Hello World of Machine Learning

The best small project to start with on a new tool is the classification of iris flowers (e.g. the iris dataset).

- Attributes are numeric so you have to figure out how to load and handle data.
- It is a classification problem, allowing you to practice with perhaps an easier type of supervised learning algorithm.
- It is a multi-class classification problem (multi-nominal) that may require some specialized handling.
- It only has 4 attributes and 150 rows, meaning it is small and easily fits into memory (and a screen or A4 page).
- All of the numeric attributes are in the same units and the same scale, not requiring any special scaling or transforms to get started.

To do

1. Installing the Python and SciPy platform.
2. Loading the dataset.
3. Summarizing the dataset.
    - Dimensions of the dataset.
    - Peek at the data itself.
    - Statistical summary of all attributes.
    - Breakdown of the data by the class variable.
4. Visualizing the dataset.
    - Univariate plots to better understand each attribute.
    - Multivariate plots to better understand the relationships between attributes.
5. Evaluating some algorithms.
    - Separate out a validation dataset.
    - Set-up the test harness to use 10-fold cross validation.
    - Build multiple different models to predict species from flower measurements
    - Select the best model.

        test 6 different algorithms:

        - Logistic Regression (LR)
        - Linear Discriminant Analysis (LDA)
        - K-Nearest Neighbors (KNN).
        - Classification and Regression Trees (CART).
        - Gaussian Naive Bayes (NB).
        - Support Vector Machines (SVM).

6. Making some predictions.

Codes & O/P:

```
# Load libraries
import pandas
from pandas.plotting import scatter_matrix
import matplotlib.pyplot as plt
from sklearn import model_selection
from sklearn.metrics import classification_report
from sklearn.metrics import confusion_matrix
from sklearn.metrics import accuracy_score
from sklearn.linear_model import LogisticRegression
from sklearn.tree import DecisionTreeClassifier
from sklearn.neighbors import KNeighborsClassifier
from sklearn.discriminant_analysis import LinearDiscriminantAnalysis
from sklearn.naive_bayes import GaussianNB
from sklearn.svm import SVC
```

```
# Load dataset
url = "https://raw.githubusercontent.com/jbrownlee/Datasets/master/iris.csv"
names = ['sepal-length', 'sepal-width', 'petal-length', 'petal-width', 'class']
dataset = pandas.read_csv(url, names=names)
```

```
# shape
print(dataset.shape)
```

```
(150, 5)
```

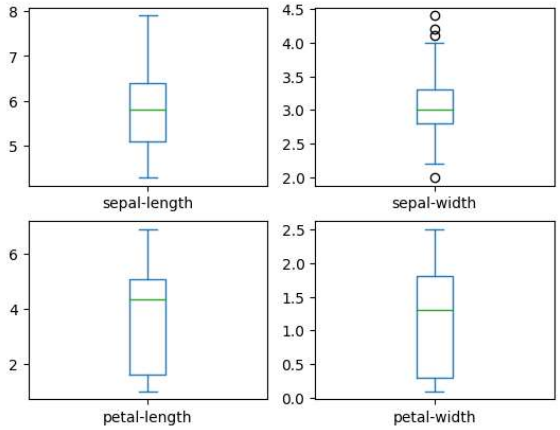
```
# descriptions
print(dataset.describe())
```

```
       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
```

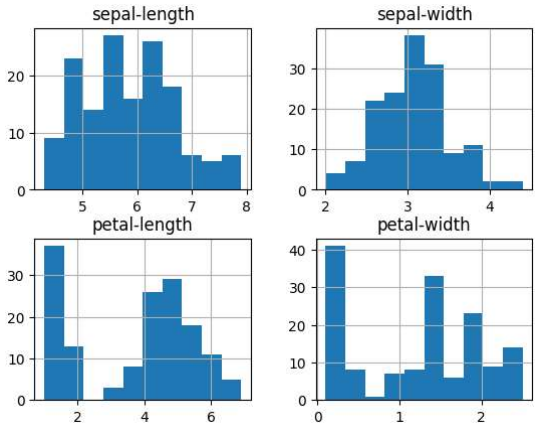
```
# class distribution
print(dataset.groupby('class').size())
```

```
class
Iris-setosa        50
Iris-versicolor    50
Iris-virginica     50
dtype: int64
```

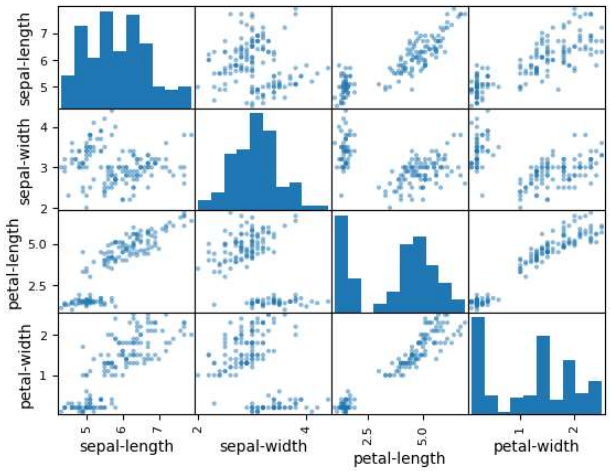
```
# box and whisker plots
dataset.plot(kind='box', subplots=True, layout=(2,2), sharex=False,
sharey=False)
plt.show()
```




```
# histograms
dataset.hist()
plt.show()
```




```
# scatter plot matrix
scatter_matrix(dataset)
plt.show()
```



```
# Split-out validation dataset
array = dataset.values
X = array[:,0:4]
Y = array[:,4]
validation_size = 0.20
seed = 7
X_train, X_validation, Y_train, Y_validation =
model_selection.train_test_split(X, Y, test_size=validation_size,
random_state=seed)
```

```
# Test options and evaluation metric
seed = 7
scoring = 'accuracy'
```

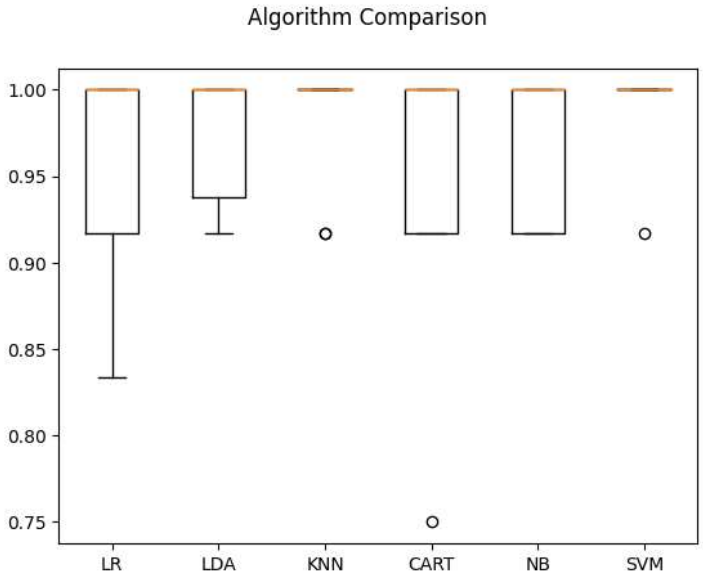
```
# Spot Check Algorithms
models = []
models.append(('LR', LogisticRegression(solver='liblinear', multi_class='ovr')))
models.append(('LDA', LinearDiscriminantAnalysis()))
models.append(('KNN', KNeighborsClassifier()))
models.append(('CART', DecisionTreeClassifier()))
models.append(('NB', GaussianNB()))
models.append(('SVM', SVC(gamma='auto')))


from sklearn import model_selection

results = []
names = []
for name, model in models:
    kfold = model_selection.KFold(n_splits=10, shuffle=True, random_state=seed)
    cv_results = model_selection.cross_val_score(model, X_train, Y_train,
cv=kfold, scoring=scoring)
    results.append(cv_results)
    names.append(name)
    msg = "%s: %f (%f)" % (name, cv_results.mean(), cv_results.std())
    print(msg)
```

```
LR: 0.958333 (0.055902)
LDA: 0.975000 (0.038188)
KNN: 0.983333 (0.033333)
CART: 0.950000 (0.076376)
NB: 0.966667 (0.040825)
SVM: 0.991667 (0.025000)
```

```
# Compare Algorithms
fig = plt.figure()
fig.suptitle('Algorithm Comparison')
ax = fig.add_subplot(111)
plt.boxplot(results)
ax.set_xticklabels(names)
plt.show()
```




```
# Make predictions on validation dataset
knn = KNeighborsClassifier()
knn.fit(X_train, Y_train)
predictions = knn.predict(X_validation)
print(accuracy_score(Y_validation, predictions))
print(confusion_matrix(Y_validation, predictions))
print(classification_report(Y_validation, predictions))
```

```
0.9
[[ 7  0  0]
 [ 0 11  1]
 [ 0  2  9]]
                 precision    recall  f1-score   support

    Iris-setosa       1.00      1.00      1.00         7
Iris-versicolor       0.85      0.92      0.88        12
 Iris-virginica       0.90      0.82      0.86        11

       accuracy                           0.90        30
      macro avg       0.92      0.91      0.91        30
   weighted avg       0.90      0.90      0.90        30
```