Assignment1_pt2

February 13, 2023

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

[ ]:
```
# read csv into dataframe, categorical data already in encoded labels
df = pd.read_csv('data.csv')
df.head(5)
```

[ ]:

	Purchase	SUS	Duration	Gender	ASR_Error	Intent_Error
0	1	84	254	0	3	2
1	0	58	247	0	6	9
2	0	56	125	1	6	8
3	0	55	22	0	11	7
4	1	95	262	0	2	3

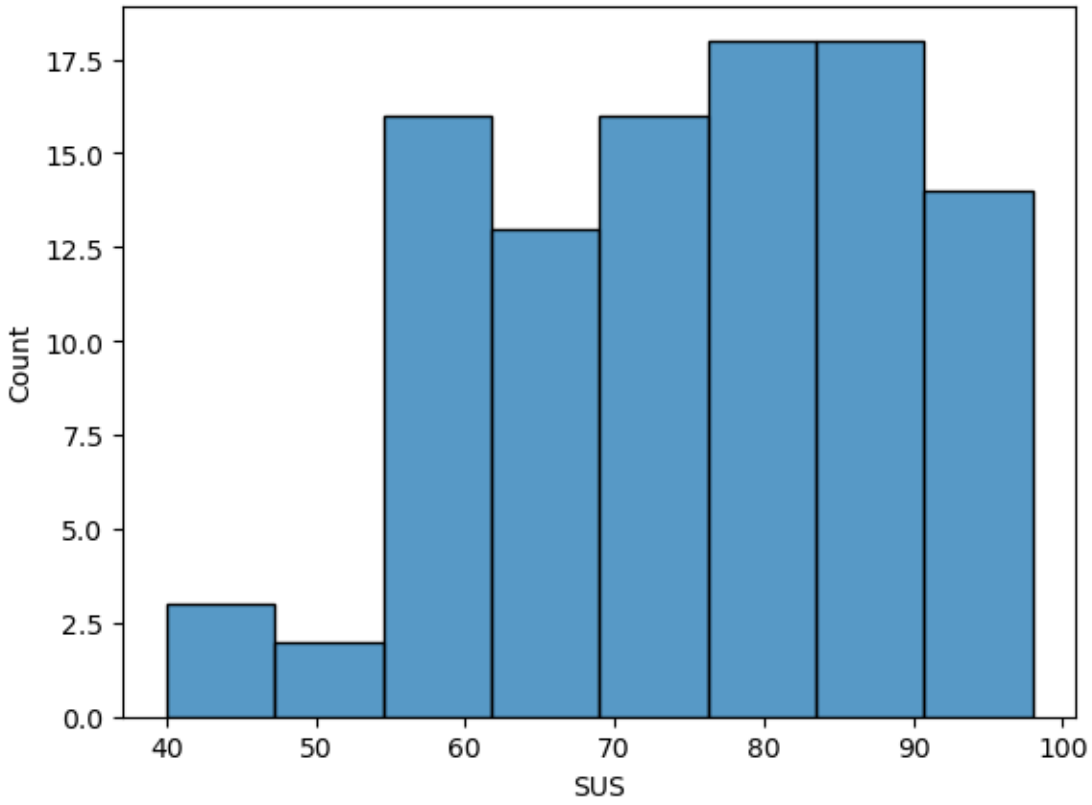
[ ]:
```
# checking for missing values
df.isna().sum()
```

[ ]:
```
Purchase        0
SUS             0
Duration        0
Gender          0
ASR_Error       0
Intent_Error    0
dtype: int64
```

[ ]:
```
# pearson: standard correlation coefficient
df.corr(method='pearson')['SUS'].sort_values()
```

[ ]:
```
Intent_Error   -0.693675
ASR_Error      -0.662405
Duration       -0.006631
Gender          0.111523
Purchase        0.661931
SUS             1.000000
Name: SUS, dtype: float64
```

[ ]:
```
# looking at SUS distribution
sns.histplot(data=df['SUS'])
plt.show()
```



