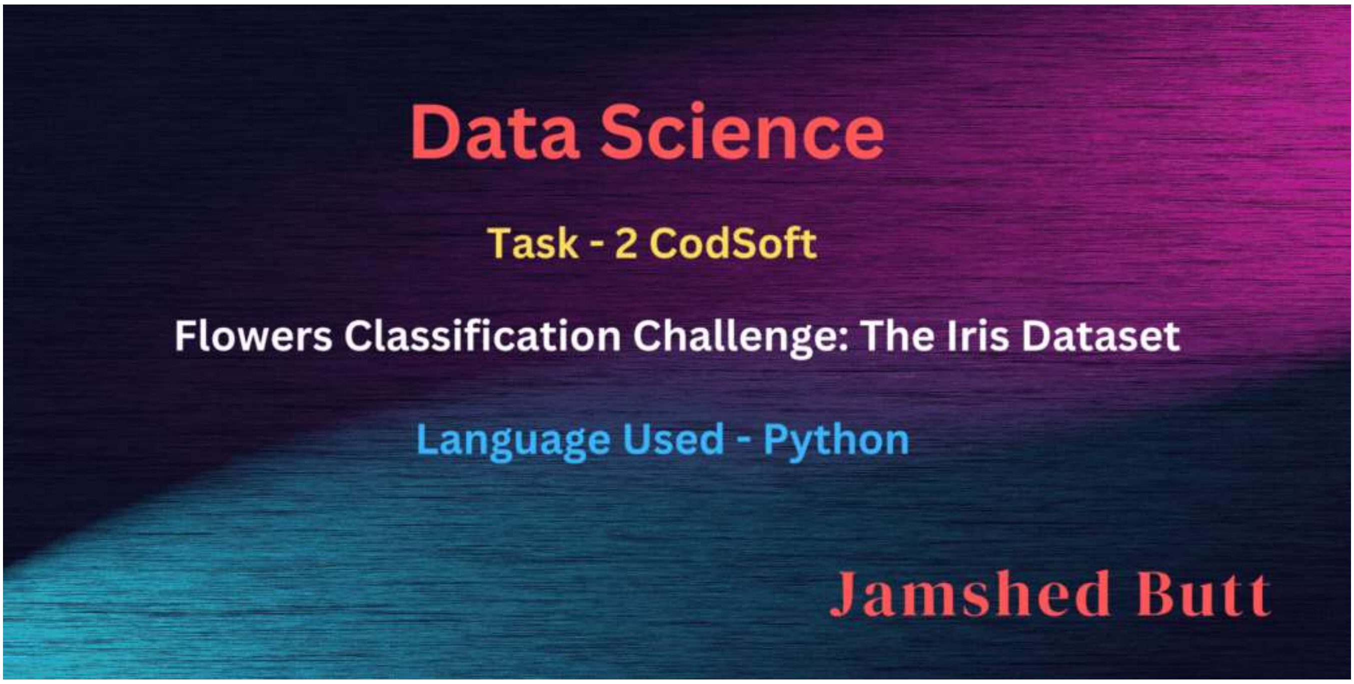
```
from IPython import display
display.Image("/content/Modern Minimal Gradient Background Technology Banner (1).gif")
```



Project Name ✨ Titanic Dataset ✨

AUTHOR : **Jamshed Butt** from **Data Science**

✨ Aim Of The Project ✨

The aim of the Iris dataset is to facilitate research in pattern recognition, classification, and data analysis by providing measurements of iris flowers from three species, aiding in species differentiation.

Import Libraries

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import scipy.stats as stats
import pylab

#Normalize Data
from sklearn.preprocessing import StandardScaler

#Conert Categorical to Numerical Value
from sklearn.preprocessing import LabelEncoder

#Columns Relationship for target value
from sklearn.feature_selection import mutual_info_classif,SelectKBest,f_classif

#Splitting Data
from sklearn.model_selection import train_test_split,cross_val_score

#PCA
from sklearn.decomposition import PCA

#Model
from sklearn.linear_model import LogisticRegression
from sklearn.ensemble import RandomForestClassifier
from sklearn.neighbors import KNeighborsClassifier

#Metrics
from sklearn.metrics import accuracy_score,classification_report,confusion_matrix,roc_curve,auc
from sklearn import metrics
```

Load Dataset

```
df = pd.read_csv("/content/drive/MyDrive/Datasets/IRIS.csv")
df.head()
```

	sepal_length	sepal_width	petal_length	petal_width	species
0	5.1	3.5	1.4	0.2	Iris-setosa
1	4.9	3.0	1.4	0.2	Iris-setosa
2	4.7	3.2	1.3	0.2	Iris-setosa
3	4.6	3.1	1.5	0.2	Iris-setosa
4	5.0	3.6	1.4	0.2	Iris-setosa

```
df.shape
```

```
(150, 5)
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 150 entries, 0 to 149
Data columns (total 5 columns):
 #   Column        Non-Null Count  Dtype  
---  ------        --------------  -----  
 0   sepal_length  150 non-null    float64
 1   sepal_width   150 non-null    float64
 2   petal_length  150 non-null    float64
 3   petal_width   150 non-null    float64
 4   species       150 non-null    object 
dtypes: float64(4), object(1)
memory usage: 6.0+ KB
```

```
df.isnull().sum()
```

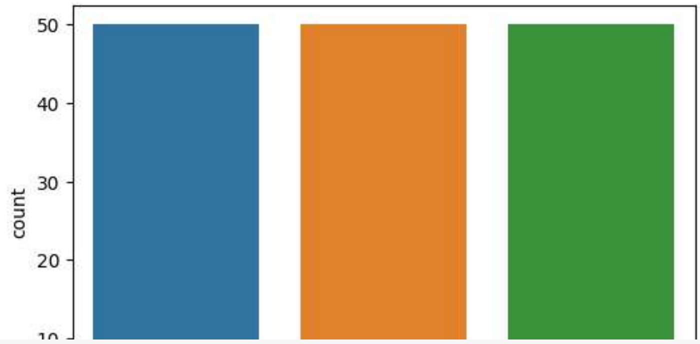
```
sepal_length    0
sepal_width     0
petal_length    0
petal_width     0
species         0
dtype: int64
```

```
df.describe()
```

	sepal_length	sepal_width	petal_length	petal_width
count	150.000000	150.000000	150.000000	150.000000
mean	5.843333	3.054000	3.758667	1.198667
std	0.828066	0.433594	1.764420	0.763161
min	4.300000	2.000000	1.000000	0.100000
25%	5.100000	2.800000	1.600000	0.300000
50%	5.800000	3.000000	4.350000	1.300000
75%	6.400000	3.300000	5.100000	1.800000
max	7.900000	4.400000	6.900000	2.500000

Univariate Analysis

