atistical-analysis-using-python-1

September 13, 2024

0.0.1 Python for Statistical Analysis

Install the required libraries using the following commands:

[4]:
```
pip install seaborn pandas numpy scipy scikit-learn statsmodels
```

```
Requirement already satisfied: seaborn in c:\users\meena\anaconda3\lib\site-
packages (0.13.2)
Requirement already satisfied: pandas in c:\users\meena\anaconda3\lib\site-
packages (2.2.2)
Requirement already satisfied: numpy in c:\users\meena\anaconda3\lib\site-
packages (1.26.4)
Requirement already satisfied: scipy in c:\users\meena\anaconda3\lib\site-
packages (1.13.1)
Requirement already satisfied: scikit-learn in
c:\users\meena\anaconda3\lib\site-packages (1.4.2)
Requirement already satisfied: statsmodels in c:\users\meena\anaconda3\lib\site-
packages (0.14.2)
Requirement already satisfied: matplotlib!=3.6.1,>=3.4 in
c:\users\meena\anaconda3\lib\site-packages (from seaborn) (3.8.4)
Requirement already satisfied: python-dateutil>=2.8.2 in
c:\users\meena\anaconda3\lib\site-packages (from pandas) (2.9.0.post0)
Requirement already satisfied: pytz>=2020.1 in
c:\users\meena\anaconda3\lib\site-packages (from pandas) (2024.1)
Requirement already satisfied: tzdata>=2022.7 in
c:\users\meena\anaconda3\lib\site-packages (from pandas) (2023.3)
Requirement already satisfied: joblib>=1.2.0 in
c:\users\meena\anaconda3\lib\site-packages (from scikit-learn) (1.4.2)
Requirement already satisfied: threadpoolctl>=2.0.0 in
c:\users\meena\anaconda3\lib\site-packages (from scikit-learn) (2.2.0)
Requirement already satisfied: patsy>=0.5.6 in
c:\users\meena\anaconda3\lib\site-packages (from statsmodels) (0.5.6)
Requirement already satisfied: packaging>=21.3 in
c:\users\meena\anaconda3\lib\site-packages (from statsmodels) (23.2)
Requirement already satisfied: contourpy>=1.0.1 in
c:\users\meena\anaconda3\lib\site-packages (from
matplotlib!=3.6.1,>=3.4->seaborn) (1.2.0)
Requirement already satisfied: cycler>=0.10 in
c:\users\meena\anaconda3\lib\site-packages (from
```

```
matplotlib!=3.6.1,>=3.4->seaborn) (0.11.0)
Requirement already satisfied: fonttools>=4.22.0 in
c:\users\meena\anaconda3\lib\site-packages (from
matplotlib!=3.6.1,>=3.4->seaborn) (4.51.0)
Requirement already satisfied: kiwisolver>=1.3.1 in
c:\users\meena\anaconda3\lib\site-packages (from
matplotlib!=3.6.1,>=3.4->seaborn) (1.4.4)
Requirement already satisfied: pillow>=8 in c:\users\meena\anaconda3\lib\site-
packages (from matplotlib!=3.6.1,>=3.4->seaborn) (10.3.0)
Requirement already satisfied: pyparsing>=2.3.1 in
c:\users\meena\anaconda3\lib\site-packages (from
matplotlib!=3.6.1,>=3.4->seaborn) (3.0.9)
Requirement already satisfied: six in c:\users\meena\anaconda3\lib\site-packages
(from patsy>=0.5.6->statsmodels) (1.16.0)
Note: you may need to restart the kernel to use updated packages.
```

Sample Code for Statistical Analysis in Python

[7]:
```
import pandas as pd
```

[9]:
```
import scipy.stats as stats
import numpy as np
import statsmodels.api as sm
import seaborn as sns
import matplotlib.pyplot as plt
```

Loading the mental health Dataset

[4]:
```
df=pd.read_csv("mental_health_and_technology_usage_2024.csv")
```

[5]:
```
df.head()
```

[5]:

	User_ID	Age	Gender	Technology_Usage_Hours	Social_Media_Usage_Hours	Gaming_Hours	Screen_Time_Hours	Mental_Health_Status	Stress_Level	Sleep_Hours	Physical_Activity_Hours	Support_Systems_Access
0	USER-00001	23	Female	6.57	6.00	0.68	12.36	Good	Low	8.01	6.71	No
1	USER-00002	21	Male	3.01	2.57	3.74	7.61	Poor	High			
2	USER-00003	51	Male	3.04	6.14	1.26	3.16	Fair	High			
3	USER-00004	25	Female	3.84	4.48	2.59	13.08	Excellent	Medium			
4	USER-00005	53	Male	1.20	0.56	0.29	12.63	Good	Low			

```
1          7.28                    5.88                   Yes
2          8.04                    9.81                    No
3          5.62                    5.28                   Yes
4          5.55                    4.00                    No

  Work_Environment_Impact Online_Support_Usage
0                Negative                  Yes
1                Positive                   No
2                Negative                   No
3                Negative                  Yes
4                Positive                  Yes
```