[ ]:
```
# plot distribution of SUS for purchasers and non-purchasers

fig = plt.figure(figsize=(16,9))

ax1 = fig.add_subplot(121)
sns.distplot(df.loc[df['Purchase'] == 1]['SUS'], color='c')
ax1.set_title('Distribution of SUS for purchasers')

ax2 = fig.add_subplot(122)
sns.distplot(df.loc[df['Purchase'] == 0]['SUS'], color='b')
ax2.set_title('Distribution of SUS for non-purchasers')

plt.show()
```

```
/opt/anaconda3/envs/env/lib/python3.11/site-
packages/seaborn/distributions.py:2619: FutureWarning: `distplot` is a
deprecated function and will be removed in a future version. Please adapt your
```

```
code to use either `displot` (a figure-level function with similar flexibility)
or `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
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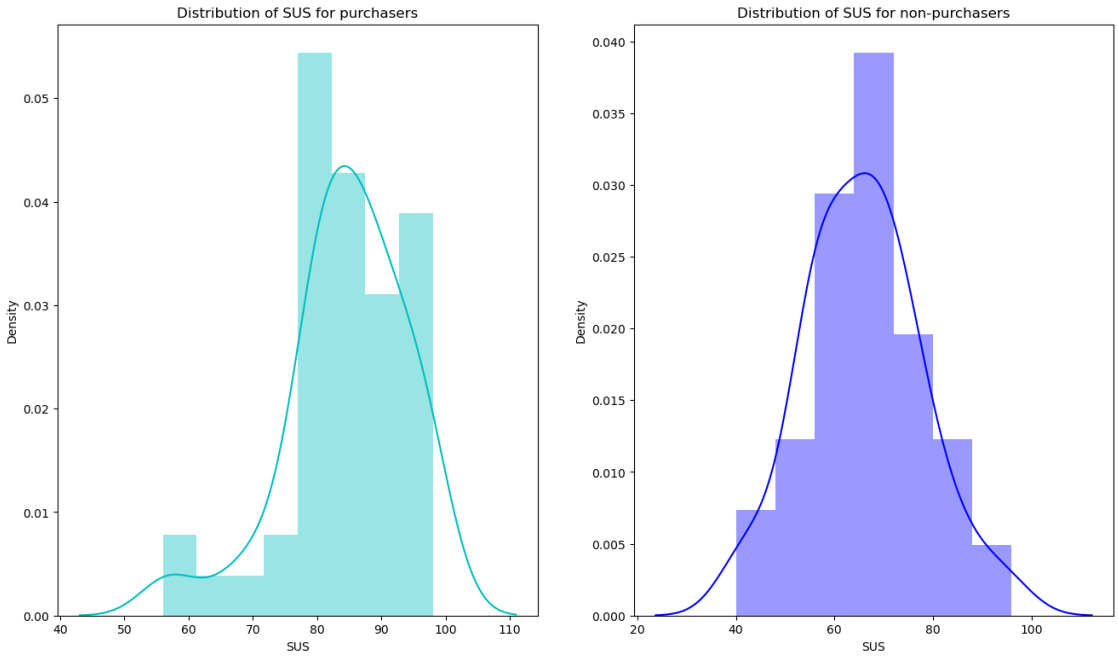
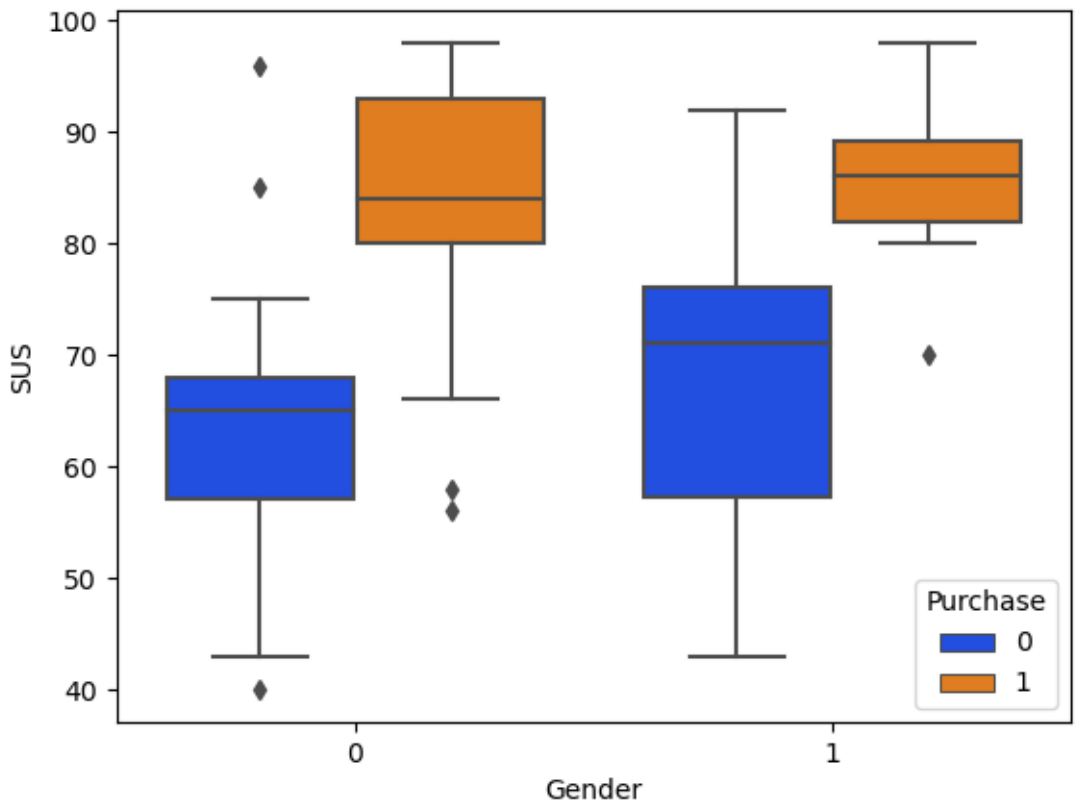


[ ]:
```
# compare SUS between genders of purchases
sns.boxplot(x="Gender", y="SUS", hue="Purchase", data=df, palette='bright')
plt.show() # 0-Female, 1-Male
```



[ ]:
```
# use Ordinary Least Squares (OLS) Regression to find significant variables

