Hands-on Lab: Generative AI for Data Insights

One of the principal steps in understanding and interpreting data is drawing statistical and correlative insights from the data. In this lab, you will learn how to use efficient prompts on a Generative AI platform to create a Python script for generating insights on a data set available in a CSV file.

Objectives

In this lab, you will learn how to create prompts to generate Python code that can:

- Generate a statistical description of all the features of the data set
- Generate regression and box plots for different attributes to compare their distribution against a target attribute
- Evaluate the correlation value, Pearson coefficient, and p-values for different parameters of the data set with the target parameter
- Create pivot tables for a group of parameters and visualize them using pcolor plots

Data set

For this lab, you'll use a clean version of a publically available data set about used car sales.

The CSV file for this clean version of the data set is available at the following URL:

```
URL = "https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBMDeveloperSkillsNetwork-DA0101EN-Coursera/laptop_pricing_dataset_mod2.csv"
```

The dataset is a filtered and modified version of the Laptop Price Prediction using specifications dataset, available under the Database Contents License (DbCL) v1.0 on the Kaggle website.

Testing environment

You can test the codes generated using this lab in a JupyterLite environment. Click the following link to launch a JupyterLite lab environment.

JupyterLite test environment

Follow the steps mentioned in this link to set up the testing environment.

Reading the data set and generating the statistical description

First, you must import the data set into the interface as a pandas data frame. To complete the first objective, you can further generate a statistical description of the data set.

The data set is now assumed to be completely prepared and ready for exploratory data analysis. The headers for the data set must be in the first row of the CSV file.

To read the CSV file to a data frame and a generate statistical description of the data set, provide the generative AI model with the following prompt.

```
Write a python code to perform the following actions.
1. Import a data set from a CSV file, The headers for the data set must be in the first row of the CSV file.
2. Generate the statistical description of all the features used in the data set. Include "object" data types as well.
```

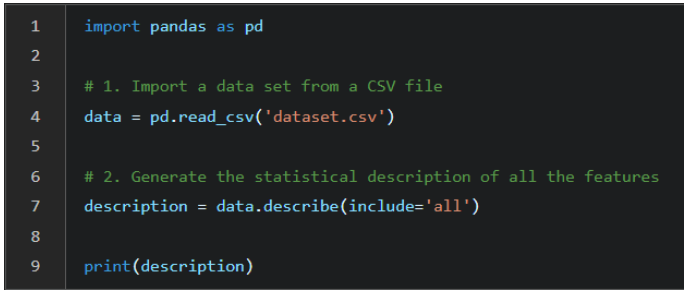
This prompt will display code that looks like what you see below:

```
import pandas as pd

# 1. Import a data set from a CSV file
data = pd.read_csv('dataset.csv')

# 2. Generate the statistical description of all the features
description = data.describe(include='all')

print(description)
```



You can use the relevant code and run the code in the testing environment.

Creating parameter visualizations

Next, you decided that you need to see the distribution of various attributes against the target attribute. The target attribute, in this case, is `Price`. Different forms of visualizations are for different types of attributes. Attributes with continuous values use regression plots, and the attributes with categorical values use box plots.
You can provide the generative AI model with a list of continuous values and another list of categorical values within a single prompt and ask the model to create a code that generates these plots.

The attributes with continuous values are `CPU_frequency`, `Screen_Size_inch` and `Weight_pounds`.
The attributes with categorical values are `Category`, `GPU`, `OS`, `CPU_core`, `RAM_GB` and `Storage_GB_SSD`.

Create the following prompt:

```
Write a Python code to perform the following actions.
1. Create regression plots for the attributes "CPU_frequency", "Screen_Size_inch" and "Weight_pounds" against "Price".
2. Create box plots for the attributes "Category", "GPU", "OS", "CPU_core", "RAM_GB" and "Storage_GB_SSD" against the attribute "Price".
```

The output should be as shown below.

```
import pandas as pd import
seaborn as sns
import matplotlib.pyplot as plt

# 1. Create regression plots
data = pd.read_csv('dataset.csv')

regression_attributes = ['CPU_frequency', 'Screen_Size_inch', 'Weight_pounds']
for attribute in regression_attributes:
    sns.regplot(x=attribute, y='Price', data=data)
    plt.title(f'Regression plot for {attribute} vs Price')
    plt.xlabel(attribute)
    plt.ylabel('Price')
    plt.show()

# 2. Create box plots
boxplot_attributes = ['Category', 'GPU', 'OS', 'CPU_core', 'RAM_GB', 'Storage_GB_SSD']
for attribute in boxplot_attributes:
    sns.boxplot(x=attribute, y='Price', data=data)
    plt.title(f'Box plot for {attribute} vs Price')
    plt.xlabel(attribute)
    plt.ylabel('Price')
    plt.show()
```

You can use the relevant code generated by running this prompt.

