assignment-4-ds

October 7, 2024

#Assignment 4 - Data Science

[39]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
```

[40]:
```
data = pd.read_csv('cerials.csv')
```

1 EDA on Cerials data

[41]:
```
data
```

[41]:

	Cereal	Calories	Sugar
0	Kellogg's All Bran	80.0	6.0
1	Kellogg's Corn Flakes	100.0	2.0
2	Wheaties	100.0	4.0
3	Nature's Path Organic	110.0	4.0
4	Multigrain Flakes	NaN	NaN
5	Kellogg's Rice Krispies	130.0	4.0
6	Post Shredded Wheat Vanilla	190.0	11.0
7	Almond	NaN	NaN
8	Kellogg's Mini Wheats	200.0	10.0

[42]:
```
df = pd.DataFrame(data)
df
```

[42]:

	Cereal	Calories	Sugar
0	Kellogg's All Bran	80.0	6.0
1	Kellogg's Corn Flakes	100.0	2.0
2	Wheaties	100.0	4.0
3	Nature's Path Organic	110.0	4.0
4	Multigrain Flakes	NaN	NaN
5	Kellogg's Rice Krispies	130.0	4.0
6	Post Shredded Wheat Vanilla	190.0	11.0
7	Almond	NaN	NaN
8	Kellogg's Mini Wheats	200.0	10.0

[43]:
```python
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 9 entries, 0 to 8
Data columns (total 3 columns):
 #   Column    Non-Null Count  Dtype
---  ------    --------------  -----
 0   Cereal    9 non-null      object
 1   Calories  7 non-null      float64
 2   Sugar     7 non-null      float64
dtypes: float64(2), object(1)
memory usage: 344.0+ bytes
```

[44]:
```python
df.describe()
```

[44]:

	Calories	Sugar
count	7.000000	7.000000
mean	130.000000	5.857143
std	46.904158	3.387653
min	80.000000	2.000000
25%	100.000000	4.000000
50%	110.000000	4.000000
75%	160.000000	8.000000
max	200.000000	11.000000

[45]:
```python
#Find out the missing data
df.isnull().sum()
```

[45]:
```
Cereal      0
Calories    2
Sugar       2
dtype: int64
```

[46]:
```python
#Lets impute and fil the missing values
df["Calories"].fillna(df["Calories"].mean(), inplace = True)
df["Sugar"].fillna(df["Sugar"].mean(),inplace= True)
```

```
<ipython-input-46-3529f3130399>:2: FutureWarning: A value is trying to be set on
a copy of a DataFrame or Series through chained assignment using an inplace
method.
The behavior will change in pandas 3.0. This inplace method will never work
because the intermediate object on which we are setting values always behaves as
a copy.

For example, when doing 'df[col].method(value, inplace=True)', try using
'df.method({col: value}, inplace=True)' or df[col] = df[col].method(value)
instead, to perform the operation inplace on the original object.
```

```
  df["Calories"].fillna(df["Calories"].mean(), inplace = True)
<ipython-input-46-3529f3130399>:3: FutureWarning: A value is trying to be set on
a copy of a DataFrame or Series through chained assignment using an inplace
method.
The behavior will change in pandas 3.0. This inplace method will never work
because the intermediate object on which we are setting values always behaves as
a copy.

For example, when doing 'df[col].method(value, inplace=True)', try using
'df.method({col: value}, inplace=True)' or df[col] = df[col].method(value)
instead, to perform the operation inplace on the original object.


  df["Sugar"].fillna(df["Sugar"].mean(),inplace= True)
```

[47]:
```python
#Check out again for missing data
df.isnull().sum()
```

[47]:
```
Cereal      0
Calories    0
Sugar       0
dtype: int64
```

[48]:
```python
df
```

[48]:

	Cereal	Calories	Sugar
0	Kellogg's All Bran	80.0	6.000000
1	Kellogg's Corn Flakes	100.0	2.000000
2	Wheaties	100.0	4.000000
3	Nature's Path Organic	110.0	4.000000
4	Multigrain Flakes	130.0	5.857143
5	Kellogg's Rice Krispies	130.0	4.000000
6	Post Shredded Wheat Vanilla	190.0	11.000000
7	Almond	130.0	5.857143
8	Kellogg's Mini Wheats	200.0	10.000000

2 Compute the covariance between calories and sugar content using the appropriate statistical method

[49]:
```python
cov = np.cov(df["Calories"],df["Sugar"])
cov = pd.DataFrame(cov, columns=['Sugar', 'Calories'], index=['Calories',␣
↪'Sugar'])
print(cov)
```

```
              Sugar      Calories
```

```
Calories  1650.0  100.000000
Sugar      100.0    8.607143
```

[50]:
```
# Compute the covariance between calories and sugar content
cov_matrix = df[['Calories', 'Sugar']].cov()
cov_calories_sugar = cov_matrix.loc['Calories', 'Sugar']
cov_calories_sugar
```

[50]:
```
100.0
```

[51]:
```
#Method 2 using Formula
```

#Compute the correlation coefficient between calories and sugar content using the Pearson correlation formula.

[52]:
```
# Compute the Pearson correlation coefficient between calories and sugar content
corr_calories_sugar = df[['Calories', 'Sugar']].corr().loc['Calories', 'Sugar']
corr_calories_sugar
```

[52]:
```
0.8391285978453279
```

[ ]:
```
# Displaying conclusions based on computed values
print("Covariance between Calories and Sugar: ", cov_calories_sugar)
print("Correlation Coefficient between Calories and Sugar: ␣
↪",corr_calories_sugar)
```

[54]:
```
# Displaying conclusions based on computed values
print(f"Covariance between Calories and Sugar: {cov_calories_sugar}")
print(f"Correlation Coefficient between Calories and Sugar: ␣
↪{corr_calories_sugar}")
```

```
Covariance between Calories and Sugar: 100.0
Correlation Coefficient between Calories and Sugar: 0.8391285978453279
```

[55]:
```
# Drawing conclusions about the relationship between calories and sugar
if cov_calories_sugar > 0:
    print("There is a positive covariance between Calories and Sugar. This␣
↪suggests that as the calorie content increases, sugar content tends to␣
↪increase as well.")
else:
    print("There is a negative covariance between Calories and Sugar. This␣
↪suggests that as the calorie content increases, sugar content tends to␣
↪decrease.")

if corr_calories_sugar > 0.7:
    print("The correlation coefficient is strong and positive, indicating a␣
↪strong linear relationship between calories and sugar.")
elif corr_calories_sugar > 0:
```

```
    print("The correlation coefficient is positive, indicating a moderate␣
 ↪linear relationship between calories and sugar.")
else:
    print("The correlation coefficient is weak or negative, indicating a weak␣
 ↪or inverse relationship between calories and sugar.")
```

```
There is a positive covariance between Calories and Sugar. This suggests that as
the calorie content increases, sugar content tends to increase as well.
The correlation coefficient is strong and positive, indicating a strong linear
relationship between calories and sugar.
```

3 Qns 2

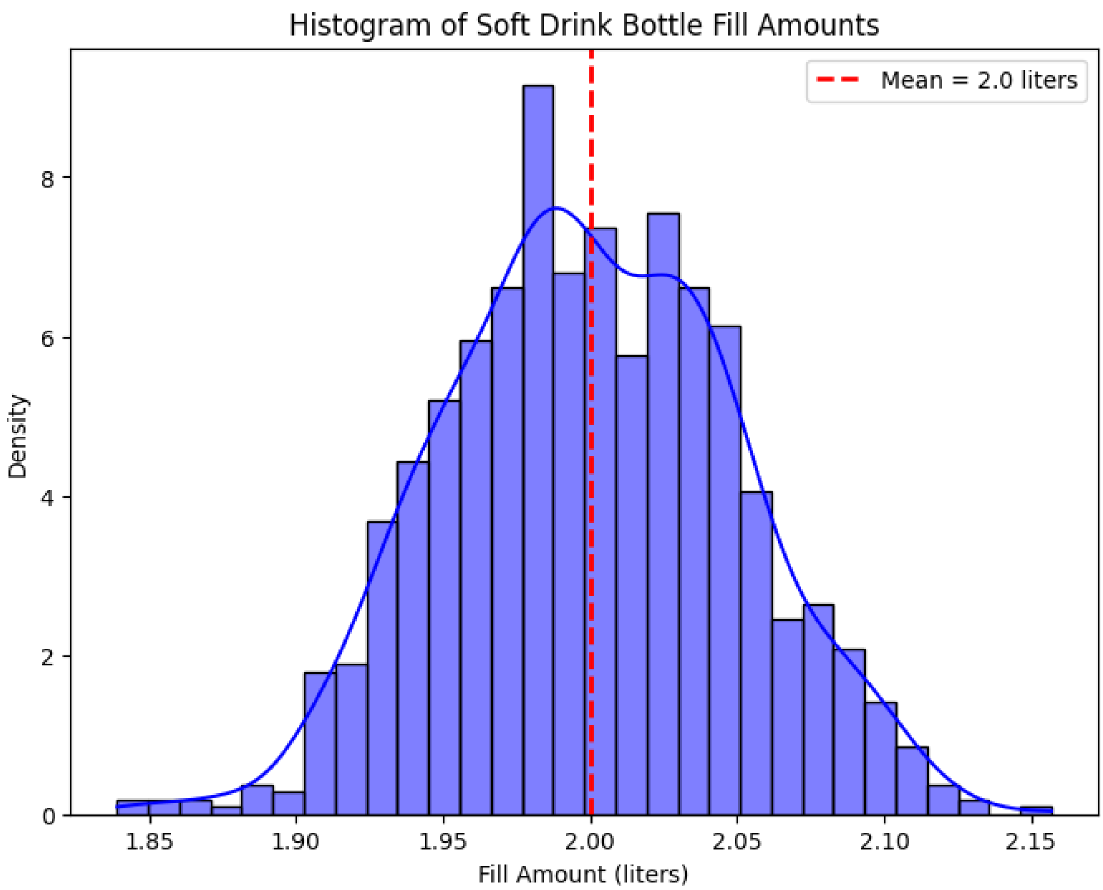
You are provided with data regarding the fill amount in 2-liter soft drink bottles, which follows a normal distribution with: Mean = 2.0 liters Standard deviation = 0.05 liters.

[56]:
```
# Parameters for the normal distribution
mean = 2.0  # Mean of the distribution (in liters)
std_dev = 0.05  # Standard deviation of the distribution (in liters)