import statsmodels.api as sm

y = df['SUS'] # dependent variable
x = df.drop(columns='SUS') # predictor variables

#add constant to predictor variables
x = sm.add_constant(x)

model = sm.OLS(y, x).fit()
print(model.summary());
```

OLS Regression Results

Dep. Variable:	SUS	R-squared:	0.593
Model:	OLS	Adj. R-squared:	0.571
Method:	Least Squares	F-statistic:	27.39
Date:	Mon, 13 Feb 2023	Prob (F-statistic):	5.25e-17
Time:	10:37:33	Log-Likelihood:	-362.39
No. Observations:	100	AIC:	736.8

```
Df Residuals:                       94   BIC:                             752.4
Df Model:                            5
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const          93.0282      5.541     16.788      0.000      82.026     104.031
Purchase        1.3412      3.676      0.365      0.716      -5.958       8.641
Duration       -0.0002      0.010     -0.025      0.980      -0.020       0.019
Gender          0.8367      1.971      0.425      0.672      -3.076       4.749
ASR_Error      -1.4254      0.401     -3.553      0.001      -2.222      -0.629
Intent_Error   -2.0092      0.439     -4.572      0.000      -2.882      -1.137
==============================================================================
Omnibus:                        6.969   Durbin-Watson:                   2.023
Prob(Omnibus):                  0.031   Jarque-Bera (JB):                8.115
Skew:                          -0.378   Prob(JB):                       0.0173
Kurtosis:                       4.173   Cond. No.                     1.27e+03
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly
specified.
[2] The condition number is large, 1.27e+03. This might indicate that there are
strong multicollinearity or other numerical problems.
```

[ ]:
```
# Regression Analysis

from sklearn.linear_model import LinearRegression
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import PolynomialFeatures
from sklearn.metrics import r2_score,mean_squared_error
```

[ ]:
```
x = df.drop(columns='SUS')
y = df['SUS']

x_train, x_test, y_train, y_test = train_test_split(x, y)
```

[ ]:
```
# Linear model prediction
# https://stats.stackexchange.com/questions/146804/
  ↪difference-between-statsmodel-ols-and-scikit-linear-regression

lr = LinearRegression().fit(x_train,y_train)

y_train_pred = lr.predict(x_train)
y_test_pred = lr.predict(x_test)
```

```
print("The R squared score of linear regression model is: ", lr.
 ↪score(x_test,y_test))
```

```
The R squared score of linear regression model is:  0.5109883135211668
```

[ ]:
```
# Quadratic

quad = PolynomialFeatures (degree = 2)
x_quad = quad.fit_transform(x)

X_train,X_test,Y_train,Y_test = train_test_split(x_quad,y, random_state = 0)

plr = LinearRegression().fit(X_train,Y_train)

Y_train_pred = plr.predict(X_train)
Y_test_pred = plr.predict(X_test)

print("The R square score of 2-order polynomial regression model is: ", plr.
 ↪score(X_test,Y_test))
```

```
The R square score of 2-order polynomial regression model is:
0.5220498503429807
```