
drive.mount('/content/drive')
```

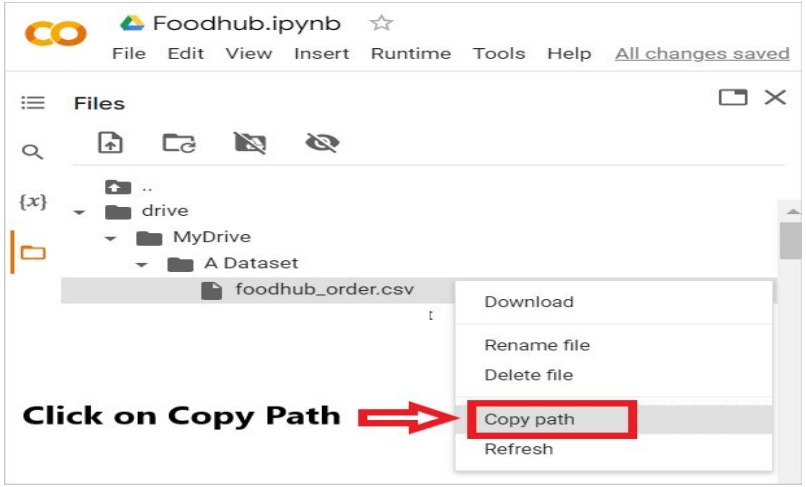
  - In the pop-up that appears, select *Connect to Google Drive* option

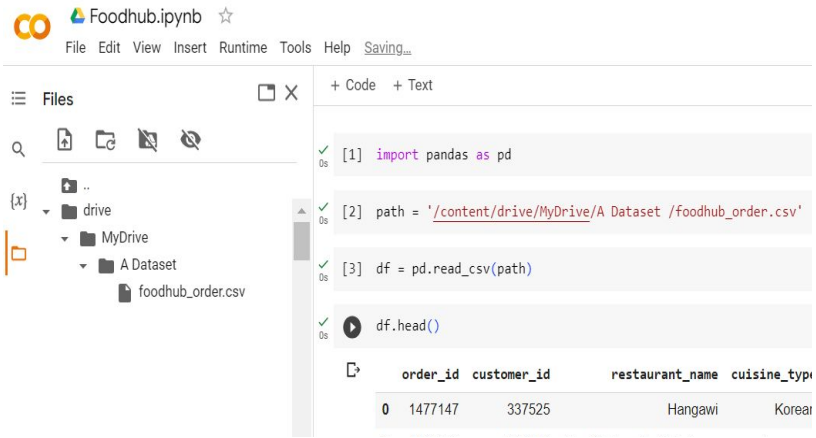
- **Step 5**: Expand the *Drive* option, and browse to your working directory
- **Step 6**: Right-click on the file and select *Copy path*
  - For example, if we want to load the file foodhub.csv, which is present in the *Colab Notebooks* folder in *MyDrive*, we would navigate to the folder and right-click on the file to get the file path

How to Load Dataset in Google Colab

- **Step 7**: Create a variable *path* and set the copied file path as the value of the variable (you can simply paste the copied file path for this)
- **Step 8**: Pass the *path* variable as an argument of the pandas *read_csv()* function to load the file into a pandas dataframe and store it in a variable
    - For example, `df = pd.read_csv(path)`
- **Step 9**: Call the head() function of the dataframe to check if the data is imported correctly
    - For example: `df.head()`

How to Load Dataset in Google Colab

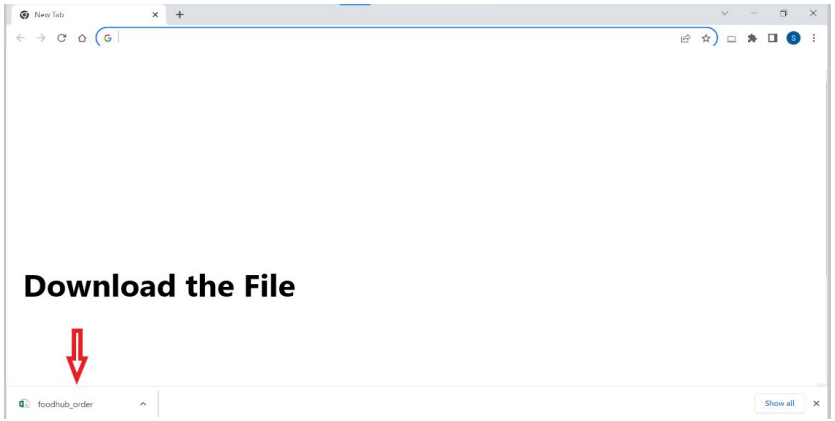


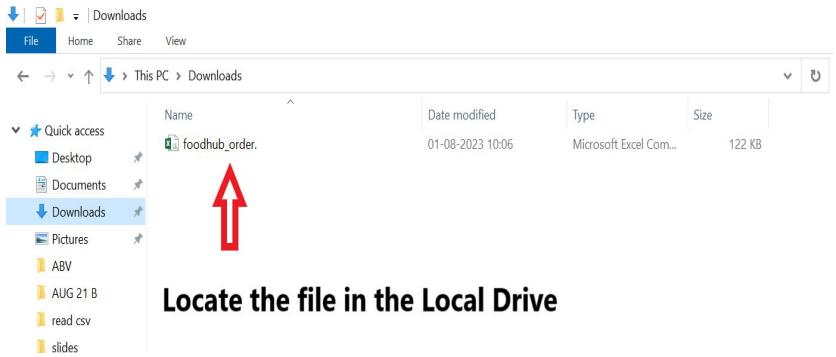


How to Load Dataset in Jupyter Notebook

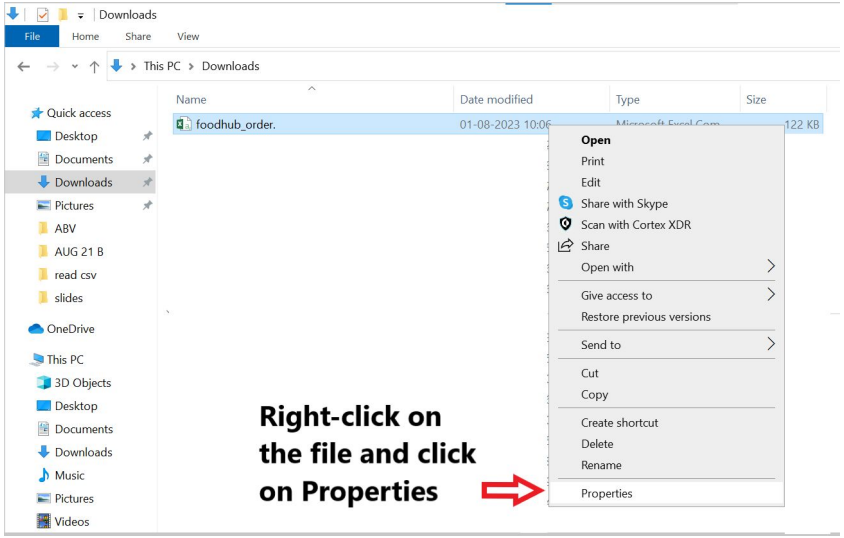
- **Step 1**: Download the CSV file you want to work with
- **Step 2**: Locate the file in the Local Drive
- **Step 3**: Right-click on the file and click on Properties and copy the file location
- **Step 4**: Import numpy and pandas
- **Step 5**: Paste the path in the variable path and add the filename at the end, as shown below
    - **Note: It is important to replace the single slash (i.e., \) in the file path with a double slash (i.e., \\)**
    - For example, if the filename is Foodhub.csv and the file path is C:\Users\User\Downloads, then the path variable should be defined as follows:
