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Iris Classification

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Iris Classification

Aim of the Project

This project aims to build a model of the iris dataset. This model can be further used to classify unknown data.

# About the Project

This is the Iris classification project. The aim of this project is to build a model that can classify the iris dataset.

## Project Steps

* Data Download
* Data Loading
* Data Summarization
* Data Visualization
* Partitioning of dataset into Training dataset and Validation dataset
* Model Creation
* Model Selection
  + Create test harness using K-Fold Cross Validation, with scoring set to 'accuracy'
  + Evaluation of models using test harness
  + Summarization, Visualization and Comparison of Results
  + Model Selection
* Making Predictions using Selected Model
* Summarization of Results
* Saving the Pipelined Project
* Testing the saved model

## Project Files

* Dataset
* Python file (using template.py as the base)
* Model files
* Image files
* Documentation
* README.md
* Project Report
* Slide deck

# About the Iris Dataset

The repository is hosted at [UCI Machine Learning Repository](https://archive.ics.uci.edu/ml/machine-learning-databases/iris/)

The data set is multivariate and contains ratio(numerical) and nominal data. There are 150 instances and 4 attributes.

## Dataset Summarization

### Shape of the dataset (instance, attribute)

(150, 5)

**We can see that there are 150 instances (or rows) and 5 attributes**

### First 20 instances

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

5 5.4 3.9 1.7 0.4 Iris-setosa

6 4.6 3.4 1.4 0.3 Iris-setosa

7 5.0 3.4 1.5 0.2 Iris-setosa

8 4.4 2.9 1.4 0.2 Iris-setosa

9 4.9 3.1 1.5 0.1 Iris-setosa

10 5.4 3.7 1.5 0.2 Iris-setosa

11 4.8 3.4 1.6 0.2 Iris-setosa

12 4.8 3.0 1.4 0.1 Iris-setosa

13 4.3 3.0 1.1 0.1 Iris-setosa

14 5.8 4.0 1.2 0.2 Iris-setosa

15 5.7 4.4 1.5 0.4 Iris-setosa

16 5.4 3.9 1.3 0.4 Iris-setosa

17 5.1 3.5 1.4 0.3 Iris-setosa

18 5.7 3.8 1.7 0.3 Iris-setosa

19 5.1 3.8 1.5 0.3 Iris-setosa

A look at the first 20 rows shows us that the data X values are of ratio(float) type and the y values are categorical and nominal

### Statistical summary

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

From the summary we can see that the data is of 150 count. The values lie between 0 and 8.

### Class Distribution

class

Iris-setosa 50

Iris-versicolor 50

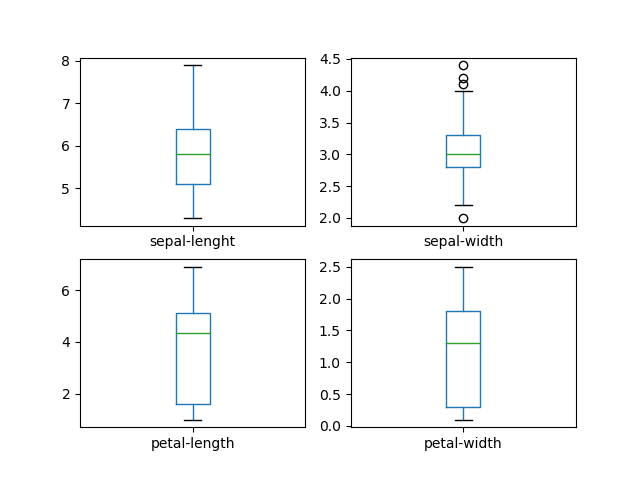
Iris-virginica 50

dtype: int64

We can see that the class distributions are well balanced, with each of the 3 classes comprising a neat third of the dataset.

## Data Visualization & analysis

### Box and whisker



**Sepal length**

We can see a well-balanced dataset. There is no visible skew. The max data point seems to be well above the 75% quartile.

**Sepal width**

We can see some outliers here, above the max point. There is slight skew towards the 75% quartile and, the data is probably skewed to the right.

**Petal length**

No outliers, but the data is very much skewed towards the 25% quartile. The 75% quartile is much closer to the mean than the 25% quartile. The minimum value is quite far from the mean.

**Petal width**

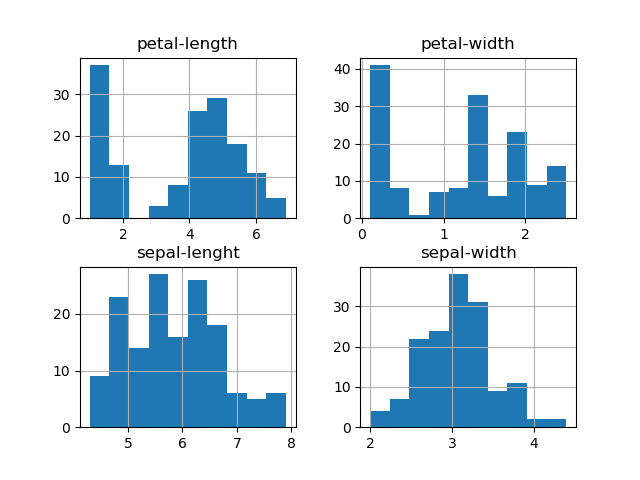
Again, the data is very much skewed towards the 25% quartile. The minimum value is quite far from the mean.

**Conclusion**

Petal length and width are both on the smaller side. Values in these 2 columns are skewed to the left. Very interesting.

In contrast, sepal length and width are much more 'normal'.

### Histogram

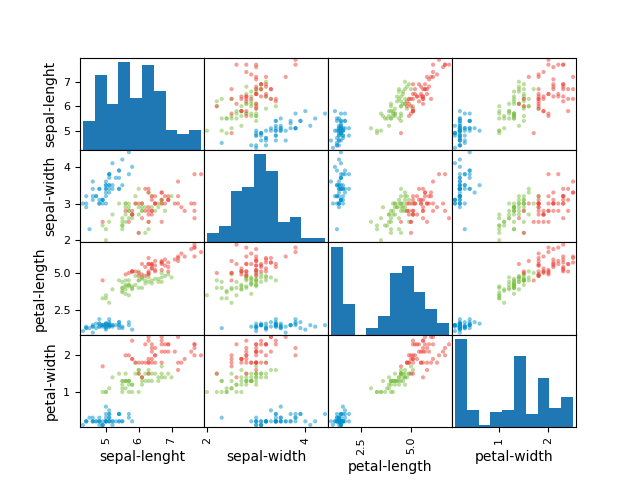


As expected, petal length and width are both heavily skewed to the left. You could draw a diagonal line from the left to the right across the Maxima of the petal width data.

Sepal length and width assume a very broken, but still imaginable bell curve.

Overall, the data seems very interesting.

### Scatter matrix



There's a slight correlation between sepal length and sepal width for one of the classes. This is also the case for sepal length and petal length.

Petal length and width also have a correlation for a part of the data.

**Conclusion**

The data has some slight correlation.

# Model Creation

The following functions were considered to build the model:

1. Linear Regression
2. Linear Discriminant Analysis
3. K-Nearest Neighbors
4. CART
5. Gaussian Naïve Bayes
6. Support Vector Machine

## Spot Checking

The models were spot checked on training dataset using a 10-k KFold Harness.

### Results

The Cross Eval Scores using 10-kfold test harness is:

lr: 0.9666666666666666 (0.04082482904638632)

lda: 0.975 (0.03818813079129868)

knn: 0.9833333333333332 (0.03333333333333335)

cart: 0.975 (0.03818813079129868)

nb: 0.975 (0.053359368645273735)

svm: 0.9916666666666666 (0.025000000000000012)

From the figure we can see the nearly all the non-linear models reach near 1.00 accuracy.

SVM and KNN seem to have the highest estimated accuracy scores. We have chosen the KNN.

## Creating the model.

We have created the model using the KNN function.

# Results

## Results of Testing on Validation Dataset

Accuracy = 0.9

Confusion Matrix:

[[ 7 0 0]

[ 0 11 1]

[ 0 2 9]]

Classification report:

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

## Results of Testing on Entire Dataset

Accuracy = 0.9666666666666667

Confusion Matrix:

[[50 0 0]

[ 0 47 3]

[ 0 2 48]]

Classification report:

precision recall f1-score support

Iris-setosa 1.00 1.00 1.00 50

Iris-versicolor 0.96 0.94 0.95 50

Iris-virginica 0.94 0.96 0.95 50

accuracy 0.97 150

macro avg 0.97 0.97 0.97 150

weighted avg 0.97 0.97 0.97 150

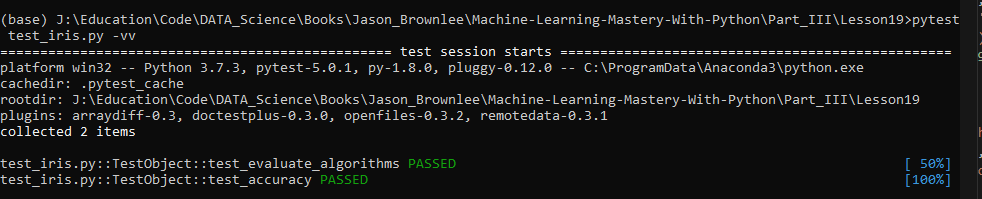
Model is accurate

# Tests

The following things were tested:

* Loading and partitioning of data
* Accuracy of finalized model

## Test Results



## Test Status

All tests have been successfully passed.

# Project Status

Project has been successfully completed.