Performing Descriptive Statistics

[6]:
```
# Calculate mean for numeric columns only
numeric_df = df.select_dtypes(include=['number'])
print("Mean:\n", numeric_df.mean())
print("\nMedian:\n", numeric_df.median())
print("\nStandard Deviation:\n", numeric_df.std())
print("\nVariance:\n",numeric_df.var())
print("\nMin:\n", numeric_df.min())
print("\nMax:\n", numeric_df.max())
print("\nMode:\n",numeric_df.mode().iloc[0])
```

```
Mean:
 Age                          41.518600
Technology_Usage_Hours        6.474341
Social_Media_Usage_Hours      3.972321
Gaming_Hours                  2.515598
Screen_Time_Hours             7.975765
Sleep_Hours                   6.500724
Physical_Activity_Hours       5.003860
dtype: float64

Median:
 Age                          42.000
Technology_Usage_Hours        6.425
Social_Media_Usage_Hours      3.950
Gaming_Hours                  2.520
Screen_Time_Hours             7.900
Sleep_Hours                   6.500
Physical_Activity_Hours       4.990
dtype: float64

Standard Deviation:
 Age                          13.920217
Technology_Usage_Hours        3.169022
Social_Media_Usage_Hours      2.313707
```

```
Gaming_Hours                1.446748
Screen_Time_Hours           4.042608
Sleep_Hours                 1.450933
Physical_Activity_Hours     2.905044
dtype: float64

Variance:
 Age                       193.772431
Technology_Usage_Hours      10.042703
Social_Media_Usage_Hours     5.353238
Gaming_Hours                 2.093081
Screen_Time_Hours           16.342677
Sleep_Hours                  2.105207
Physical_Activity_Hours      8.439280
dtype: float64

Min:
 Age                       18.0
Technology_Usage_Hours      1.0
Social_Media_Usage_Hours    0.0
Gaming_Hours                0.0
Screen_Time_Hours           1.0
Sleep_Hours                 4.0
Physical_Activity_Hours     0.0
dtype: float64

Max:
 Age                       65.0
Technology_Usage_Hours     12.0
Social_Media_Usage_Hours    8.0
Gaming_Hours                5.0
Screen_Time_Hours          15.0
Sleep_Hours                 9.0
Physical_Activity_Hours    10.0
dtype: float64

Mode:
 Age                       62.00
Technology_Usage_Hours      2.88
Social_Media_Usage_Hours    1.28
Gaming_Hours                2.46
Screen_Time_Hours          11.78
Sleep_Hours                 6.67
Physical_Activity_Hours     4.05
Name: 0, dtype: float64
```

[7]:
```
# Additional descriptive statistics
print("\nRange:\n", numeric_df.max() - numeric_df.min())
print("\nSkewness:\n", numeric_df.skew())
print("\nKurtosis:\n", numeric_df.kurt())
```

```
Range:
 Age                          47.0
Technology_Usage_Hours       11.0
Social_Media_Usage_Hours      8.0
Gaming_Hours                  5.0
Screen_Time_Hours            14.0
Sleep_Hours                   5.0
Physical_Activity_Hours      10.0
dtype: float64

Skewness:
 Age                           0.005154
Technology_Usage_Hours        0.018047
Social_Media_Usage_Hours      0.010760
Gaming_Hours                 -0.023540
Screen_Time_Hours             0.015484
Sleep_Hours                   0.004033
Physical_Activity_Hours       0.000612
dtype: float64

Kurtosis:
 Age                          -1.208393
Technology_Usage_Hours        -1.190780
Social_Media_Usage_Hours      -1.211233
Gaming_Hours                  -1.205375
Screen_Time_Hours             -1.194322
Sleep_Hours                   -1.212284
Physical_Activity_Hours       -1.211133
dtype: float64
```