        - **path = 'C:\\Users\\User\\Downloads\\Foodhub.csv'**

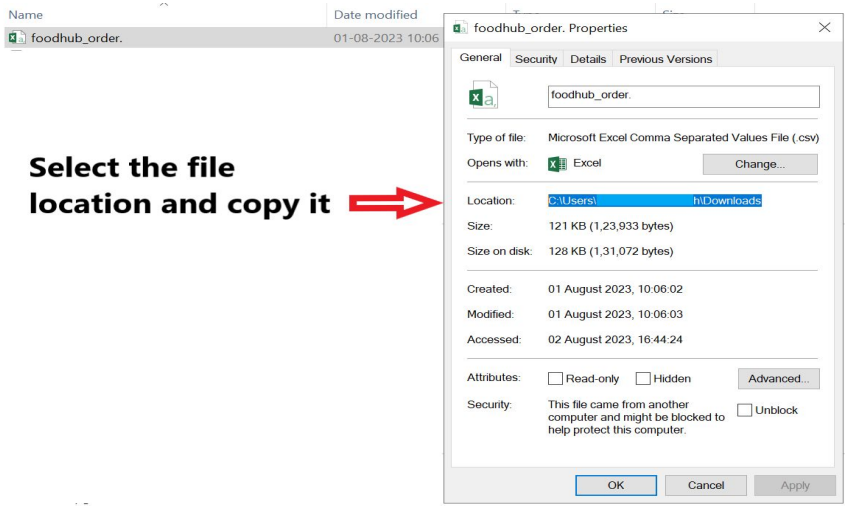
How to Load Dataset in Jupyter Notebook





How to Load Dataset in Jupyter Notebook





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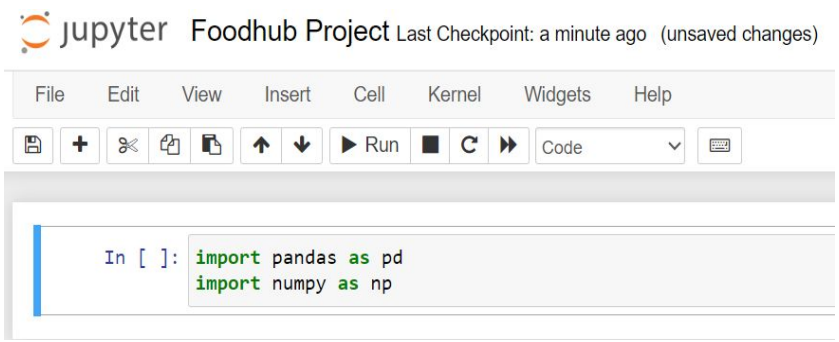

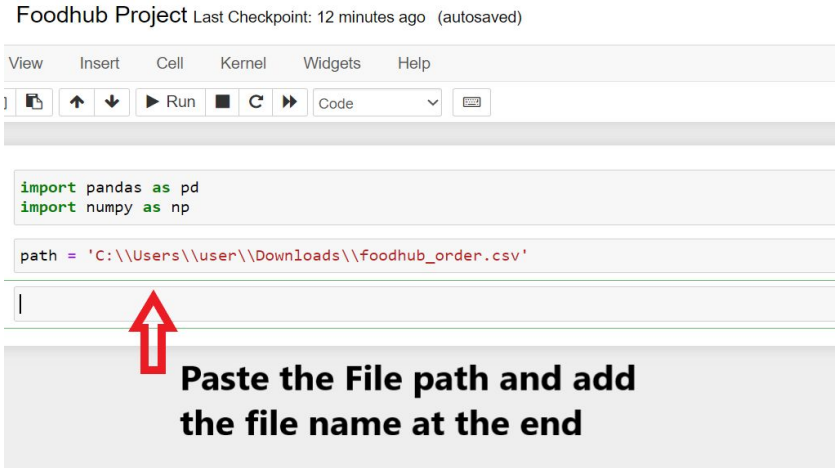

How to Load Dataset in Jupyter Notebook

- **Step 6**: Call the path variable in the read_csv() function of pandas to load the file into a pandas dataframe, and store it in a variable, for example **df = pd.read_csv(path)**
- **Step 7**: Call the head() function of the dataframe to check if the data is imported correctly, use the code **df.head()**

```
df = pd.read_csv(path)
```

```
df.head()
```

	order_id	customer_id	restaurant_name	cuisine_type	cost_of_the_order	day_of_the_week	rating	food_preparation_time	delivery_time
0	1477147	337525	Hangawi	Korean	30.75	Weekend	Not given	25	20
1	1477685	358141	Blue Ribbon Sushi Izakaya	Japanese	12.08	Weekend	Not given	25	23
2	1477070	66393	Cafe Habana	Mexican	12.23	Weekday	5	23	28
3	1477334	106968	Blue Ribbon Fried Chicken	American	29.20	Weekend	3	25	15
4	1478249	76942	Dirty Bird to Go	American	11.59	Weekday	4	25	24

FoodHub - Low-code Version

- For learners who aspire to be in managerial roles in the future, focusing on solution review, interpretation, recommendations, and communication with business stakeholders
- Steps Involved
    - Download the dataset () and the *Learner Notebook - Low Code*, (this is a template notebook)
    - Fill in the blanks in the notebook to complete and execute the code to solve the questions and perform all the tasks as per the grading rubric
    - Once the notebook is completely executed and necessary outputs obtained, a business presentation (using Microsoft PowerPoint, Google Slides, etc.) has to be created
    - The presentation should contain observations, insights, and recommendations for the business problem
        - The presentation template provided can be referred to as a sample
    - Once the presentation is complete, convert the presentation to .pdf format
- **The presentation should be submitted as a PDF file (.pdf) and NOT as a .pptx file**
- **Please make sure that all the sections mentioned in the grading rubric have been covered in the submission**

FoodHub - Full-code Version

- For learners who aspire to be in hands-on coding roles in the future, focusing on building solution codes from scratch
- Steps Involved:
    - Download the dataset and the *Learner Notebook - Full Code* (this is a template notebook containing high-level steps to perform and insight-based questions)
    - Write necessary code to solve the questions and perform all the tasks as per the grading rubric
    - Clearly write down observations, insights, and recommendations for the business problem based on the analysis performed
    - Once the notebook is complete, download it as a .ipynb file and convert it to a .html file
- **The notebook should be submitted as an HTML file (.html) and NOT as a notebook file (.ipynb)**
    - The conversion can be done via one of the following ways:
        - Jupyter Notebook:
        - Google Colab: Use free online tools
- **Please make sure that all the sections mentioned in the grading rubric have been covered in the submission**

FoodHub - Q/A

FoodHub - Project FAQs

How to approach Question 13?

Question 13: The company wants to provide a promotional offer in the advertisement of the restaurants. The condition to get the offer is that the restaurants must have a rating count of more than 50 and the average rating should be greater than 4. Find the restaurants fulfilling the criteria to get the promotional offer.