Remember to install the `seaborn` package on the testing environment.
Also, remember to execute the statement `%matplotlib inline` for the plots to be visible directly in the console.

Evaluate dependence

Usually, not all parameters in a data set have a direct or strong level of influence on the target variable. The level of influence is especially important for data scientists because the design of predictive models uses variables that affect the target variable the most.

To evaluate parametric interdependence, one can evaluate the correlation value, the Pearson coefficient, and p-values of different attributes with the target attribute.

Use the following prompt to write a prompt to evaluate dependence:

```
Write a Python code for the following.
1. Evaluate the correlation value, pearson coefficient and p-values for all numerical attributes against the target attribute "Price".
2. Don't include the values evaluated for target variable against itself.
3. Print these values as a part of a single dataframe against each individual attrubute.
```

You can view the output for this prompt below.

```
import pandas as pd import
numpy as np
from scipy.stats import pearsonr

# Assuming your dataframe has a target attribute 'Price' df =
pd.read_csv('dataset.csv')

# Select numerical attributes
numerical_attributes = df.select_dtypes(include=np.number)

# Calculate correlation values for all numerical attributes against 'Price'
correlation_values = numerical_attributes.corr()['Price'].drop('Price')

# Calculate Pearson coefficient & p-values for all numerical attributes against 'Price'
pearson_coefficients = []
p_values = []
for column in numerical_attributes.columns:
    if column != 'Price':
       pearson_coefficient, p_value =pearsonr(numerical_attributes[column], df['Price'])
       pearson_coefficients.append(pearson_coefficient)
       p_values.append(p_value)

# Create a new dataframe to store the results
results_df = pd.DataFrame({'Attribute': correlation_values.index,
                           'Correlation Value': correlation_values,
                      'Pearson Coefficient': pearson_coefficients, 'P-value': p_values})

# Print the results
print(results_df)
```

```
import pandas as pd
import numpy as np
from scipy.stats import pearsonr

# Assuming your dataframe has a target attribute 'Price'
df = pd.read_csv('dataset.csv')

# Select numerical attributes
numerical_attributes = df.select_dtypes(include=np.number)

# Calculate correlation values for all numerical attributes against 'Price'
correlation_values = numerical_attributes.corr()['Price'].drop('Price')

# Calculate Pearson coefficient and p-values for all numerical attributes against 'Price'
pearson_coefficients = []
p_values = []

for column in numerical_attributes.columns:
    if column != 'Price':
        pearson_coefficient, p_value = pearsonr(numerical_attributes[column], df['Price'])
        pearson_coefficients.append(pearson_coefficient)
        p_values.append(p_value)

# Create a new dataframe to store the results
results_df = pd.DataFrame({'Attribute': correlation_values.index, 'Correlation Value': correlation_values, 'Pearson Coefficient':

# Print the results
print(results_df)
```

You can use the code generated here to test on the testing platform.

Grouping and pivots

You can perform another form of exploratory data analysis by grouping different variables to create a pivot table, which serves as a matrix of different combinations of values as seen in the grouped variables. The respective value of the matrix is the average of all values of the target attribute that have the same combination. You can view this kind of matrix using a pcolor plot.

Say you need to create a group with parameters `GPU`, `CPU_core` and `Price`. You need a Pivot table, considering `Price` as the target variable and pcolor plot for that table.

You can follow the following prompt as an example:

```
Write a python code that performs the following actions.
1. Group the attributes "GPU", "CPU_core" and "Price", as available in a dataframe df
2. Create a pivot table for this group, assuming the target variable to be 'Price' and aggregation function as mean 3. Plot a pcolor plot for
   this pivot table.
```

You can see the output for this prompt below.

```
import pandas as pd
import matplotlib.pyplot as plt

# Import the data set as a pandas DataFrame
df = pd.read_csv('your_file.csv')

# Group the attributes
grouped_data = df.groupby(['GPU', 'CPU_core'])['Price'].mean()

# Create a pivot table
pivot_table = pd.pivot_table(df, values='Price', index='GPU',
                             columns='CPU_core', aggfunc='mean')

# Plot a pcolor plot
plt.pcolor(pivot_table, cmap='RdBu')
plt.colorbar()
plt.title('Pivot Table - Mean Price')
plt.xlabel('CPU Core')
plt.ylabel('GPU')
plt.show()
```

You can use the code from this output based on your requirements.

Conclusion

Congratulations! You have completed this lab about generating data insights using generative AI tools.

Now you should be able to build efficient and helpful prompts that can create code to:

- Generate statistical descriptions of the data
- Create visualizations, such as regression plots and box plots, to understand the distribution of the data set against the target variable
- Evaluate the dependence of different attributes against the target attribute
- Group different variables to create a pivot table and visualize the data using a pcolor plot

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