[8]:
```
# Strip any extra spaces from column names
df.columns = df.columns.str.strip()
# Check available columns and their data types
print("Available columns:", df.columns)
print("Data types:\n", df.dtypes)
# Check the first few rows
print(df.head())

# Safe column access
column_name = 'Score_Before'  # Replace with your column name
```

```python
if column_name in df.columns:
    print(df[column_name])
else:
    print(f"Column '{column_name}' does not exist.")
```

```
Available columns: Index(['User_ID', 'Age', 'Gender', 'Technology_Usage_Hours',
       'Social_Media_Usage_Hours', 'Gaming_Hours', 'Screen_Time_Hours',
       'Mental_Health_Status', 'Stress_Level', 'Sleep_Hours',
       'Physical_Activity_Hours', 'Support_Systems_Access',
       'Work_Environment_Impact', 'Online_Support_Usage'],
      dtype='object')
Data types:
 User_ID                      object
Age                           int64
Gender                       object
Technology_Usage_Hours      float64
Social_Media_Usage_Hours    float64
Gaming_Hours                float64
Screen_Time_Hours           float64
Mental_Health_Status         object
Stress_Level                 object
Sleep_Hours                 float64
Physical_Activity_Hours     float64
Support_Systems_Access       object
Work_Environment_Impact      object
Online_Support_Usage         object
dtype: object
      User_ID  Age  Gender  Technology_Usage_Hours  Social_Media_Usage_Hours  \
0  USER-00001   23  Female                    6.57                      6.00
1  USER-00002   21    Male                    3.01                      2.57
2  USER-00003   51    Male                    3.04                      6.14
3  USER-00004   25  Female                    3.84                      4.48
4  USER-00005   53    Male                    1.20                      0.56

   Gaming_Hours  Screen_Time_Hours Mental_Health_Status Stress_Level  \
0          0.68              12.36                Good          Low
1          3.74               7.61                Poor         High
2          1.26               3.16                Fair         High
3          2.59              13.08           Excellent       Medium
4          0.29              12.63                Good          Low

   Sleep_Hours  Physical_Activity_Hours Support_Systems_Access  \
0         8.01                     6.71                     No
1         7.28                     5.88                    Yes
2         8.04                     9.81                     No
3         5.62                     5.28                    Yes
4         5.55                     4.00                     No
```

```
  Work_Environment_Impact Online_Support_Usage
0                Negative                   Yes
1                Positive                    No
2                Negative                    No
3                Negative                   Yes
4                Positive                   Yes
Column 'Score_Before' does not exist.
```

[9]:
```
print("Available columns:", df.columns)
```

```
Available columns: Index(['User_ID', 'Age', 'Gender', 'Technology_Usage_Hours',
       'Social_Media_Usage_Hours', 'Gaming_Hours', 'Screen_Time_Hours',
       'Mental_Health_Status', 'Stress_Level', 'Sleep_Hours',
       'Physical_Activity_Hours', 'Support_Systems_Access',
       'Work_Environment_Impact', 'Online_Support_Usage'],
      dtype='object')
```

Performing Inferential Statistics

[10]:
```
from scipy import stats

# Example column names (replace with actual names from your dataset)
# Assume 'Tech_Use' is categorical ('Yes'/'No') and 'Mental_Health_Score' is␣
 ↪numerical
tech_use_yes = df[df['Technology_Usage_Hours'] == 'Yes']['Mental_Health_Status']
tech_use_no = df[df['Technology_Usage_Hours'] == 'No']['Mental_Health_Status']

# Perform independent t-test
t_stat_ind, p_value_ind = stats.ttest_ind(tech_use_yes, tech_use_no,␣
 ↪nan_policy='omit')
print(f"Independent T-test:\nT-statistic: {t_stat_ind}, p-value: {p_value_ind}")
```

```
Independent T-test:
T-statistic: nan, p-value: nan
```

Confidence Intervals

[11]:
```
def confidence_interval(data, confidence=0.95):
    """Compute the confidence interval for the mean of the data."""
    n = len(data)
    mean = np.mean(data)
    sem = stats.sem(data, nan_policy='omit')  # Standard Error of Mean
    h = sem * stats.t.ppf((1 + confidence) / 2., n - 1)  # Margin of Error
    return mean - h, mean + h

# Identify numerical columns
numerical_columns = df.select_dtypes(include=[np.number]).columns
```

```
# Dictionary to hold confidence intervals for each numerical column
ci_dict = {}

# Calculate confidence intervals for each numerical column
for column in numerical_columns:
    ci = confidence_interval(df[column])
    ci_dict[column] = ci

# Print the confidence intervals
for column, ci in ci_dict.items():
    print(f"Confidence Interval for {column}: {ci}")
```

```
Confidence Interval for Age: (41.24573573753896, 41.79146426246104)
Confidence Interval for Technology_Usage_Hours: (6.4122217826718275,
6.536460217328172)
Confidence Interval for Social_Media_Usage_Hours: (3.9269676931603876,
4.017674306839612)
Confidence Interval for Gaming_Hours: (2.487238817701077, 2.5439571822989224)
Confidence Interval for Screen_Time_Hours: (7.896521752038481,
8.055008247961517)
Confidence Interval for Sleep_Hours: (6.472282790392075, 6.529165209607923)
Confidence Interval for Physical_Activity_Hours: (4.946915292535763,
5.0608047074642375)
```