```
plt.figure(figsize=(6,4))
sns.countplot(x="species",data=df)
plt.xlabel("Species",fontsize=14)
plt.show()
```




```
df["species"].value_counts()
```

```
Iris-setosa        50
Iris-versicolor    50
Iris-virginica     50
Name: species, dtype: int64
```

```
sns.set(rc={"figure.figsize":(6,4)})
sns.distplot(df["sepal_length"], kde=True, color="orange", bins=10)
```

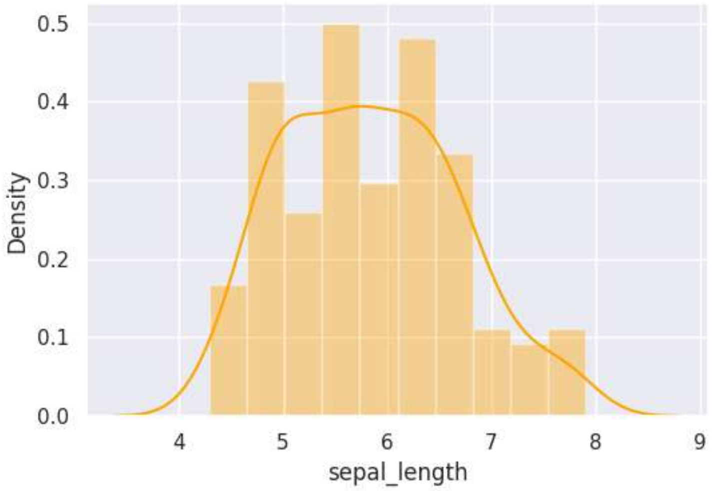
```
<ipython-input-9-e0a31f1805d9>:2: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(df["sepal_length"], kde=True, color="orange", bins=10)
<Axes: xlabel='sepal_length', ylabel='Density'>
```




```
plt.figure(figsize=(6,4))
sns.scatterplot(x="sepal_length",y=df.index,data=df)
plt.show()
```

```
sns.set(rc={"figure.figsize":(6,4)})
sns.distplot(df["sepal_width"], kde=True, color="orange", bins=10)
```

```
<ipython-input-11-5b24ae600e6a>:2: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

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https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(df["sepal_width"], kde=True, color="orange", bins=10)
<Axes: xlabel='sepal_width', ylabel='Density'>
```
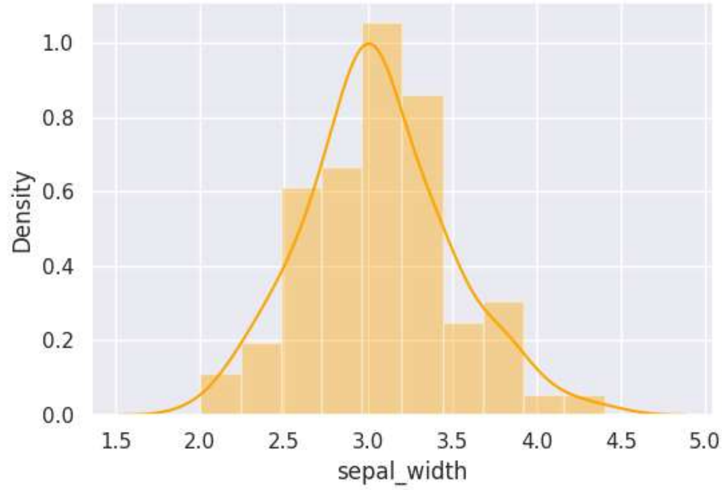
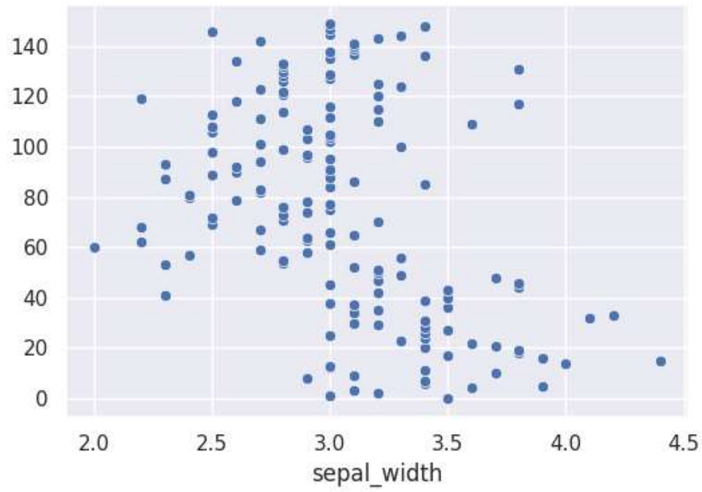
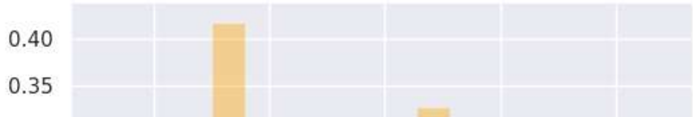




```
plt.figure(figsize=(6,4))
sns.scatterplot(x="sepal_width",y=df.index,data=df)
plt.show()
```

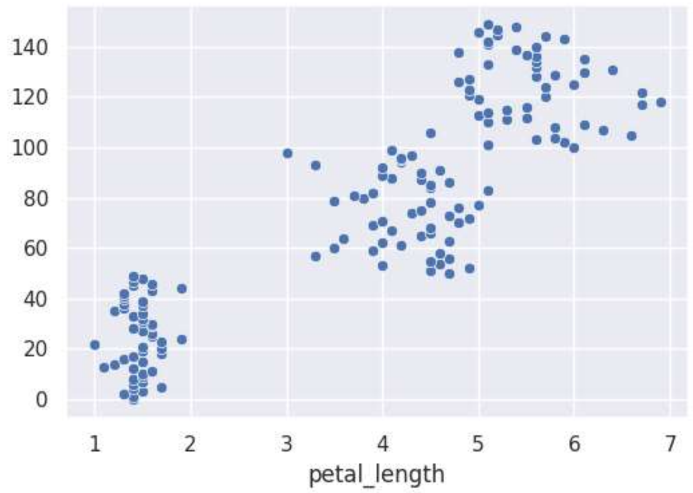



```
sns.set(rc={"figure.figsize":(6,4)})
sns.distplot(df["petal_length"], kde=True, color="orange", bins=10)
```

