Practical EDA by Tanvir Azhar

What is Exploratory Data Analysis?

Exploratory Data Analysis (EDA) is a method of analyzing datasets to summarize their main characteristics. With this technique, we can visualize the hidden aspects of the underlying patterns of the data. We will also be able to deal with the duplicate values, outliers, and also see some trends or patterns present in the dataset.

Here we will see about the Iris dataset.

Iris Dataset

Iris dataset is considered as the Hello World for ML. It contains the columns namely - Petal Length, Petal Width, Sepal Length, Sepal Width, and Species Type. As in a flowering plant, the researchers have measured various features of the petals and sepals and classified them signally.

Load Dataset

First we will use the Pandas library to read this CSV file, and we will convert it into the dataframe. read_csv() method is used to read CSV files.

In [1]:
```
import pandas as pd
# Reading the CSV file
df = pd.read_csv("/kaggle/input/datasets/uciml/iris/iris.csv")
# Printing top 5 rows
df.head()
```

Out[1]:

	sepal_length	sepal_width	petal_length	petal_width	class
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

Getting Information from the dataset

In [2]:
```
df.shape
```

Out[2]:
```
(150, 5)
```

We can see that the dataframe contains 5 columns and 150 rows.

In [3]:
```
df.info()
```

Out[3]:
```
<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   class         150 non-null    object
dtypes: float64(4), object(1)
memory usage: 5.9 KB
```

We can see that only one column has categorical data and all the other columns are of the numeric type with non-null entries.

Here, .info() is a statistical function of the dataset using the descriptive method. The descriptive function applies basic statistical computations on the dataset like entries values, count of data points standard deviation, etc. Any missing value or NaN value will be automatically skipped. describe() function gives a good picture of the distribution of data.

In [4]:
```
df.describe()
```

Out[4]:

	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

Checking Missing Values

In [5]:
```
df.isnull().sum()
```

Out[5]:
```
sepal_length    0
sepal_width     0
petal_length    0
petal_width     0
class           0
dtype: int64
```

Missing values can occur when no information is provided for one or more items or for a whole unit. We will use the isnull() function.

Checking Duplicates

In [6]:
```
dupl = df.drop_duplicates(keep=False)
dupl
```

Out[6]:

	sepal_length	sepal_width	petal_length	petal_width	class
142	5.8	2.7	5.1	1.9	Iris-virginica
381	7.9	3.8	6.4	2.0	Iris-virginica
539	4.9	2.5	4.5	1.7	Iris-virginica

We can see that there are only three unique species. Let's see if the dataset is balanced or not, as all the species contain equal number of entries or not. We will use the frame.value_counts() function. The function returns a Series containing counts of unique values.

In [7]:
```
df.value_counts("class")
```

Out[7]:
```
class
Iris-setosa        50
Iris-versicolor    50
Iris-virginica     50
dtype: int64
```

We can see that all the species contain an equal amount of ones, so we should not delete any entries.

Data Visualization

- Visualizing the target column the target column will be the Species (class column) because at the end we will need the result according to the species only. Let's see a counter for species.

In [8]:
```
# matplotlib magic
%matplotlib inline
import matplotlib.pyplot as plt
ax = df.hist(figsize=(10,10))
ax[0][0].set_title("Sepal Length")
ax[0][1].set_title("Sepal Width")
ax[1][0].set_title("Petal Length")
ax[1][1].set_title("Petal Width")
```

Out[8]:
```
Matplotlib is building the font cache; this may take a moment.
```

- Histogram between variables. We use the matplotlib.pyplot library for sepal length and sepal width and also between petal length and petal width. Example 1: Comparing Sepal Length and Sepal Width.

In [9]:
```
# matplotlib magic
%matplotlib inline
import matplotlib.pyplot as plt

iris.scatter(x="sepal_length", y="sepal_width",
             c="species", colormap="jet")

# Placing legend outside the figure
plt.legend(bbox_to_anchor=(1, 1), loc=2)

plt.show()
```

From the above plot, we can infer that,

- Species Setosa has smaller sepal lengths but larger sepal widths.
- Versicolor Species lies in the middle of the other two species in terms of sepal length and width.
- Species Virginica has larger sepal lengths but comparatively smaller sepal widths.