Regression Analysis

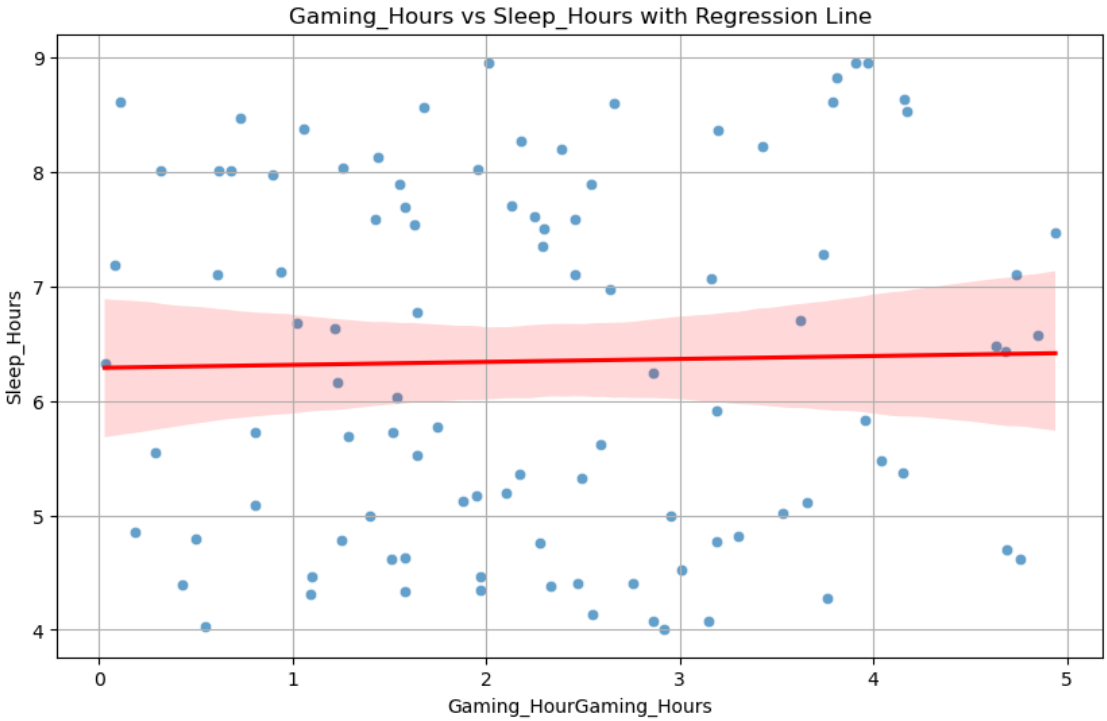
[20]:
```
import statsmodels.api as sm
#df['Gaming_Hours']=np.
 ↪asarray(df['Gaming_Hours'])#df['Mental_Health_Status']=np.
 ↪asarray(df['Mental_Health_Status'])
# Define independent variable (add constant for intercept)
X=df['Gaming_Hours']
X = sm.add_constant(X)

# Define dependent variable
y = df['Sleep_Hours']

# Fit linear regression model
model = sm.OLS(y, X).fit()

# Print model summary
print(model.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:            Sleep_Hours   R-squared:                       0.000
Model:                            OLS   Adj. R-squared:                  0.000
Method:                 Least Squares   F-statistic:                     1.080
```

```
Date:                Thu, 12 Sep 2024   Prob (F-statistic):              0.299
Time:                        10:31:44   Log-Likelihood:                -17910.
No. Observations:               10000   AIC:                         3.582e+04
Df Residuals:                    9998   BIC:                         3.584e+04
Df Model:                           1
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const          6.4745      0.029    222.458      0.000       6.417       6.532
Gaming_Hours   0.0104      0.010      1.039      0.299      -0.009       0.030
==============================================================================
Omnibus:                     9757.153   Durbin-Watson:                   1.973
Prob(Omnibus):                  0.000   Jarque-Bera (JB):              612.235
Skew:                           0.004   Prob(JB):                    1.13e-133
Kurtosis:                       1.788   Cond. No.                         6.35
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly
specified.
```

Visualizing the results:

[23]:
```
import matplotlib.pyplot as plt
import seaborn as sns
# Plot data and regression line
df2=df.head(100)
plt.figure(figsize=(10, 6))
sns.scatterplot(x='Gaming_Hours', y='Sleep_Hours', data=df2, alpha=0.7)
sns.regplot(x='Gaming_Hours', y='Sleep_Hours', data=df2, scatter=False,␣
 ↪color='red')

# Add labels and title
plt.xlabel('Gaming_HourGaming_Hours')
plt.ylabel('Sleep_Hours')
plt.title('Gaming_Hours vs Sleep_Hours with Regression Line')

# Show plot
plt.grid(True)
plt.show()
```


Gaming_Hours vs Sleep_Hours with Regression Line
Sleep_Hours
Gaming_HourGaming_Hours
9
8
7
6
5
4
0
1
2
3
4
5

[ ]: