Azure Machine Learning Studio

Tutorial 01

Chun-Kit Yeung

Hong Kong University of Science and Technology

COMP4211 (Spring 2018)

Table of Contents

Who am I?

- Your TA for this course :)
- Graduated from HKUST and now a 2-nd year MPhil student.
- Interested in machine learning in real world application. Specifically, machine learning in education.
- Speak English, Mandarin, and native in Cantonese. Ask me any question in whatever language you like.

Tell me about who you are?

In order to give a right materials in this tutorial, I would like to know:

- Which major background are you from?
- Why are you taking this course?
- What are you expected to learn from this course?
- What are you expected to learn from the tutorial session?
- Do you want to know more about the theoretical stuffs, or something practical?

What is your technical background?

Also, to give a right paced in this tutorial, I would like to know:

- What is your proficiency level in Python?
- Have you heard of Numpy, Pandas?
- What about Scikit-learn?
- Tensorflow, MXNet, PyTorch, CNTK?

What are the goals of tutorial in this course?

Throughout this semester, we will mainly use Azure to manage our machine learning project in the tutorials. It provides the working environment on both cloud and desktop for you to manage and run your machine learning project.

My personal goal, on behalf of a TA, is that you will attain the both the theoretical and practical knowledge of machine learning. More importantly, thinking of being in your shoes, I hope that you can confidently write what you learn in tutorials in your CV.

What are we going to do in this tutorial?

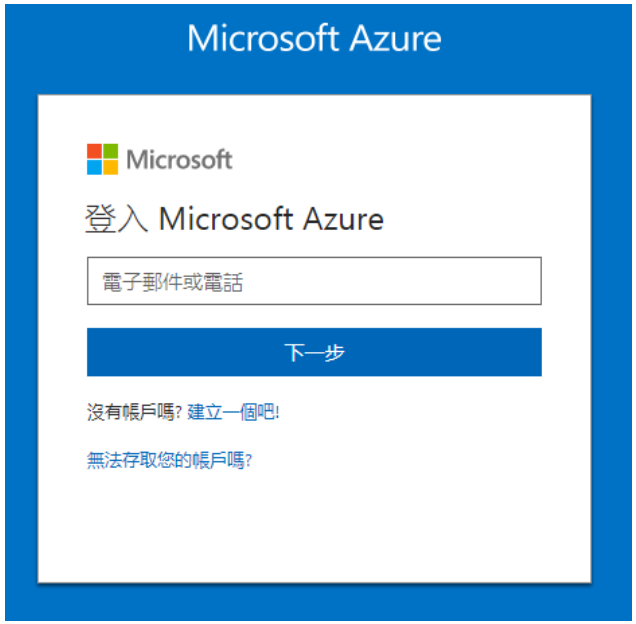
In this tutorial, you will

- register an account on Azure,
- have a first touch on Azure Machine Learning (ML) Studio, and
- build an iris classification project using naive Bayes classifier (if time is available.)

Table of Contents

Register Account in Azure

1. Open a browser and enter `https://azure.microsoft.com/en-us/`
2. Press “Start Free” until the login page



3. Login Microsoft Azure with your email (preferably xxx@connect.ust.hk)

Azure Machine Learning Studio

After created your account,

1. enter `https://studio.azureml.net/`.
2. press “Sign In” and login with your registered account.
3. After login, you will see something like the following, except the projects which I have created earlier.

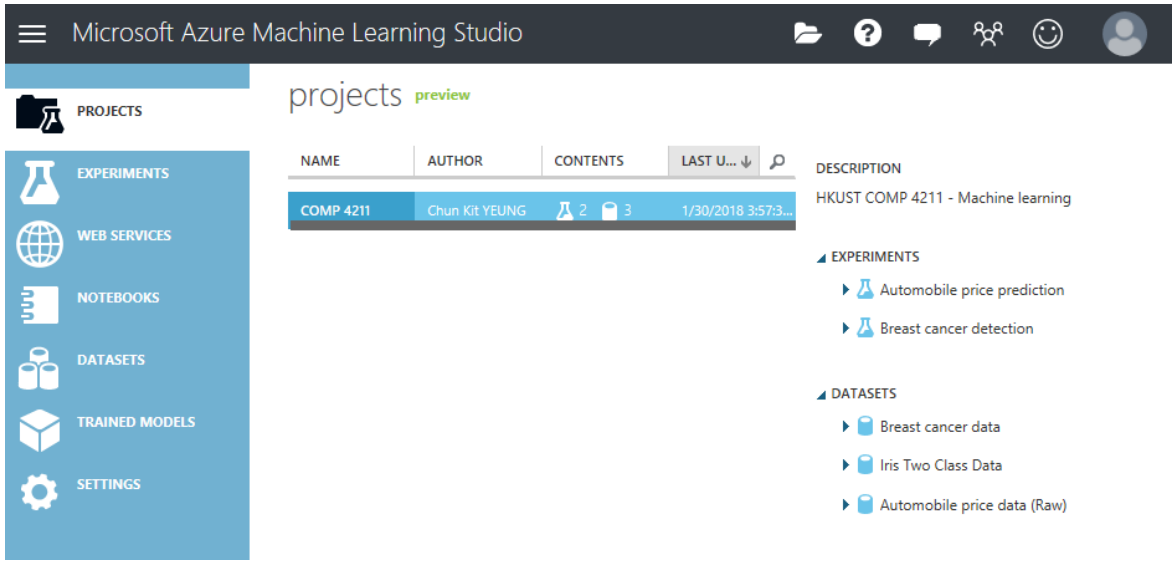


Table of Contents

Create an experiment

Create a model

1. Get data
2. Prepare the data (Not required this time.)
3. Define the columns used

Train the model

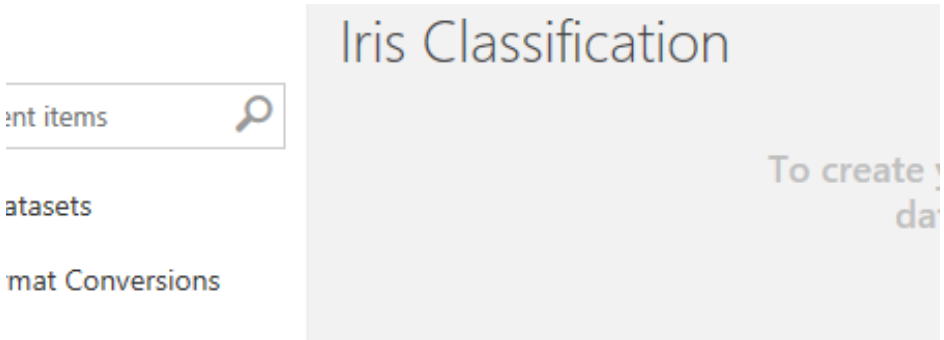
4. Choose and apply a learning algorithm

Score and test the model

5. Predict new iris labels

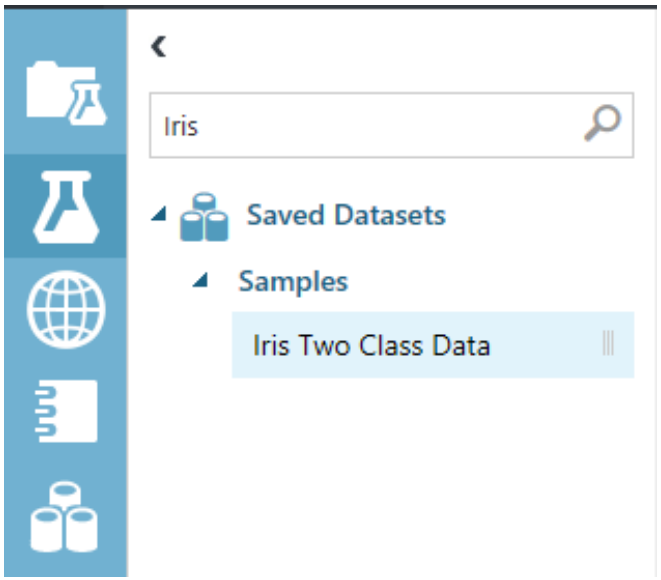
Step 1: Get Data

1. Create a new experiment by clicking **+NEW** at the bottom of the Machine Learning Studio window, select **EXPERIMENT**, and then select **Blank Experiment**.
2. The experiment is given a default name that you can see at the top of the canvas. Select this text and rename it to something meaningful, for example, **Iris Classification**. The name doesn't need to be unique.