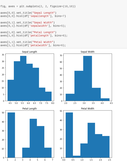
Example 2: Comparing Petal Length and Petal Width

In [10]:
```
# matplotlib magic
%matplotlib inline
import matplotlib.pyplot as plt

iris.scatter(x="petal_length", y="petal_width",
             c="species", colormap="jet")

# Placing legend outside the figure
plt.legend(bbox_to_anchor=(1, 1), loc=2)

plt.show()
```



From the above plot, we can infer that,

- Species Setosa has smaller petal lengths and widths.
- Versicolor Species lies in the middle of the other two species in terms of petal length and width.
- Species Virginica has larger petal lengths and widths.

Let's plot all the column's relationships using a pairplot. It can be used for multivariate analysis.

In [11]:
```
# matplotlib magic
%matplotlib inline
import matplotlib.pyplot as plt

iris.pairplot(hf_height, aspect = 1.5,
              hue='class', height=3)
```

Out[11]:
```
<seaborn.axisgrid.PairGrid at 0x7f4c7f7f7d50>
```

We can see many types of relationships from this plot such as the species Setosa has the smallest of petal widths and lengths. It also has the smallest sepal length but larger sepal widths. Such information can be gathered about any other species.

Histogram

Histograms allow seeing the distribution of data for various columns. It can be used for ex as well as for outlier analysis.

In [12]:
```
# matplotlib magic
%matplotlib inline
import matplotlib.pyplot as plt

fig, axes = plt.subplots(2, 2, figsize=(8,6))

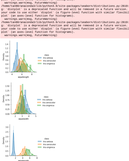
axes[0,0].hist(iris['sepal_length'])
axes[0,0].set_title("Sepal Length")

axes[0,1].hist(iris['sepal_width'])
axes[0,1].set_title("Sepal Width")

axes[1,0].hist(iris['petal_length'])
axes[1,0].set_title("Petal Length")

axes[1,1].hist(iris['petal_width'])
axes[1,1].set_title("Petal Width")

plt.show()
```



From the above plot, we can see that,

- The highest frequency of the sepal length is between 30 and 35 which is between 5.5 and 6.5
- The highest frequency of the sepal width is between 65 and 70 which is between 3.0 and 3.5
- The highest frequency of the petal length is around 40 which is between 1 and 1.5
- The highest frequency of the petal width is between 40 and 50 which is between 0.1 and 0.5

Correlation with Seaborn

Pairplots are also used for the correlation of all observations and visualization it through a histogram i.e. only one observation and thus we choose one particular column of the dataset.

In [13]:
```
# matplotlib magic
%matplotlib inline
import matplotlib.pyplot as plt

plot = sns.pairplot(iris, hue="species")
plot.savefig("output.png")

plot = sns.pairplot(iris, hue="species",
                    palette="husl")
plot.savefig("output_husl.png")

plot = sns.pairplot(iris, hue="species",
                    palette="husl",
                    diag_kind="hist")
plot.savefig("output_husl_hist.png")

plt.show()
```

```
/home/jupyter-parameswari/lib/python3.6/site-packages/matplotlib/rcsetup.py:205: MatplotlibDeprecationWarning: \n'finance.sty' \n'mpl_toolkits.mplot3d.rotate_axes' \n'text.dvipngrey' \n'text.latex.preamble' \n'text.latex.preamble_without_packages' \n'text.latex.unicode' \n'text.usetex' \n'verbose.fileo' \n'verbose.level' \n'webagg.port' \n'webagg.port_retries' \n'webagg.supported_cursors' \n'webagg.timeout' \n'wx.frame' \n'wx.nbagg.cursor' \n'wx.newtimer' \n'wx.no_use' \n'wx.toolbar' \n'wx.wxpro' \n'wxagg.cursor' \n'wxagg.debug' \n'wxagg.keyhandler' \n'wxagg.newtimer' \n'wxagg.toolbar' \n'wxagg.type' \n'xaxis.minorticks.on' \n'xaxis.minorticks.show' \n'xaxis.minorticks.visible' \n'xaxis.offset' \n'xaxis.rotation' \n'xaxis.tick.bottom' \n'xaxis.tick.top' \n'xaxis.unit' \n'xaxis.upper' \n'xaxis.visible' \n'xtick.alignment' \n'xtick.major.bottom' \n'xtick.major.pad' \n'xtick.major.size' \n'xtick.minor.bottom' \n'xtick.minor.pad' \n'xtick.minor.size' \n'xtick.minor.top' \n'xtick.top' 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