# Number of simulated data points (e.g., 1000 bottles)
n = 1000

# Simulate the fill amounts for 1000 bottles
fill_amounts = np.random.normal(mean, std_dev, n)
```

[57]:
```
# Display basic statistics
print(f"Mean of the simulated fill amounts: {np.mean(fill_amounts):.3f} liters")
print(f"Standard Deviation of the simulated fill amounts: {np.std(fill_amounts):
 ↪.3f} liters")
```

```
Mean of the simulated fill amounts: 2.000 liters
Standard Deviation of the simulated fill amounts: 0.049 liters
```

[58]:
```
# Plot the histogram of the fill amounts
plt.figure(figsize=(8, 6))
sns.histplot(fill_amounts, bins=30, kde=True, color='blue', stat='density')
plt.axvline(mean, color='red', linestyle='dashed', linewidth=2, label=f'Mean =␣
 ↪{mean} liters')
plt.title('Histogram of Soft Drink Bottle Fill Amounts')
plt.xlabel('Fill Amount (liters)')
plt.ylabel('Density')
plt.legend()
plt.show()
```



[59]:
```
# Perform a normality test (Shapiro-Wilk Test)
stat, p_value = stats.shapiro(fill_amounts)

print(f"\nShapiro-Wilk Test Statistic: {stat:.3f}")
print(f"Shapiro-Wilk Test p-value: {p_value:.3f}")

if p_value > 0.05:
    print("The fill amounts follow a normal distribution (Fail to Reject H0).")
else:
    print("The fill amounts do not follow a normal distribution (Reject H0).")
```

```
Shapiro-Wilk Test Statistic: 0.998
Shapiro-Wilk Test p-value: 0.233
The fill amounts follow a normal distribution (Fail to Reject H0).
```

[60]:
```
# Summary of the data
print(f"\nSummary of Fill Amounts:")
print(f"Min: {np.min(fill_amounts):.3f} liters")
```

```python
print(f"Max: {np.max(fill_amounts):.3f} liters")
print(f"Mean: {np.mean(fill_amounts):.3f} liters")
print(f"Standard Deviation: {np.std(fill_amounts):.3f} liters")
```

```
Summary of Fill Amounts:
Min: 1.839 liters
Max: 2.157 liters
Mean: 2.000 liters
Standard Deviation: 0.049 liters
```

[68]:
```python
# Create a Pandas DataFrame
df = pd.DataFrame({'Fill_Amount': fill_amounts})

# Calculate the proportion of bottles within a certain range
proportion_between = df[(df['Fill_Amount'] >= 1.90) & (df['Fill_Amount'] <= 2.
↪10)].shape[0] / n

# Calculate the proportion of bottles less than a certain value
proportion_less_than = df[df['Fill_Amount'] < 1.90].shape[0] / n

print(f"Proportion of bottles between 1.90 and 2.10 liters: {proportion_between:
↪.4f}")
print(f"Proportion of bottles with less than 1.90 liters: {proportion_less_than:
↪.4f}")
```

```
Proportion of bottles between 1.90 and 2.10 liters: 0.9580
Proportion of bottles with less than 1.90 liters: 0.0270
```

[ ]:

#Assignment Submmited by UI22CS03