Step 1: Filter the restaurant's column for those restaurants that do not have a rating as 'Not given'

Step 2: Convert the rating column created above from object to integer datatype

Step 3: Create a dataframe that contains the restaurant names with their rating counts

Step 4: Get all the restaurant names that have a rating count of more than 50

Step 5: find the mean rating of the restaurants by using the group by function

FoodHub - Project FAQs

How to approach Question 14?

Question 14: The company charges the restaurant 25% on the orders having cost greater than 20 dollars and 15% on the orders having cost greater than 5 dollars. Find the net revenue generated by the company across all orders.

Step 1: Create a function with conditional statements (for each category, 25%, 15% and 0%(else condition)) and mention the revenue for each condition.

Step 2: Apply these conditions on the cost_of_the_order column to calculate the revenue, same the value in a revenue column.

Step 3: Taking summation of the revenue column will give the total revenue.

FoodHub - Project FAQs

Is there a way to transfer the graphs from Colab to the presentation without it looking blurry?

There are multiple ways to transfer the graphs.

1. Use the following line of code just after the visualization code:

   `plt.savefig("output.jpg", bbox_inches='tight')`

   For example:

   ```
   sns.histplot(data=data, x='column')

   plt.savefig("output.jpg", bbox_inches='tight')
   ```

2. Use the snipping tool to snip the visual plot from the Jupyter notebook and paste the snip in ppts.
3. Right-click on the image and click on copy and paste the copied plot in the ppt or document.

Great Learning

Happy Learning !