Step 1: Get Data

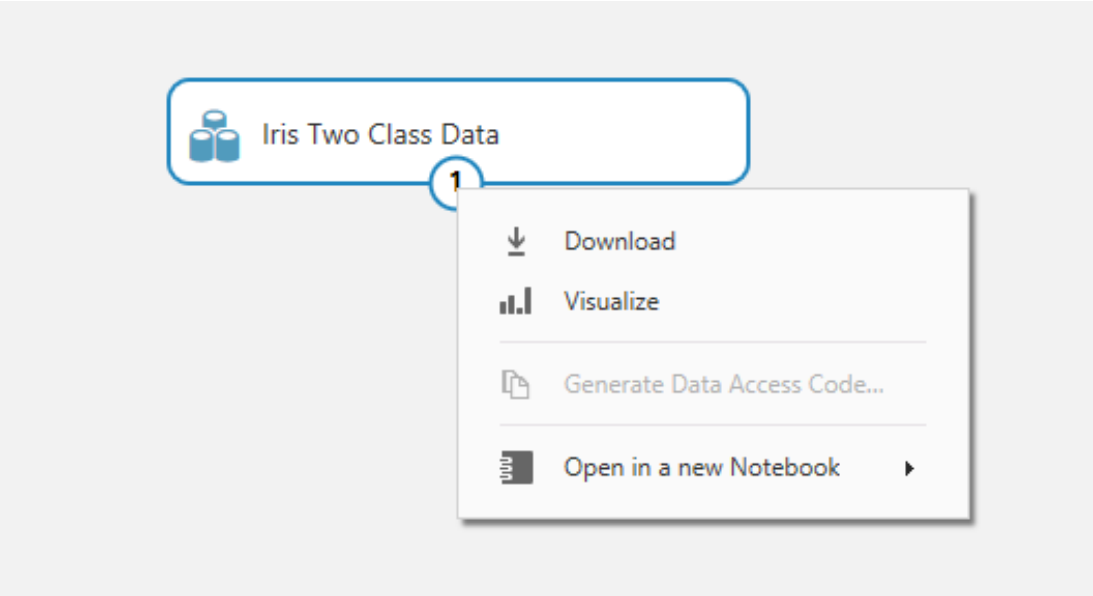
3. To the left of the experiment canvas is a palette of datasets and modules. Type **Iris** in the Search box at the top of this palette to find the dataset labeled **Iris Two Class Data**. Drag this dataset to the experiment canvas.



Step 2: Prepare Data

Dataset usually requires some preprocessing before it can be analyzed, as the data may be corrupted, inaccurate, or even missing in the database. Fortunately, in the iris dataset, the data is clean and do not require preprocessing.

Let's see what the data looks like using Azure. Click the output port at the bottom of the automobile dataset, and then select **Visualize**.



Step 3: Define the columns used

The goal of the iris classification problem is to find a machine learning model $h(\cdot)$ to predict whether the given sample $\mathbf{x}$ is an iris or not, i.e. $y \in \{0, 1\}$, where 1 indicates the sample is an iris.

Specifically, we are going to select a supervised machine learning model $h(\cdot)$ which maps an input sample $\mathbf{x} = (x_1, x_2, \ldots, x_n)$ to an output y. That is $y = h(\mathbf{x})$ (you can view it as a math function.) Different machine learning algorithms have different approaches in finding such the model $h(\cdot)$.

Before to train a model, one thing has to be decided. That is what should the $\mathbf{x}$ be to feed in the algorithm.

Step 3: Define the columns used

In Iris dataset, there are 5 columns: *class, sepal-length, sepal-width, petal-length, and petal-width*.

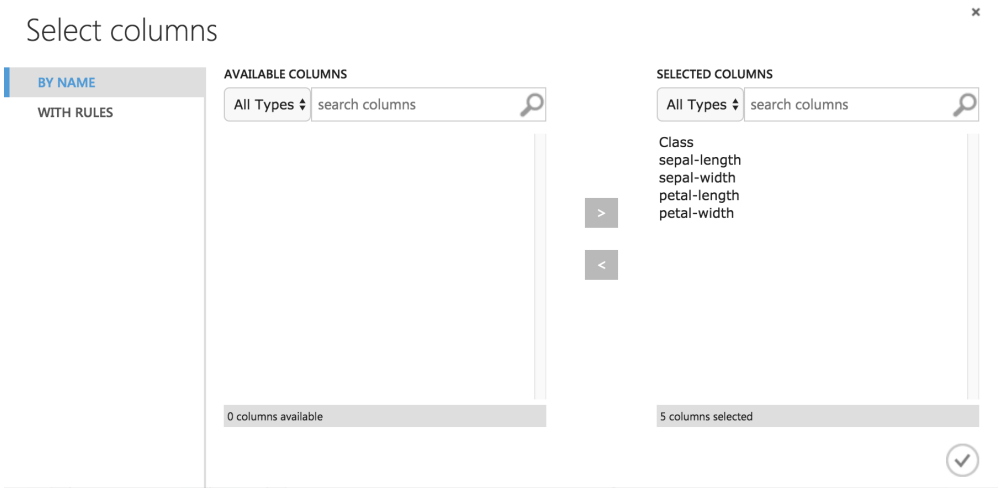
Obviously, the class indicates whether a sample is an iris or not, while the sepal-length, sepal-width, petal-length, and petal-width are the information about the sample.

Since they might all be relevant to classify whether a given sample is an iris, we will use them all to form the input $\mathbf{x}$. We also call $\mathbf{x}$ to be *"features"*, as they are the features characterizing the sample.

Step 3: Define the columns used

Let's do it in Azure.

1. Drag **Select Columns in Dataset** module to the experiment canvas. Connect the left output port of the iris dataset to the input of the "Select Columns in Dataset" module.
2. Click **Launch column selector** in the **Properties** pane.
3. Select the columns used (both the features and label) as follow:



4. Click the check mark (OK) button.

Step 4: Choose and apply a learning algorithm

Now that the data is ready, constructing a predictive model consists of training and testing. We'll use our data to train the model, and then we'll test the model to see how closely it is able to predict the label.

1. Select and drag the "Split Data" module to the experiment canvas and connect it to the last "Select Columns in Dataset" module.
2. Click the "Split Data" module to select it. Find the **Fraction of rows in the first output dataset** (in the **Properties** pane to the right of the canvas) and set it to 0.75. This way, we'll use 75 percent of the data to train the model, and hold back 25 percent for testing (later, you can experiment with using different percentages).
3. Visualize the two output ports to see the split result.

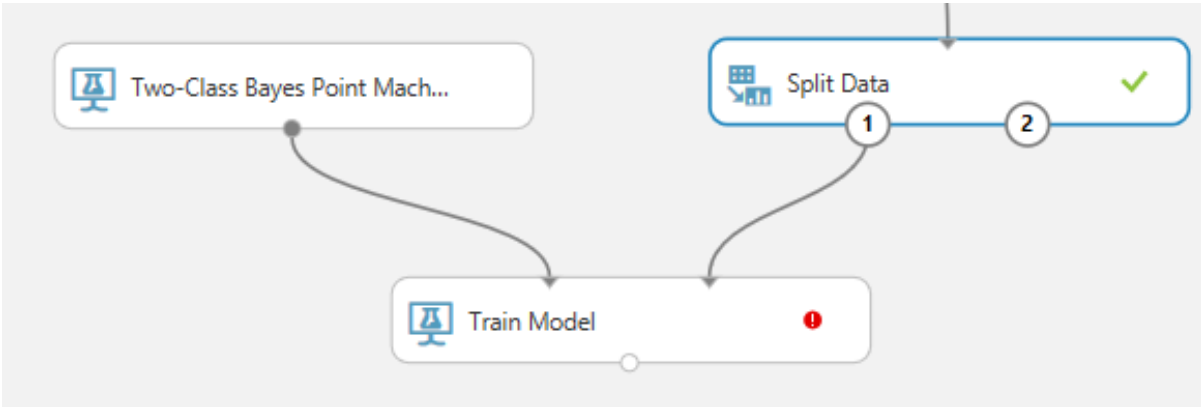
Step 4: Choose and apply a learning algorithm

4. To select the learning algorithm, expand the Machine Learning category in the module palette to the left of the canvas, and then expand Initialize Model. This displays several categories of modules that can be used to initialize machine learning algorithms.