```
<ipython-input-13-53ed0085d8fc>:2: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(df["petal_length"], kde=True, color="orange", bins=10)
<Axes: xlabel='petal_length', ylabel='Density'>
```

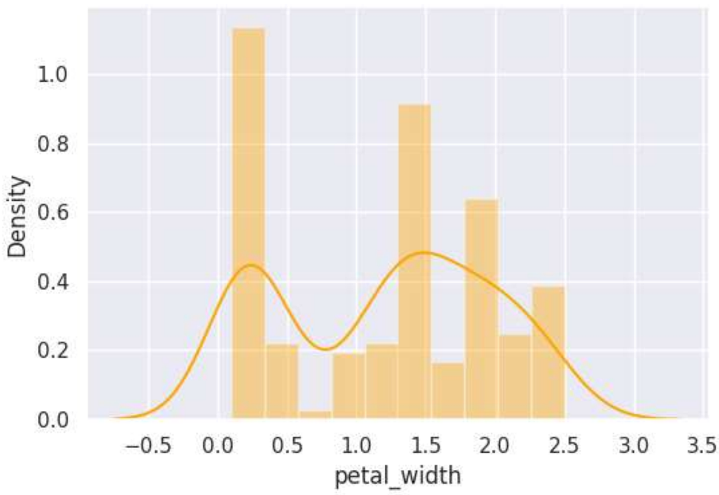



```
plt.figure(figsize=(6,4))
sns.scatterplot(x="petal_length",y=df.index,data=df)
plt.show()
```

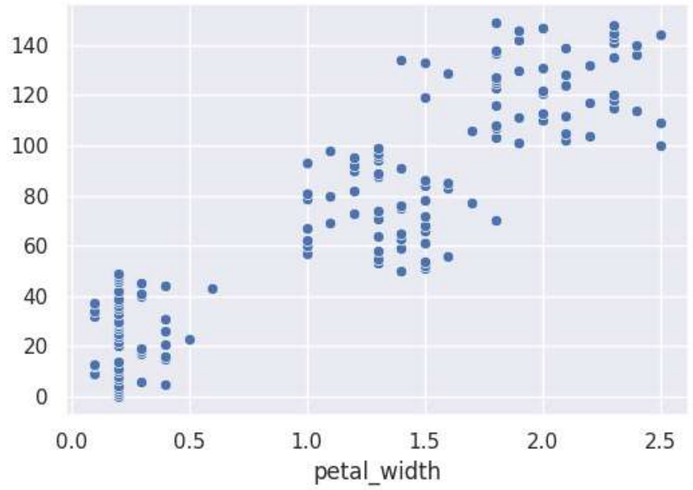



```
sns.set(rc={"figure.figsize":(6,4)})
sns.distplot(df["petal_width"], kde=True, color="orange", bins=10)
```

```
<ipython-input-15-6f7a78f94cf3>:2: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(df["petal_width"], kde=True, color="orange", bins=10)
<Axes: xlabel='petal_width', ylabel='Density'>
```




```
plt.figure(figsize=(6,4))
sns.scatterplot(x="petal_width",y=df.index,data=df)
plt.show()
```



EDA (Exploratory Data Analysis)

Removeing Duplicate

```
duplicate = df.duplicated()
print(duplicate.sum())
```

```
3
```

```
df.drop_duplicates(inplace=True)
```

```
df.duplicated().sum()
```

```
0
```

Check NaN Value And Remove NaN Values

```
df.isnull().sum()
```

```
sepal_length    0
sepal_width     0
petal_length    0
petal_width     0
species         0
dtype: int64
```

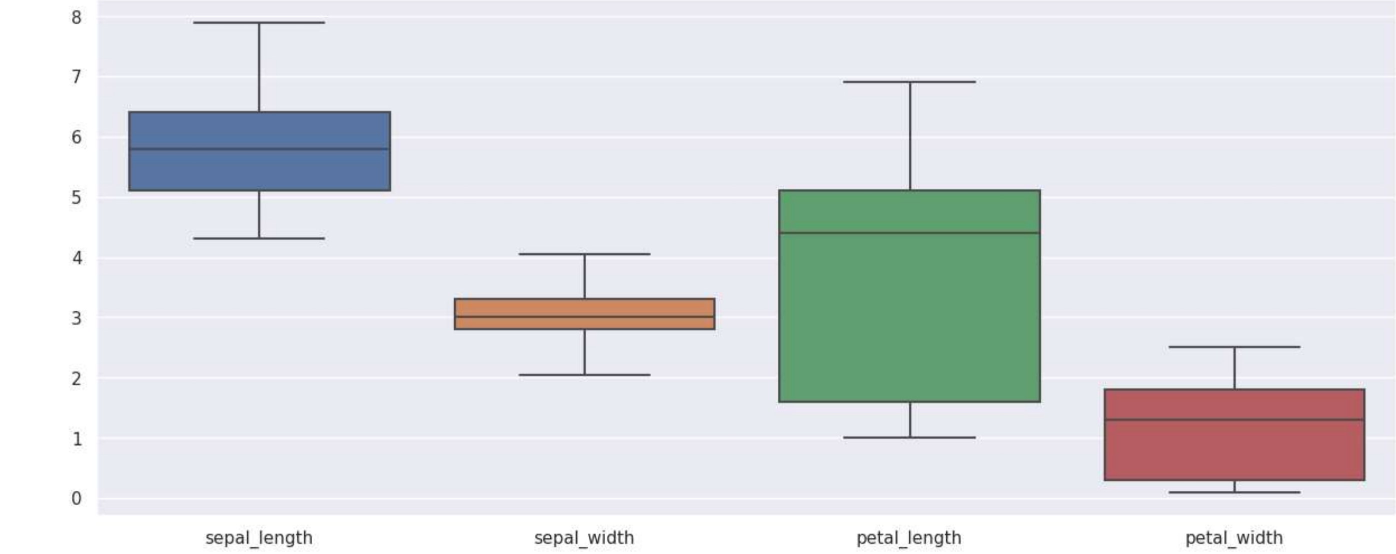
Removing Outlier

```
num_cols = df.select_dtypes(include=["int64","float64"])

plt.figure(figsize=(15,6))
sns.boxplot(num_cols)
plt.show()
```

```
def remove_outlier(col):
  sorted(col)
  Q1,Q3 = col.quantile([0.25,0.75])
  IQR = Q3 - Q1
  lower_range = Q1 - (1.5 * IQR)
  upper_range = Q3 + (1.5 * IQR)
  return lower_range,upper_range
```

```
for i in num_cols.columns:
    lower_range,upper_range = remove_outlier(df[i])
    df[i] = np.where(df[i] > upper_range, upper_range, df[i])
    df[i] = np.where(df[i] < lower_range, lower_range, df[i])
```

