7. KNIME – Building Your Own Model

In this chapter, you will build your own machine learning model to categorize the plants based on a few observed features. We will use the well-known **iris** dataset from **UCI Machine Learning Repository** for this purpose. The dataset contains three different classes of plants. We will train our model to classify an unknown plant into one of these three classes.

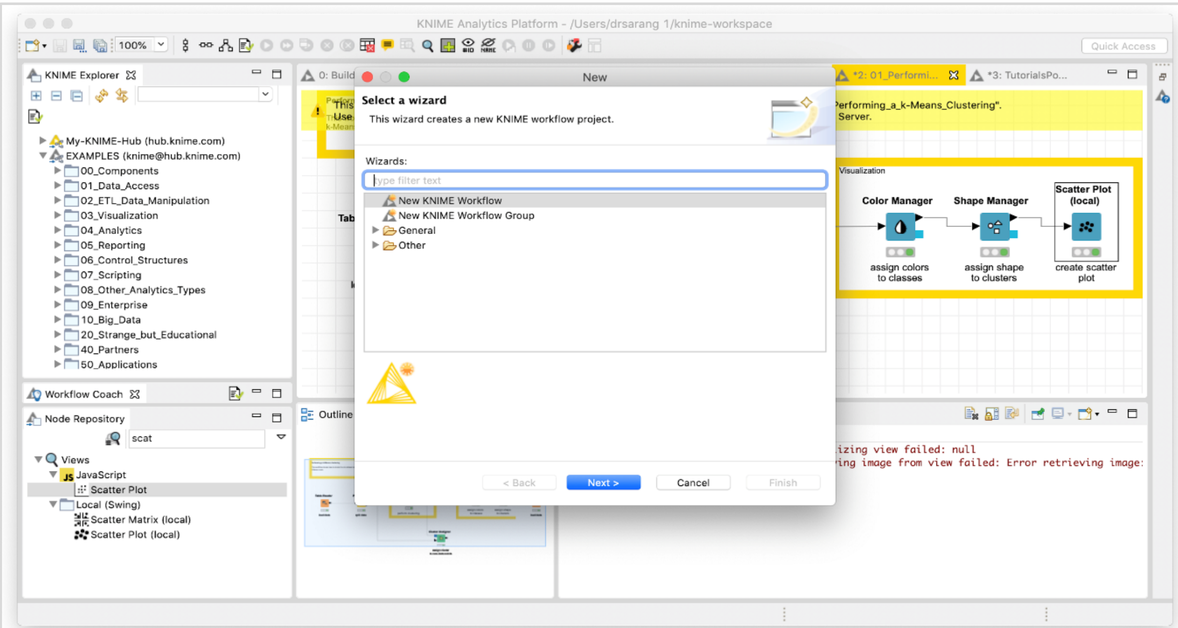
We will start with creating a new workflow in KNIME for creating our machine learning models.

Creating Workflow

To create a new workflow, select the following menu option in the KNIME workbench.

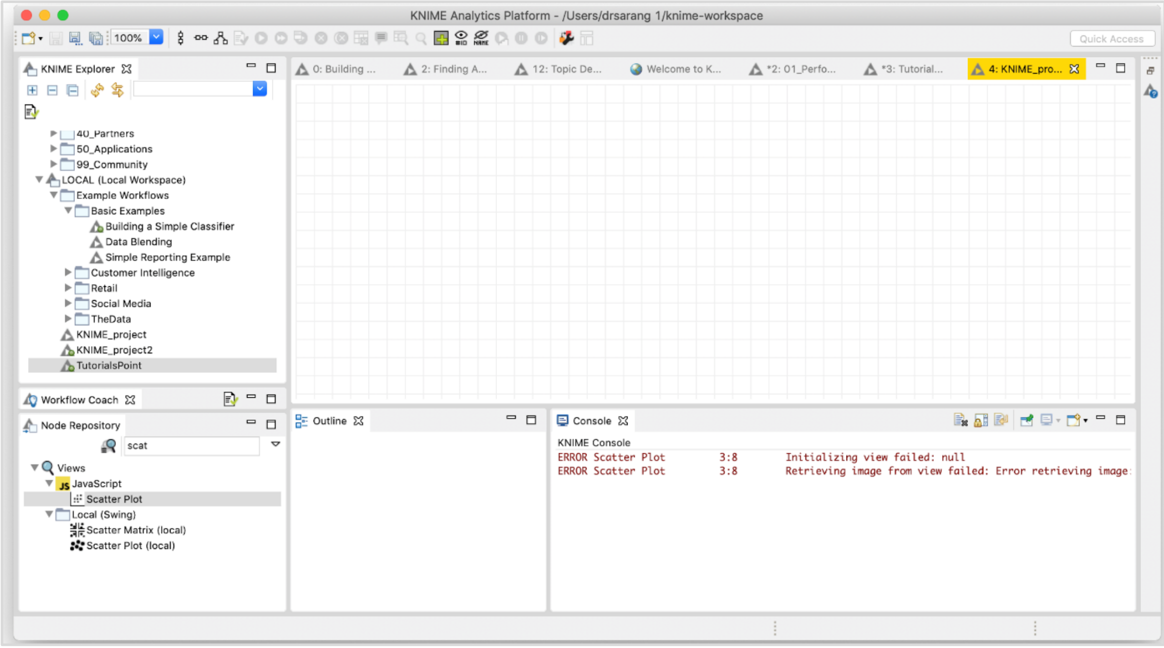
```
File → New
```

You will see the following screen:



Select the **New KNIME Workflow** option and click on the **Next** button. On the next screen, you will be asked for the desired name for the workflow and the destination folder for saving it. Enter this information as desired and click **Finish** to create a new workspace.

A new workspace with the given name would be added to the **Workspace** view as seen here:



You will now add the various nodes in this workspace to create your model. Before, you add nodes, you have to download and prepare the **iris** dataset for our use.

Preparing Dataset

Download the **iris** dataset from the UCI Machine Learning Repository site (https://archive.ics.uci.edu/ml/datasets/iris). The downloaded iris.data file is in CSV format. We will make some changes in it to add the column names.

Open the downloaded file in your favorite text editor and add the following line at the beginning.

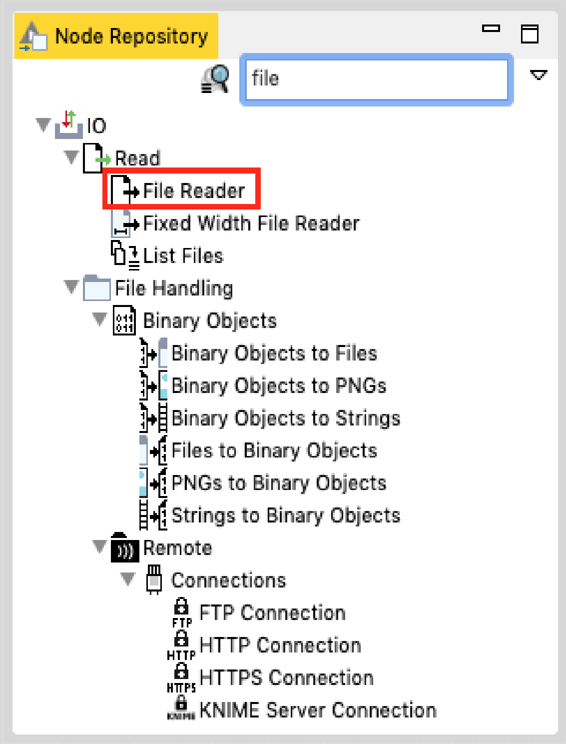
```
sepal length, petal length, sepal width, petal width, class
```

When our **File Reader** node reads this file, it will automatically take the above fields as column names.

Now, you will start adding various nodes.

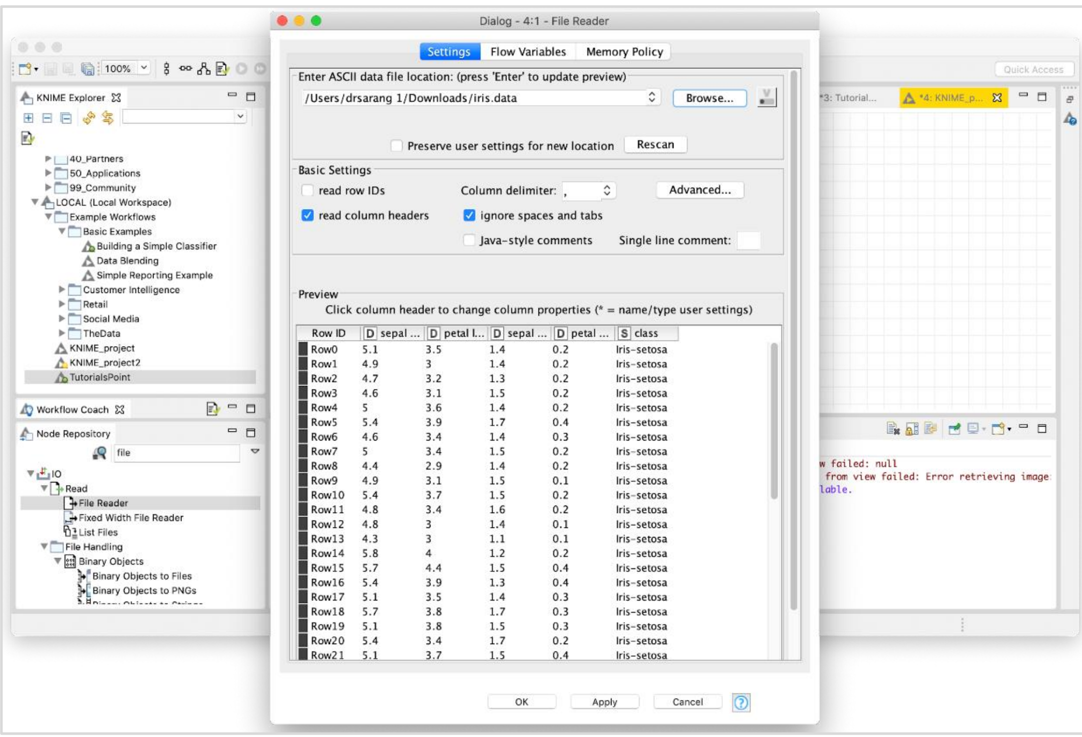
Adding File Reader

Go to the **Node Repository** view, type "`file`" in the search box to locate the **File Reader** node. This is seen in the screenshot below:



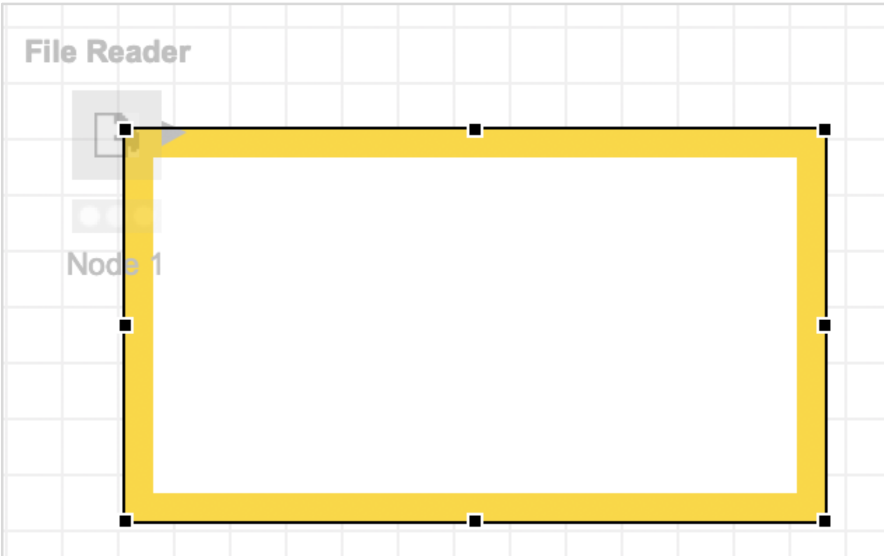
Select and double click the **File Reader** to add the node into the workspace. Alternatively, you may use drag-n-drop feature to add the node into the workspace. After the node is added, you will have to configure it. Right click on the node and select the **Configure** menu option. You have done this in the earlier lesson.

The settings screen looks like the following after the datafile is loaded.



To load your dataset, click on the **Browse** button and select the location of your iris.data file. The node will load the contents of the file which are displayed in the lower portion of the configuration box. Once you are satisfied that the datafile is located properly and loaded, click on the **OK** button to close the configuration dialog.

You will now add some annotation to this node. Right click on the node and select **New Workflow Annotation** menu option. An annotation box would appear on the screen as shown in the screenshot here:



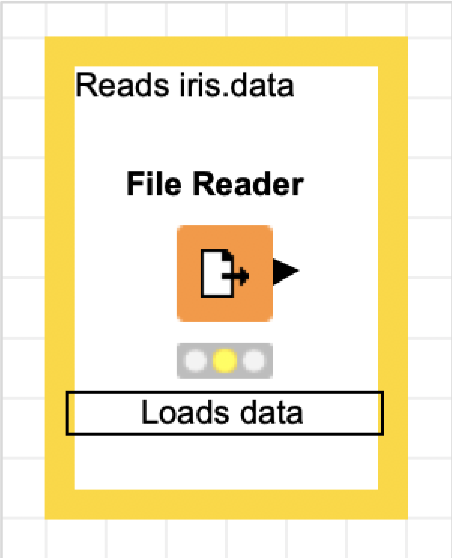
Click inside the box and add the following annotation:

```
Reads iris.data
```

Click anywhere outside the box to exit the edit mode. Resize and place the box around the node as desired. Finally, double click on the **Node 1** text underneath the node to change this string to the following:

```
Loads data
```

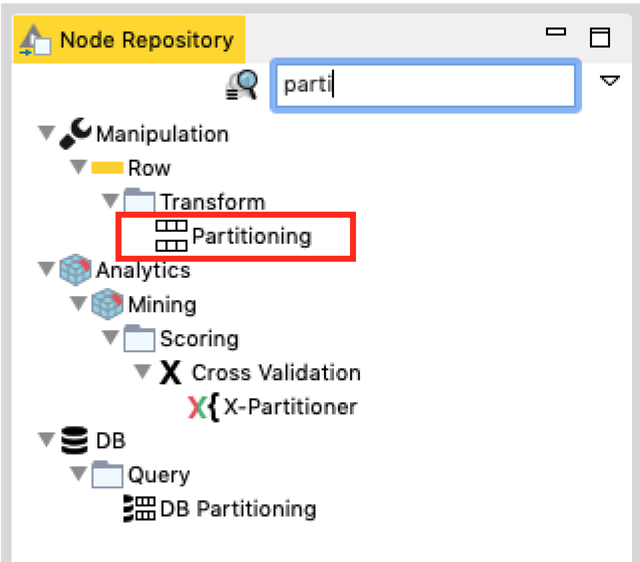
At this point, your screen would look like the following:



We will now add a new node for partitioning our loaded dataset into training and testing.

Adding Partitioning Node

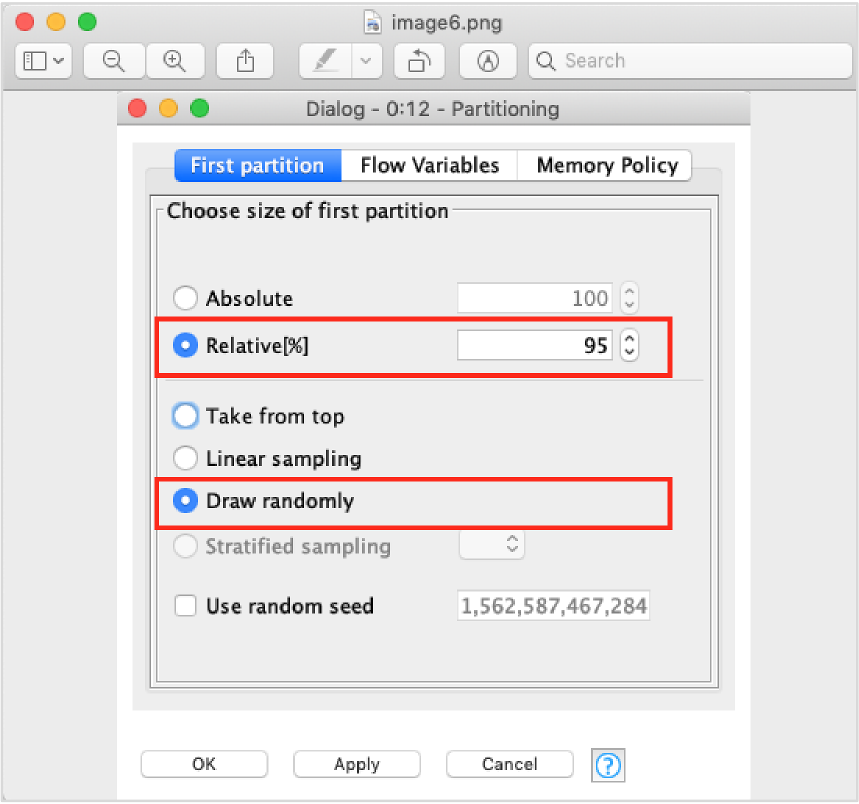
In the **Node Repository** search window, type a few characters to locate the **Partitioning** node, as seen in the screenshot below:



Add the node to our workspace. Set its configuration as follows:

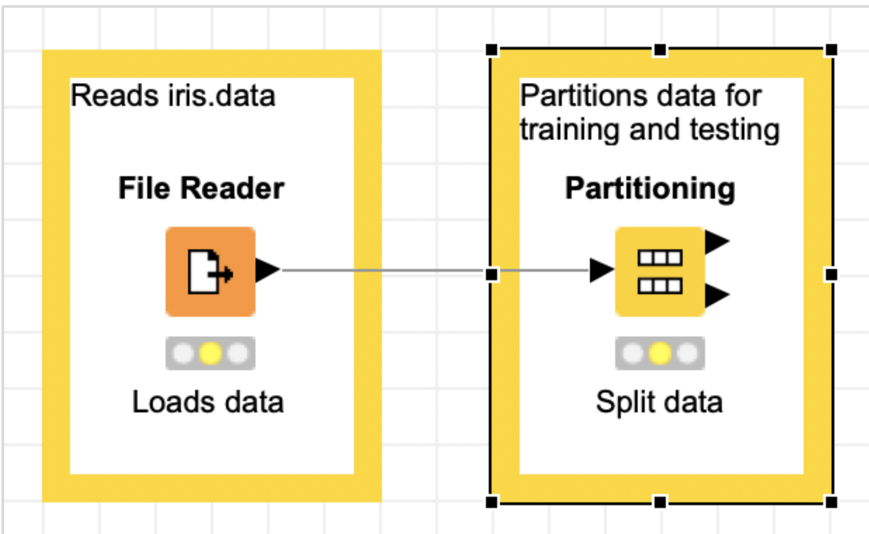
```
Relative (%) : 95
Draw Randomly
```

The following screenshot shows the configuration parameters.



Next, make the connection between the two nodes. To do so, click on the output of the **File Reader** node, keep the mouse button clicked, a rubber band line would appear, drag it to the input of **Partitioning** node, release the mouse button. A connection is now established between the two nodes.

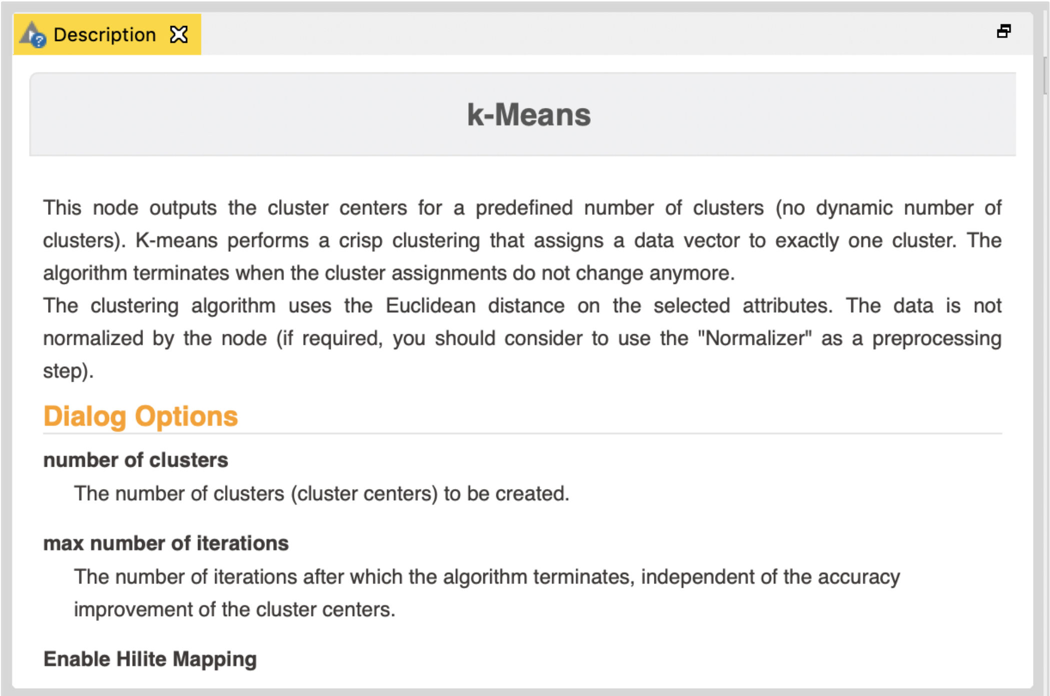
Add the annotation, change the description, position the node and annotation view as desired. Your screen should look like the following at this stage:



Next, we will add the **k-Means** node.

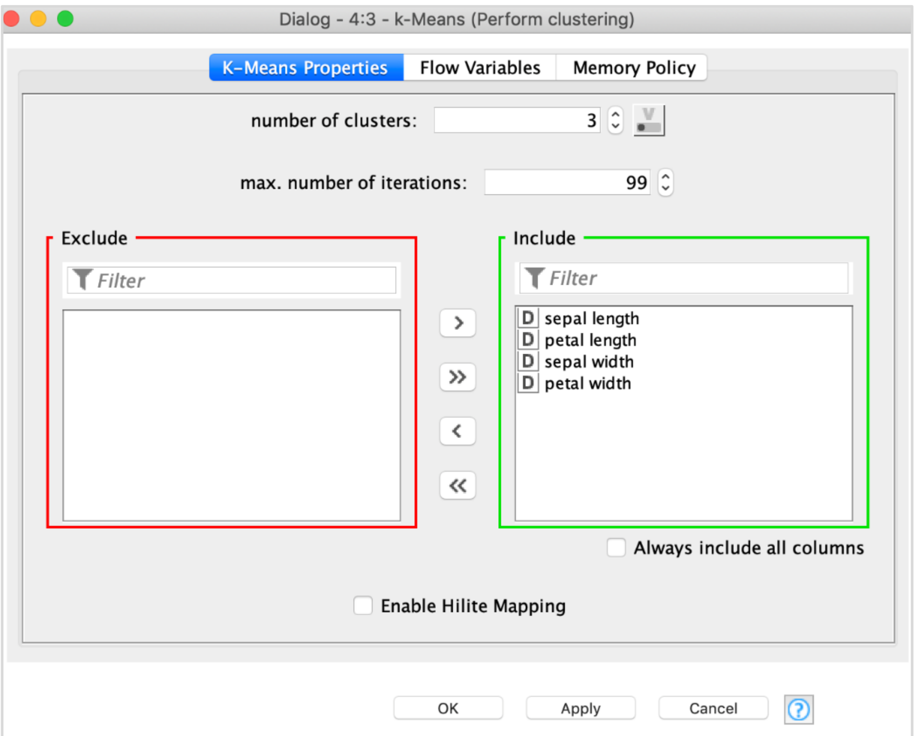
Adding k-Means Node

Select the **k-Means** node from the repository and add it to the workspace. If you want to refresh your knowledge on k-Means algorithm, just look up its description in the description view of the workbench. This is shown in the screenshot below:



Incidentally, you may look up the description of different algorithms in the description window before taking a final decision on which one to use.

Open the configuration dialog for the node. We will use the defaults for all fields as shown here:

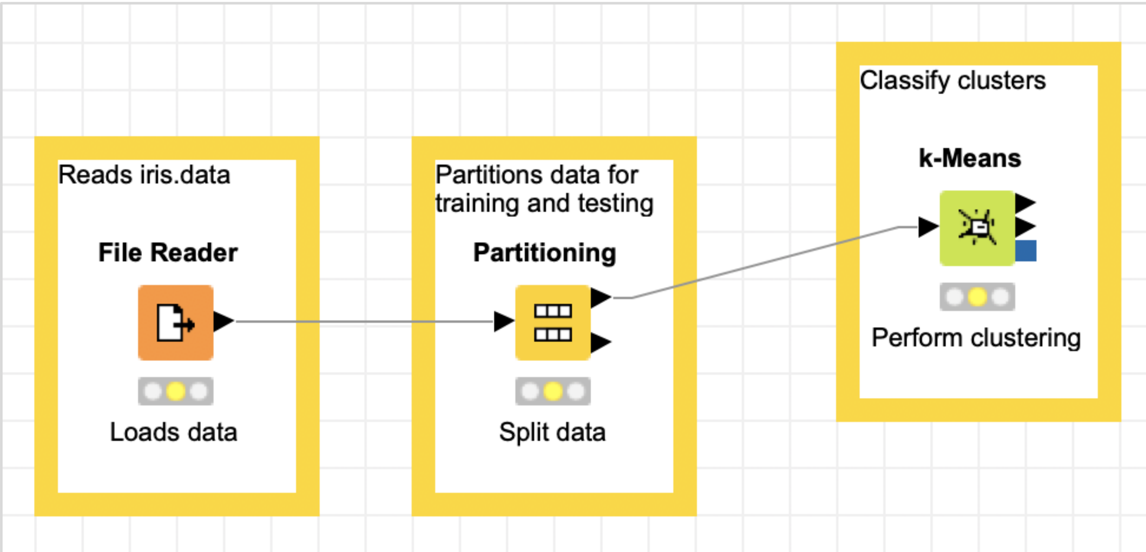


Click **OK** to accept the defaults and to close the dialog.

Set the annotation and description to the following:

- Annotation: `Classify clusters`
- Description: `Perform clustering`

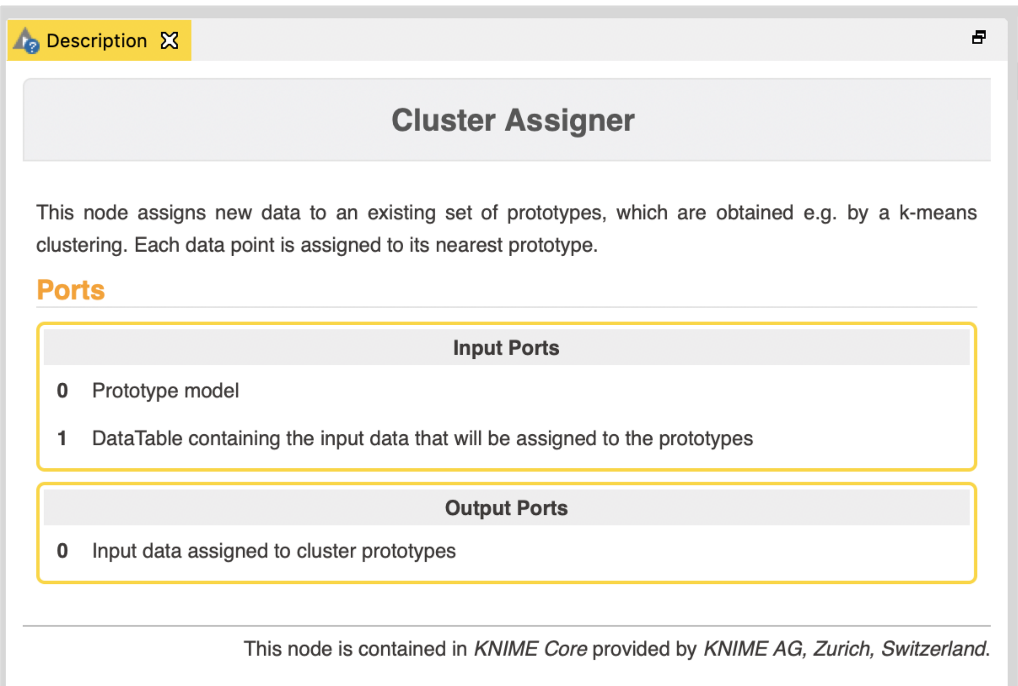
Connect the top output of the **Partitioning** node to the input of **k-Means** node. Reposition your items and your screen should look like the following:



Next, we will add a **Cluster Assigner** node.

Adding Cluster Assigner

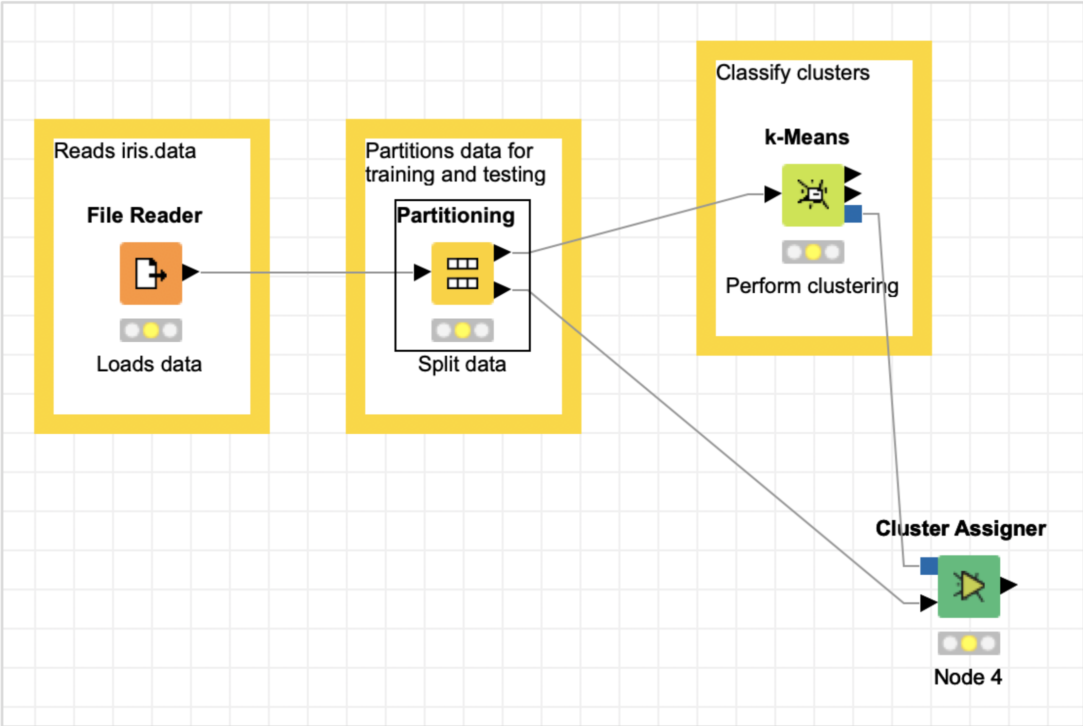
The **Cluster Assigner** assigns new data to an existing set of prototypes. It takes two inputs - the prototype model and the datatable containing the input data. Look up the node's description in the description window which is depicted in the screenshot below:



Thus, for this node you have to make two connections:

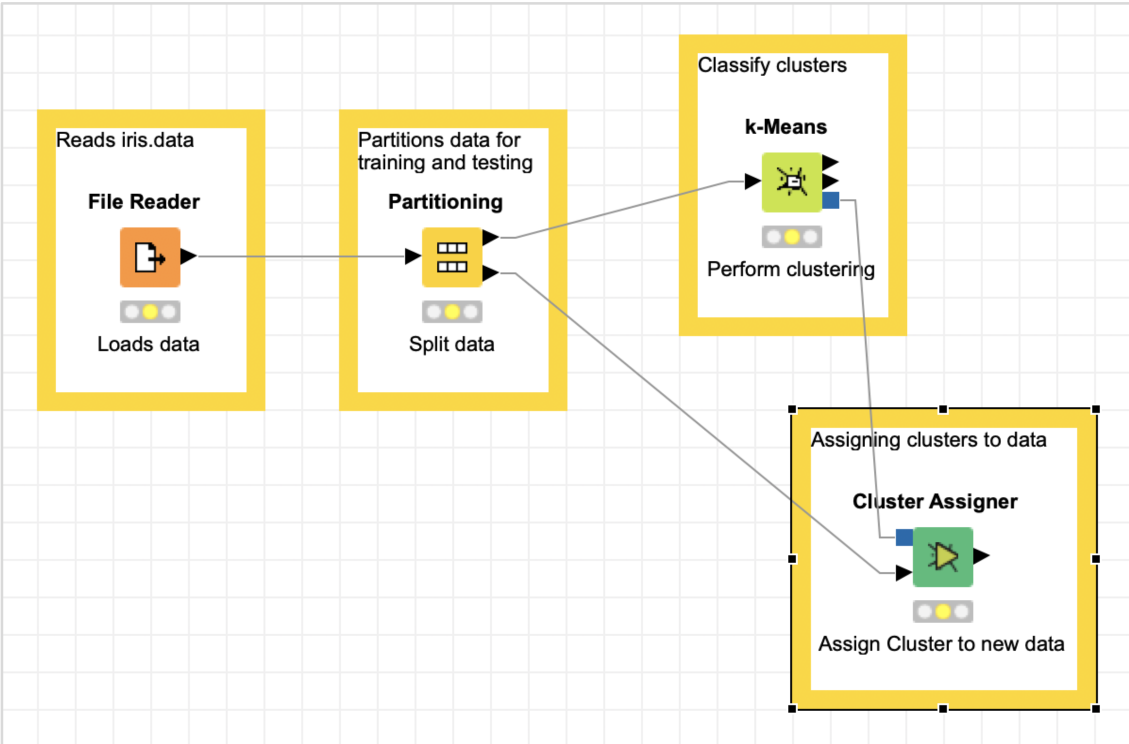
- The PMML Cluster Model output of **Partitioning** node → Prototypes Input of **Cluster Assigner**
- Second partition output of **Partitioning** node → Input data of **Cluster Assigner**

These two connections are shown in the screenshot below:



The **Cluster Assigner** does not need any special configuration. Just accept the defaults.

Now, add some annotation and description to this node. Rearrange your nodes. Your screen should look like the following:

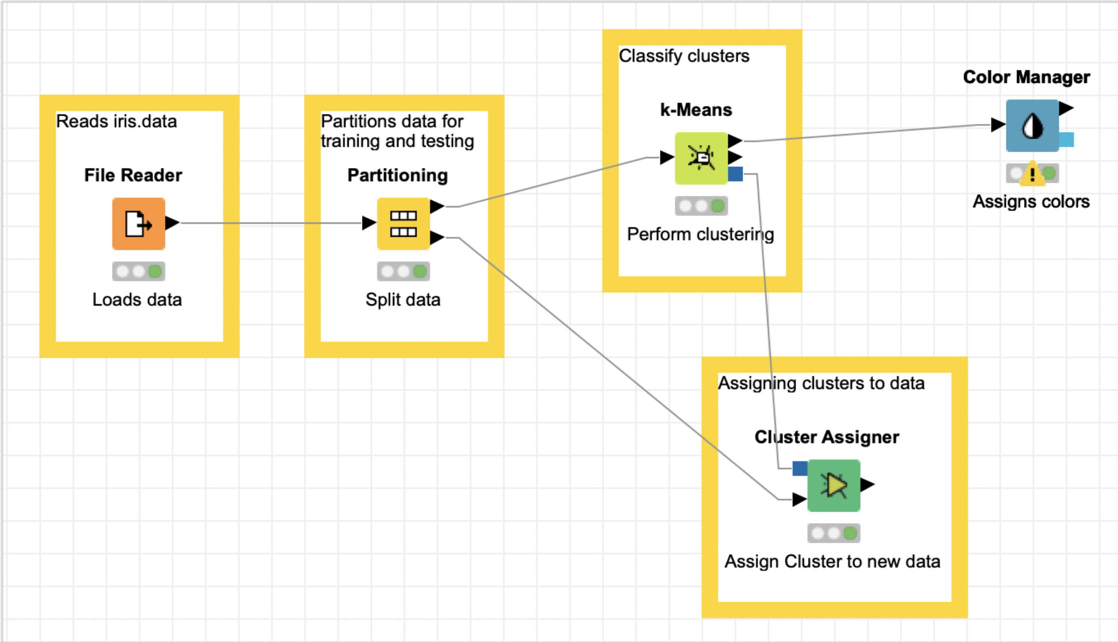


At this point, our clustering is completed. We need to visualize the output graphically. For this, we will add a scatter plot. We will set the colors and shapes for three classes differently in the scatter plot. Thus, we will filter the output of the **k-Means** node first through the **Color Manager** node and then through **Shape Manager** node.

Adding Color Manager

Locate the **Color Manager** node in the repository. Add it to the workspace. Leave the configuration to its defaults. Note that you must open the configuration dialog and hit **OK** to accept the defaults. Set the description text for the node.

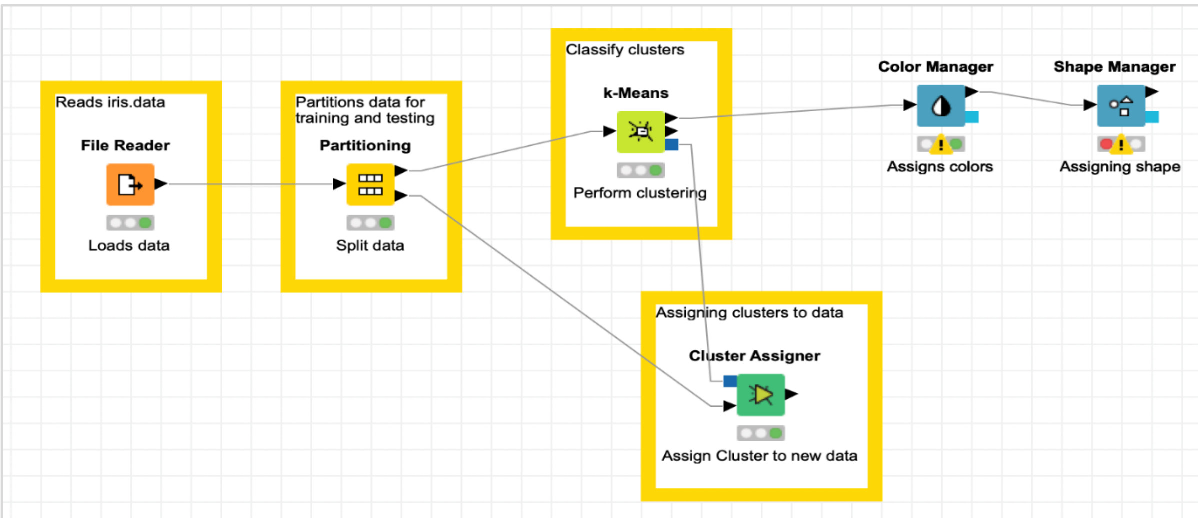
Make a connection from the output of **k-Means** to the input of **Color Manager**. Your screen would look like the following at this stage:



Adding Shape Manager

Locate the **Shape Manager** in the repository and add it to the workspace. Leave its configuration to the defaults. Like the previous one, you must open the configuration dialog and hit **OK** to set defaults. Establish the connection from the output of **Color Manager** to the input of **Shape Manager**. Set the description for the node.

Your screen should look like the following:



Now, you will be adding the last node in our model and that is the scatter plot.

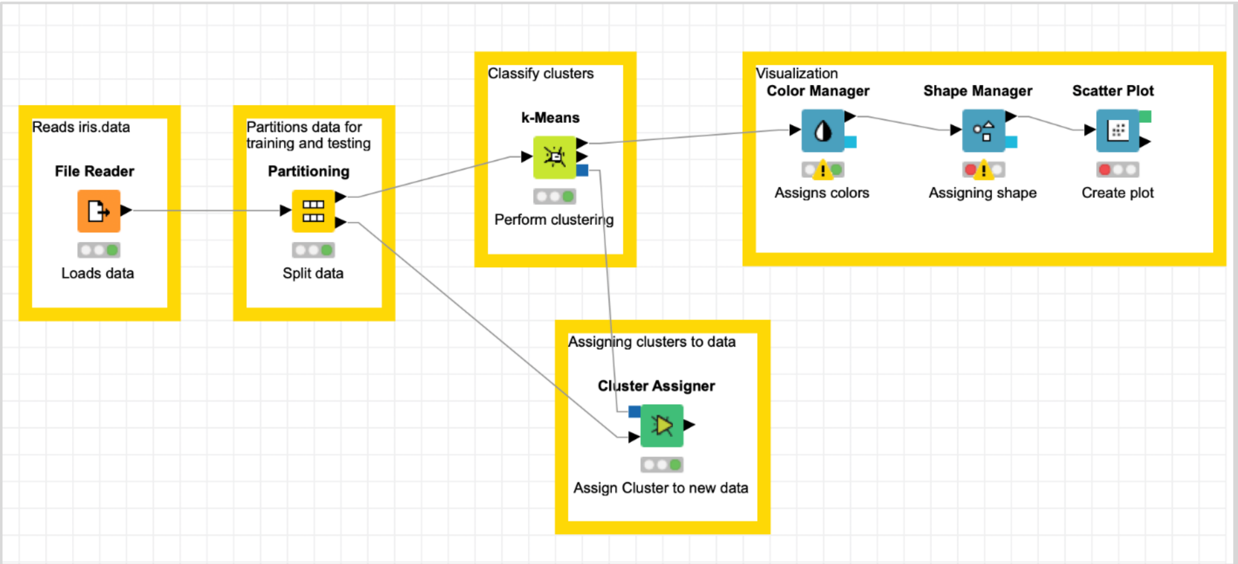
Adding Scatter Plot

Locate **Scatter Plot** node in the repository and add it to the workspace. Connect the output of **Shape Manager** to the input of **Scatter Plot**. Leave the configuration to defaults. Set the description.

Finally, add a group annotation to the recently added three nodes

Annotation: `Visualization`

Reposition the nodes as desired. Your screen should look like the following at this stage.



This completes the task of model building.

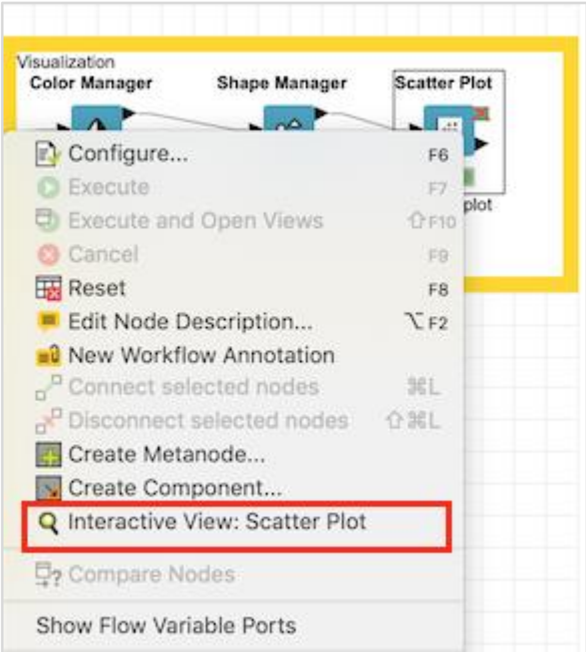
8. KNIME –Testing the Model

To test the model, execute the following menu options: **Node → Execute All**

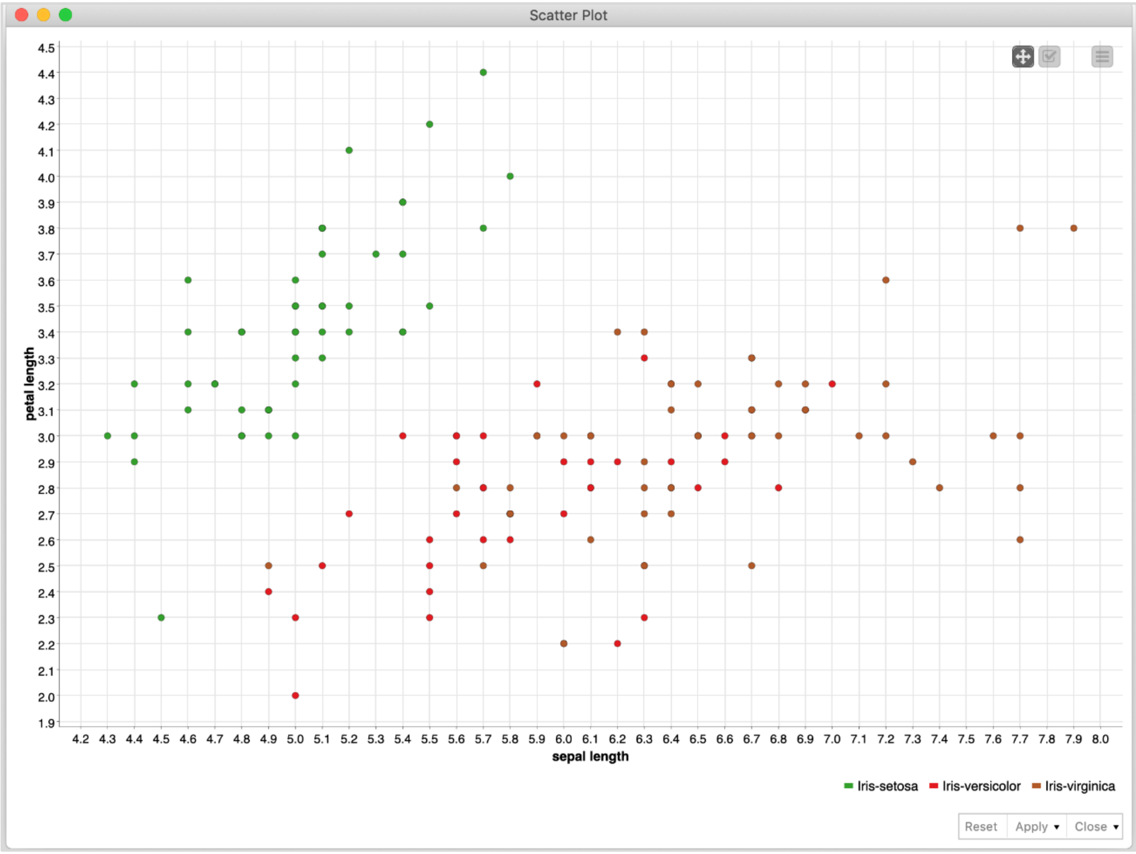
If everything goes correct, the status signal at the bottom of each node would turn green. If not, you will need to look up the **Console** view for the errors, fix them up and re-run the workflow.

Now, you are ready to visualize the predicted output of the model. For this, right click the **Scatter Plot** node and select the following menu options: **Interactive View: Scatter Plot**

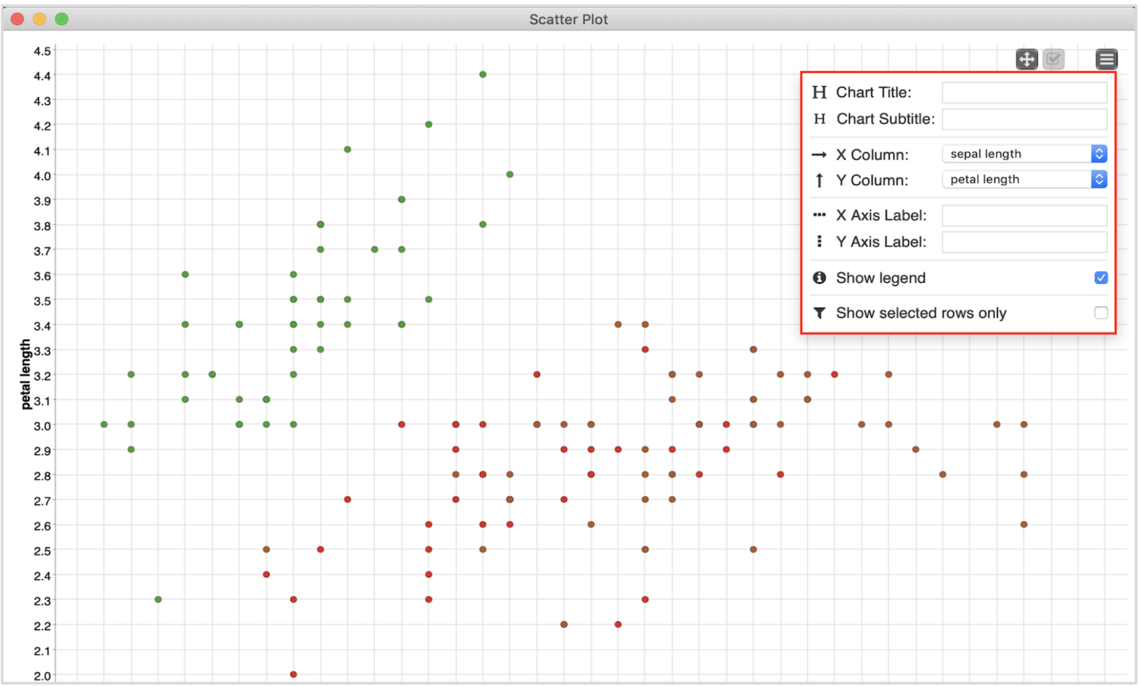
This is shown in the screenshot below:



You would see the scatter plot on the screen as shown here:



You can run through different visualizations by changing x- and y- axes. To do so, click on the settings menu at the top right corner of the scatter plot. A popup menu would appear as shown in the screenshot below:



You can set the various parameters for the plot on this screen to visualize the data from several aspects.

This completes our task of model building.

9. KNIME – Summary and Future Work

KNIME provides a graphical tool for building Machine Learning models. In this tutorial, you learned how to download and install KNIME on your machine.

Summary

You learned the various views provided in the KNIME workbench. KNIME provides several predefined workflows for your learning. We used one such workflow to learn the capabilities of KNIME. KNIME provides several pre-programmed nodes for reading data in various formats, analyzing data using several ML algorithms, and finally visualizing data in many different ways. Towards the end of the tutorial, you created your own model starting from scratch. We used the well-known iris dataset to classify the plants using k-Means algorithm.

You are now ready to use these techniques for your own analytics.

Future Work

If you are a developer and would like to use the KNIME components in your programming applications, you will be glad to know that KNIME natively integrates with a wide range of programming languages such as Java, R, Python and many more.