```
num_cols = df.select_dtypes(include=["int64","float64"])

plt.figure(figsize=(15,6))
sns.boxplot(num_cols)
plt.show()
```



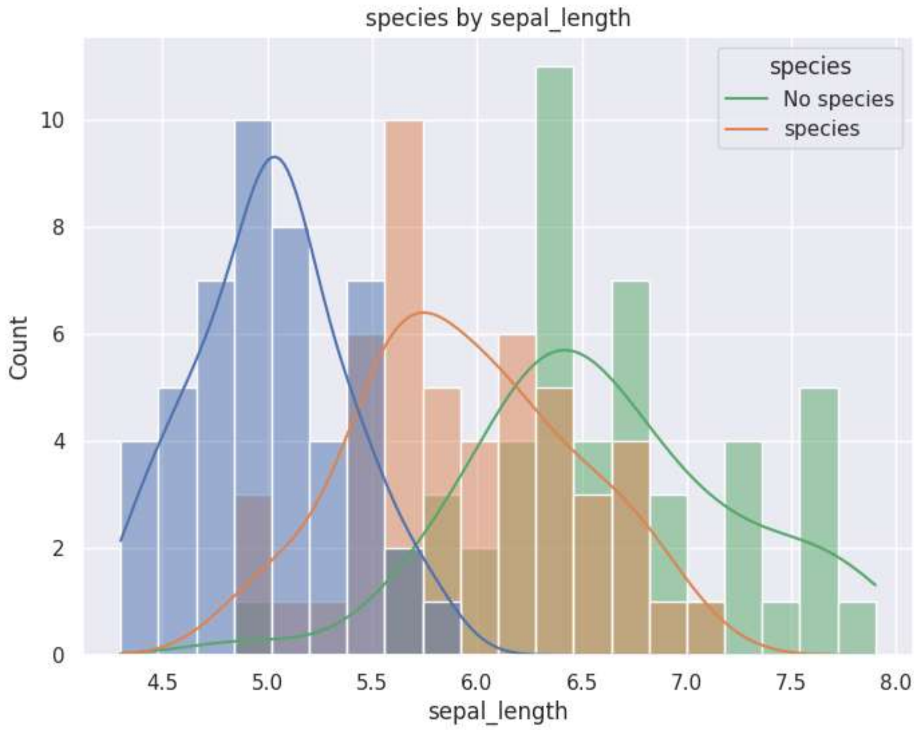
Bivariate Analysis

```
df.info()
```

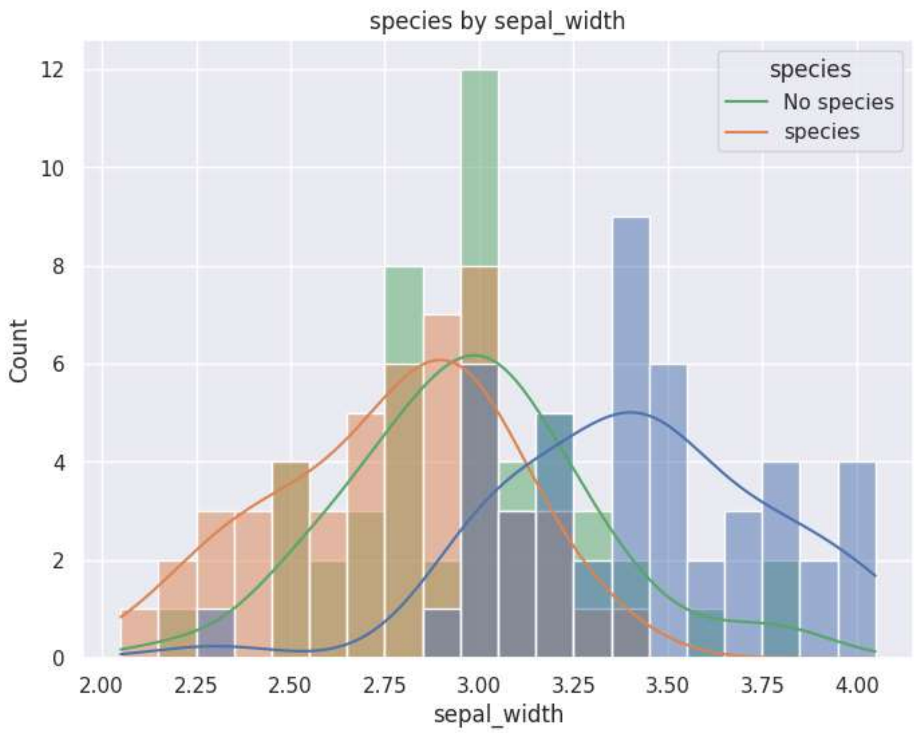
```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 147 entries, 0 to 149
Data columns (total 5 columns):
 #   Column        Non-Null Count  Dtype
---  ------        --------------  -----
 0   sepal_length  147 non-null    float64
 1   sepal_width   147 non-null    float64
 2   petal_length  147 non-null    float64
 3   petal_width   147 non-null    float64
 4   species       147 non-null    object
dtypes: float64(4), object(1)
memory usage: 6.9+ KB
```

```
plt.figure(figsize=(8, 6))
sns.histplot(data=df, x='sepal_length', hue='species', kde=True, bins=20)
plt.title('species by sepal_length')
plt.xlabel('sepal_length')
plt.ylabel('Count')
```

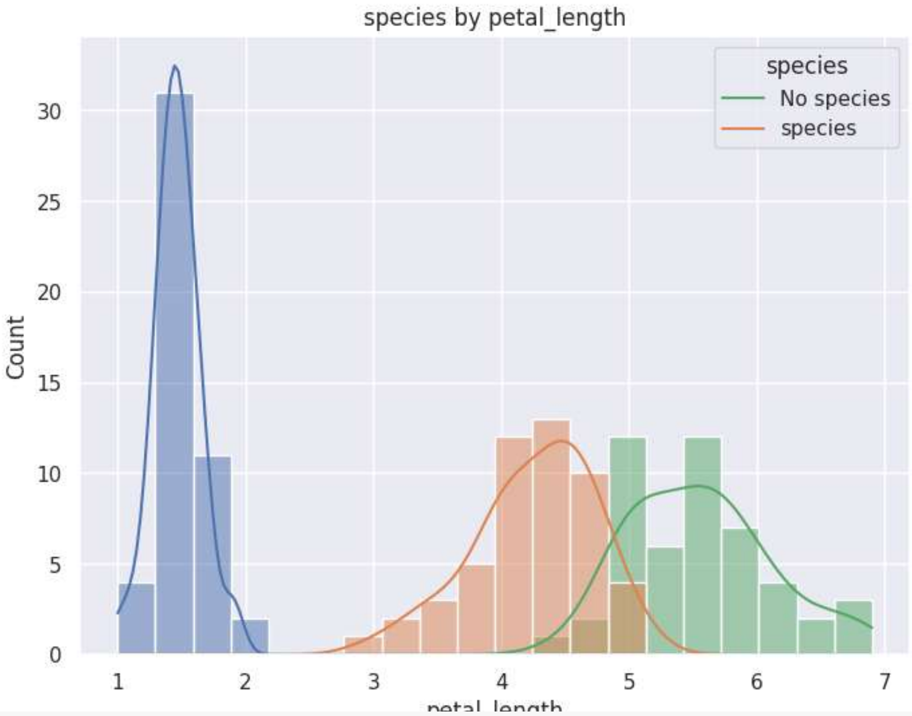
```
plt.legend(title='species', loc='upper right', labels=['No species', 'species'])
plt.show()
```



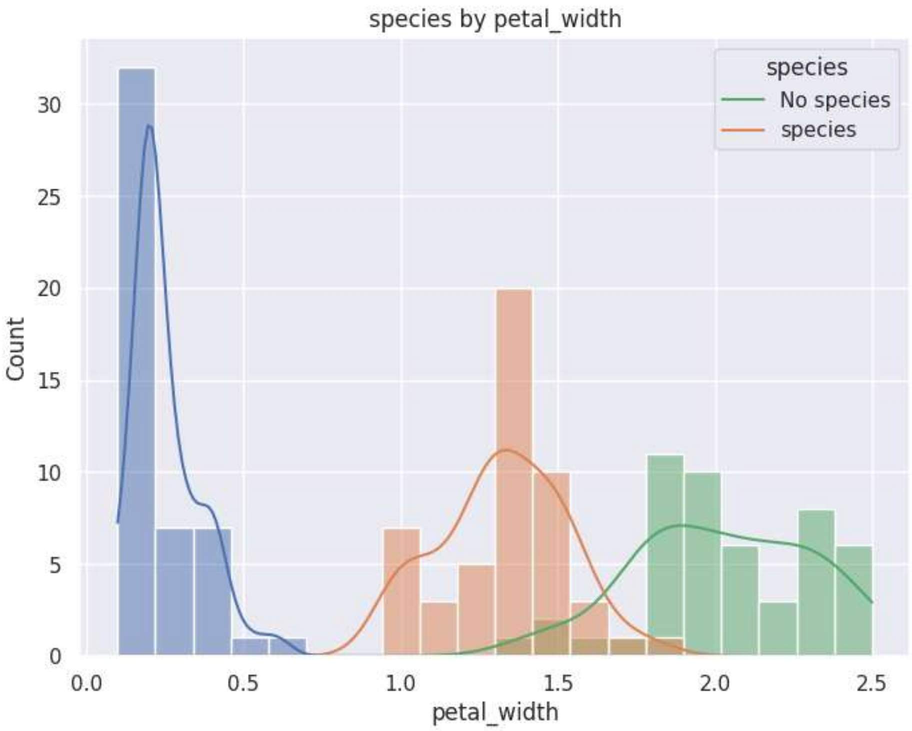

```
plt.figure(figsize=(8, 6))
sns.histplot(data=df, x='sepal_width', hue='species', kde=True, bins=20)
plt.title('species by sepal_width')
plt.xlabel('sepal_width')
plt.ylabel('Count')
plt.legend(title='species', loc='upper right', labels=['No species', 'species'])
plt.show()
```



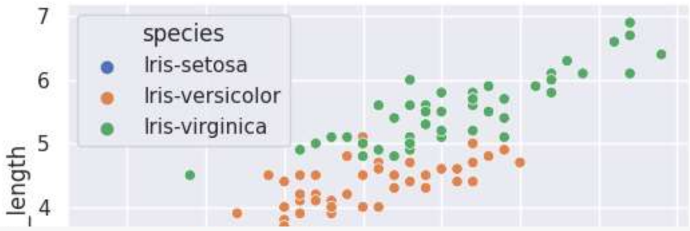

```
plt.figure(figsize=(8, 6))
sns.histplot(data=df, x='petal_length', hue='species', kde=True, bins=20)
plt.title('species by petal_length')
plt.xlabel('petal_length')
plt.ylabel('Count')
plt.legend(title='species', loc='upper right', labels=['No species', 'species'])
plt.show()
```



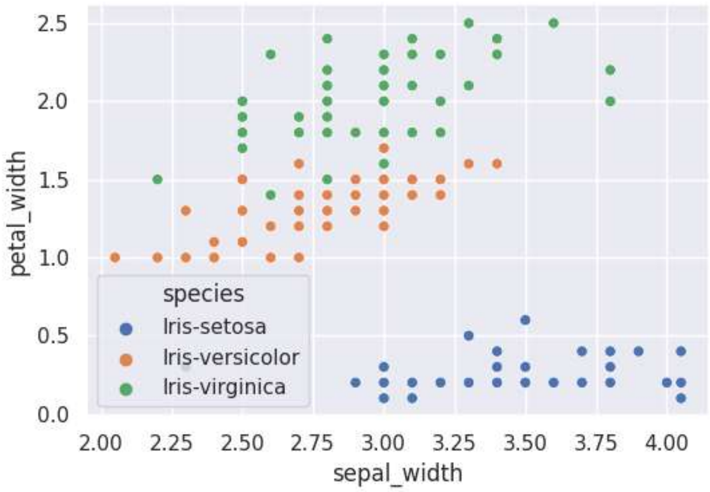

```
plt.figure(figsize=(8, 6))
sns.histplot(data=df, x='petal_width', hue='species', kde=True, bins=20)
plt.title('species by petal_width')
plt.xlabel('petal_width')
plt.ylabel('Count')
plt.legend(title='species', loc='upper right', labels=['No species', 'species'])
plt.show()
```




```
sns.scatterplot(x="sepal_length",y="petal_length",data=df,hue="species")
plt.show()
```

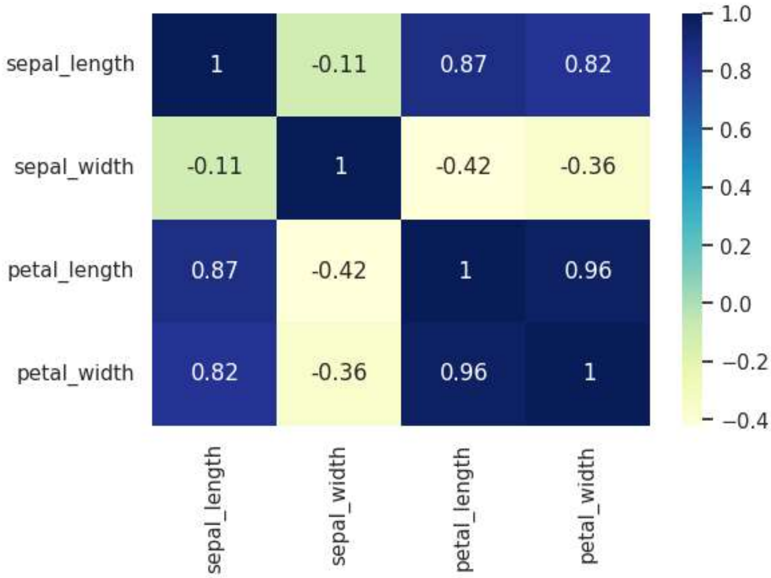



```
sns.scatterplot(x="sepal_width",y="petal_width",data=df,hue="species")
plt.show()
```

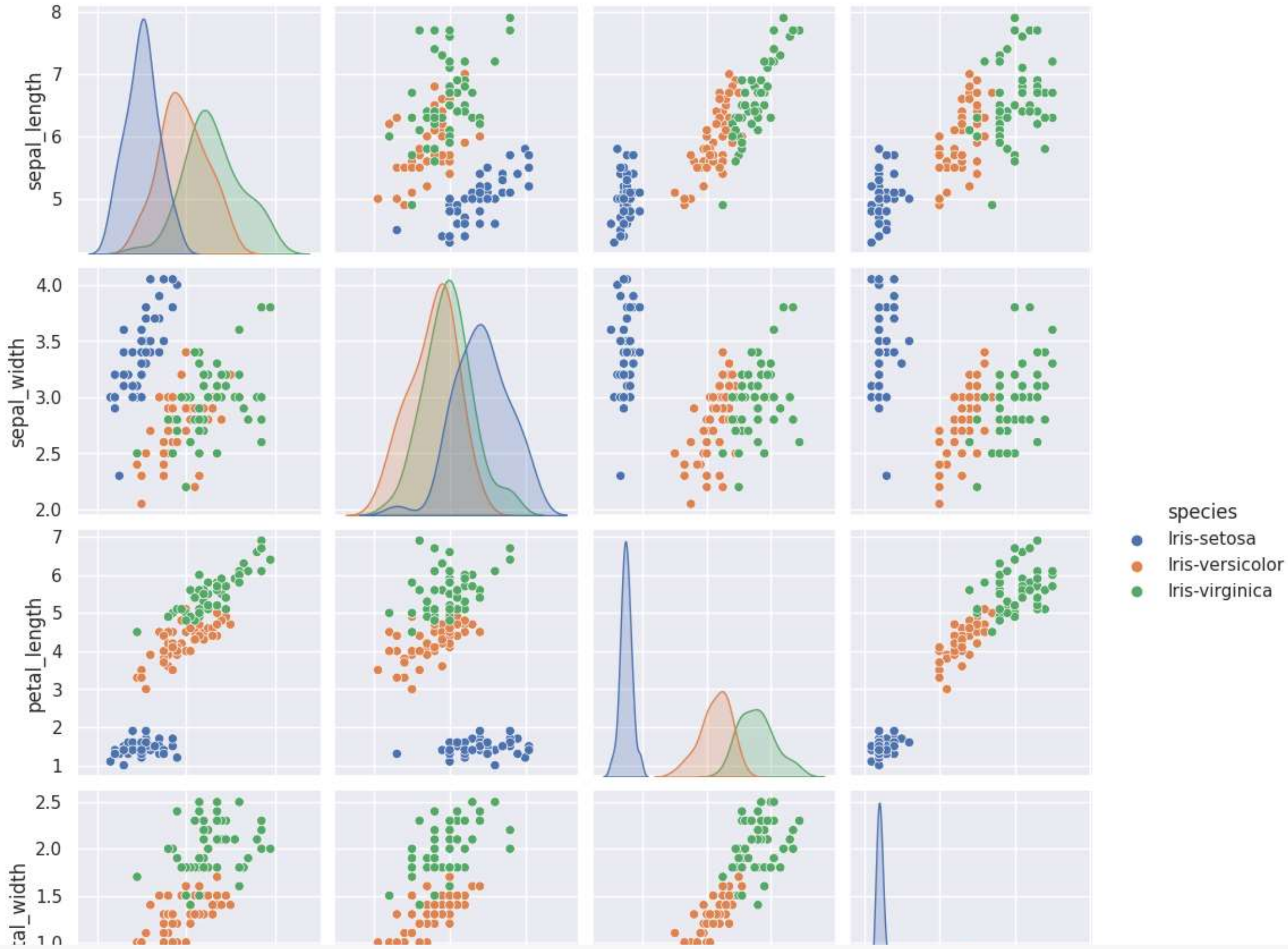



```
sns.heatmap(df.corr(), cmap="YlGnBu", annot=True)
```

```
<ipython-input-32-1f8db7c938a8>:1: FutureWarning: The default value of numeric_only in DataFrame.corr is deprecated. In a future ve
  sns.heatmap(df.corr(), cmap="YlGnBu", annot=True)
<Axes: >
```

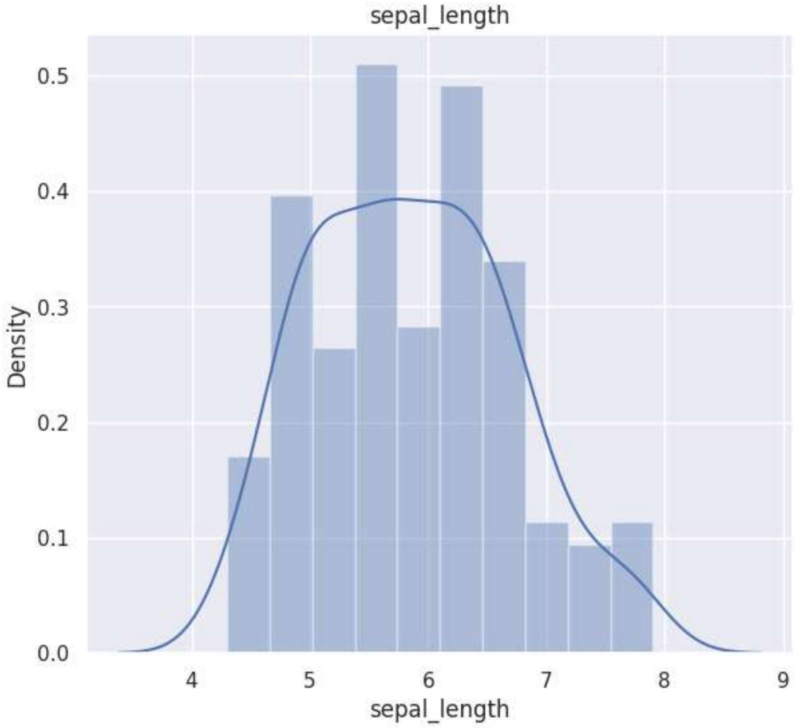



```
sns.pairplot(df,hue="species")
plt.show()
```




```
def plots(num_cols, variable):
    plt.figure(figsize=(15,6))
    plt.subplot(1, 2, 1)
    #num_cols[variable].hist()
    sns.distplot(num_cols[variable], kde=True, bins=10)
    plt.title(variable)
    plt.subplot(1, 2, 2)
    stats.probplot(num_cols[variable], dist="norm", plot=pylab)
    plt.title(variable)
    plt.show()
for i in num_cols.columns:
  plots(num_cols, i)
```

```
<ipython-input-33-d3397ca1f647>:5: UserWarning: 

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(num_cols[variable], kde=True, bins=10)
```




```
<ipython-input-33-d3397ca1f647>:5: UserWarning: 

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

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https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(num_cols[variable], kde=True, bins=10)
```

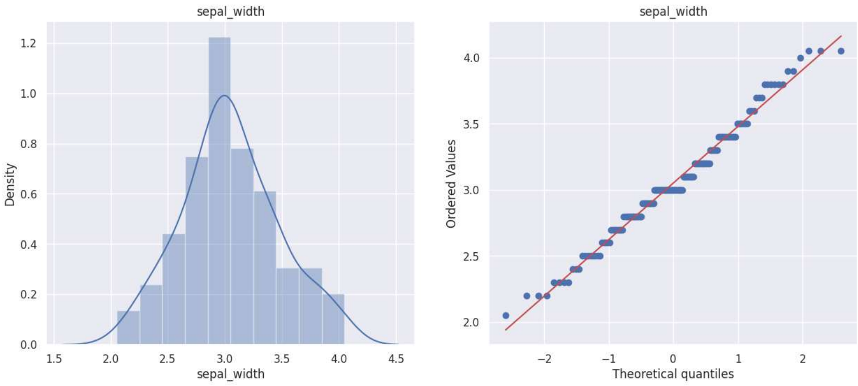


```
<ipython-input-33-d3397ca1f647>:5: UserWarning: 

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

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similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(num_cols[variable], kde=True, bins=10)
```

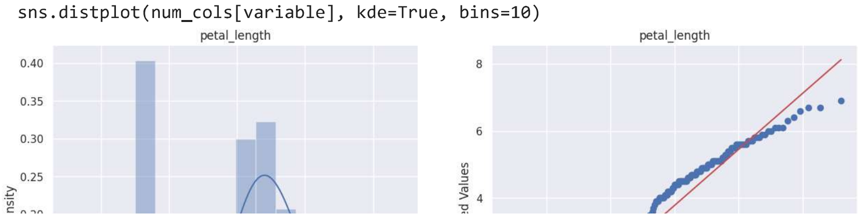

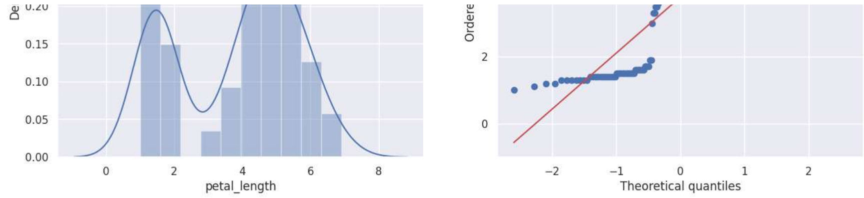


```
<ipython-input-33-d3397ca1f647>:5: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

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For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(num_cols[variable], kde=True, bins=10)
```
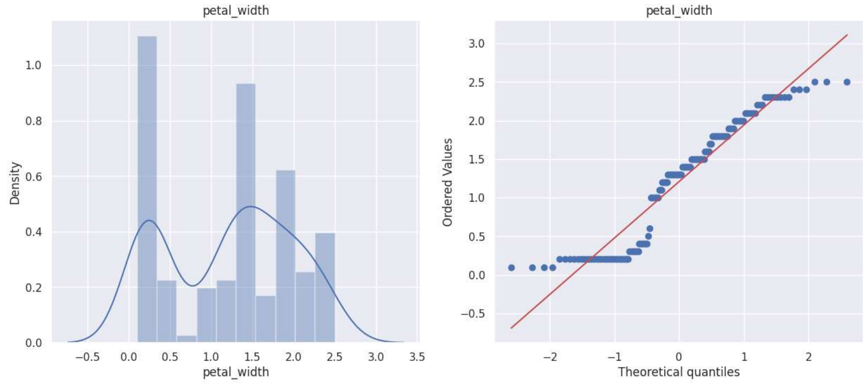



Feature Engineering

Mutual Information

```
X = df.iloc[:,:4]
Y = df["species"]
```

```
X.head()
```

	sepal_length	sepal_width	petal_length	petal_width
0	5.1	3.5	1.4	0.2
1	4.9	3.0	1.4	0.2
2	4.7	3.2	1.3	0.2
3	4.6	3.1	1.5	0.2
4	5.0	3.6	1.4	0.2

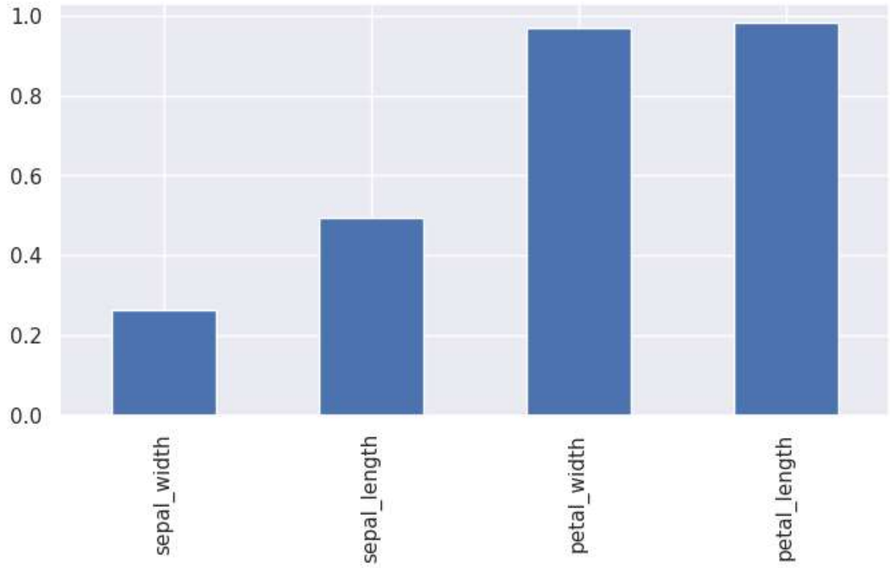
```
mi_score = mutual_info_classif(X,Y)
mi_score = pd.Series(mi_score)
mi_score.index = X.columns
mi_score.sort_values(ascending=True)
```

```
sepal_width     0.264381
sepal_length    0.493026
petal_width     0.970660
```

```
petal_length    0.981816
dtype: float64
```

```
mi_score.sort_values(ascending=True).plot.bar(figsize=(8, 4))
```

```
<Axes: >
```



Spliting Data into Train and Test

```
train_data,test_data,train_label,test_label = train_test_split(X,Y,test_size=0.2,random_state=0)
```

```
print("train_data : ",train_data.shape)
print("train_label : ",train_label.shape)
print("test_data : ",test_data.shape)
print("test_label : ",test_label.shape)
```

```
train_data :  (117, 4)
train_label :  (117,)
test_data :  (30, 4)
test_label :  (30,)
```

Normalizing Data

```
sc = StandardScaler()
train_data_sc = sc.fit_transform(train_data)
test_data_sc = sc.fit_transform(test_data)
```

```
train_data_sc
```

```
       [ 0.621766  ,  0.13207591,  0.96381606,  0.77148954],
       [-0.10570022,  2.25537267, -1.51014241, -1.36810811],
       [ 0.621766  ,  0.36799778,  0.84874823,  1.4401138 ],
       [-0.95441081,  1.78352895, -1.33754066, -1.23438326],
       [-1.43938829,  0.36799778, -1.28000674, -1.36810811],
       [ 0.37927726, -0.57568967,  0.56107864,  0.77148954],
       [ 0.621766  ,  0.36799778,  0.38847688,  0.37031498],
       [ 2.1979428 , -0.10384595,  1.30901957,  1.4401138 ],
       [-0.10570022, -0.81161153,  0.73368039,  0.90521439],
       [-0.5906777 , -0.10384595,  0.38847688,  0.37031498],
       [-0.34818896, -0.10384595,  0.38847688,  0.37031498],
       [ 0.01554415, -0.10384595,  0.73368039,  0.77148954],
       [-0.46943333, -1.51937712, -0.07179446, -0.29830929],
       [ 0.25803289, -0.57568967,  0.10080729,  0.10286527],
       [ 0.621766  , -0.57568967,  1.02134998,  1.1726641 ],
       [-0.10570022, -0.81161153,  0.04327337, -0.03085958],
       [ 2.1979428 ,  1.78352895,  1.65422308,  1.30638895],
       [-0.5906777 ,  0.8398415 , -1.22247282, -1.36810811],
       [ 0.98549911, -0.10384595,  0.79121431,  1.4401138 ],
       [ 0.621766  , -0.33976781,  0.27340905,  0.10286527],
       [-0.22694459, -1.0475334 , -0.1868623 , -0.29830929],
       [-1.07565518, -0.10384595, -1.28000674, -1.36810811],
       [ 0.13678852, -0.81161153,  0.73368039,  0.50403983],
       [ 1.22798785,  0.13207591,  0.90628214,  1.1726641 ],
       [ 1.22798785,  0.13207591,  0.73368039,  1.4401138 ],
       [-1.68187702, -1.75529898, -1.45260849, -1.23438326],
       [-1.07565518, -2.34510364, -0.1868623 , -0.29830929],
       [-0.46943333, -1.0475334 ,  0.33094296, -0.03085958],
       [ 0.50052163, -1.28345526,  0.61861255,  0.37031498],
       [-0.46943333, -1.28345526,  0.10080729,  0.10286527],
       [-1.80312139, -0.10384595, -1.45260849, -1.36810811],
```

Model

Logistic Regression

```
model_lr = LogisticRegression().fit(train_data_sc,train_label)
```

```
y_pred_1 = model_lr.predict(test_data_sc)
y_pred_1
```

```
array(['Iris-setosa', 'Iris-setosa', 'Iris-setosa', 'Iris-virginica',
       'Iris-virginica', 'Iris-versicolor', 'Iris-setosa', 'Iris-setosa',
       'Iris-virginica', 'Iris-setosa', 'Iris-setosa', 'Iris-versicolor',
       'Iris-virginica', 'Iris-versicolor', 'Iris-versicolor',
       'Iris-versicolor', 'Iris-setosa', 'Iris-versicolor',
       'Iris-virginica', 'Iris-setosa', 'Iris-versicolor', 'Iris-setosa',
       'Iris-virginica', 'Iris-versicolor', 'Iris-virginica',
       'Iris-setosa', 'Iris-virginica', 'Iris-versicolor',
       'Iris-versicolor', 'Iris-virginica'], dtype=object)
```

```
accuracy_score(y_pred_1,test_label)
```

```
1.0
```

```
confusion_matrix(y_pred_1,test_label)
```

```
array([[11,  0,  0],
       [ 0, 10,  0],
       [ 0,  0,  9]])
```

```
print(classification_report(y_pred_1,test_label))
```

```
                 precision    recall  f1-score   support

    Iris-setosa       1.00      1.00      1.00        11
Iris-versicolor       1.00      1.00      1.00        10
 Iris-virginica       1.00      1.00      1.00         9

       accuracy                           1.00        30
      macro avg       1.00      1.00      1.00        30
   weighted avg       1.00      1.00      1.00        30
```

Random Forest Model

```
model_rf = RandomForestClassifier().fit(train_data_sc,train_label)
```

```
y_pred_2 = model_rf.predict(test_data_sc)
```

```
print("Train Data Accuracy :",(model_rf.score(train_data_sc,train_label)))
print("Test Data Accuracy :",(accuracy_score(y_pred_2,test_label)))
```

```
Train Data Accuracy : 1.0
Test Data Accuracy : 0.9666666666666667
```

```
confusion_matrix(y_pred_2,test_label)
```

```
array([[11,  0,  0],
       [ 0, 10,  1],
       [ 0,  0,  8]])
```

```
print(classification_report(y_pred_2,test_label))
```

```
                 precision    recall  f1-score   support

    Iris-setosa       1.00      1.00      1.00        11
Iris-versicolor       1.00      0.91      0.95        11
 Iris-virginica       0.89      1.00      0.94         8

       accuracy                           0.97        30
      macro avg       0.96      0.97      0.96        30
   weighted avg       0.97      0.97      0.97        30
```

KNN Model

```
model_knn = KNeighborsClassifier(n_neighbors=3).fit(train_data_sc,train_label)
```

```
y_pred_3 = model_knn.predict(test_data_sc)
```

```
print("Test Data Accuracy :",(accuracy_score(y_pred_3,test_label)))
```

```
Test Data Accuracy : 0.9666666666666667
```

```
confusion_matrix(y_pred_3,test_label)
```

```
array([[11,  0,  0],
       [ 0,  9,  0],
       [ 0,  1,  9]])
```

```
print(classification_report(y_pred_3,test_label))
```

```
                 precision    recall  f1-score   support

    Iris-setosa       1.00      1.00      1.00        11
Iris-versicolor       0.90      1.00      0.95         9
 Iris-virginica       1.00      0.90      0.95        10

       accuracy                           0.97        30
      macro avg       0.97      0.97      0.96        30
   weighted avg       0.97      0.97      0.97        30
```

Connected to Python 3 Google Compute Engine backend