   For this experiment, select the “Two-Class Bayes Point Machine” which is the naive Bayes classifier, and drag it to the experiment canvas.

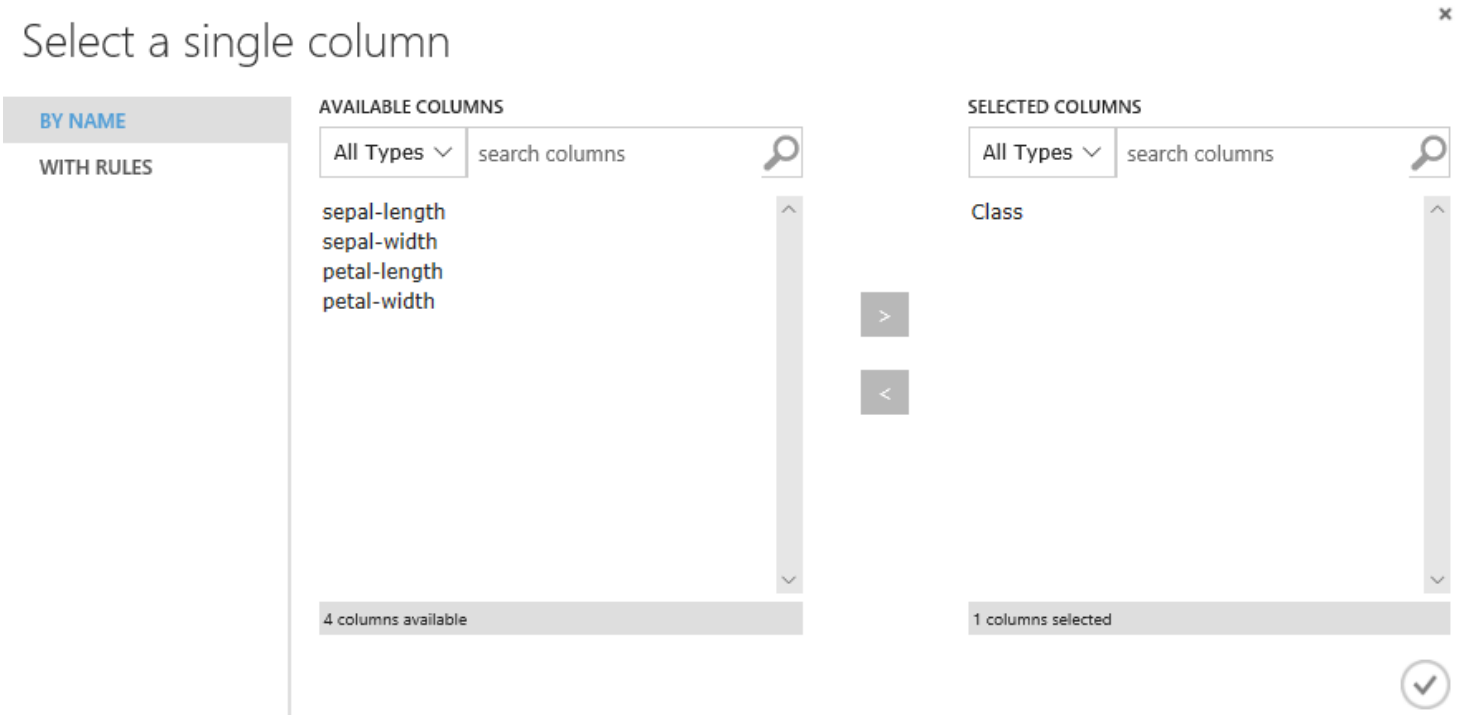
Step 4: Choose and apply a learning algorithm

5. Find and drag the “Train Model” module to the experiment canvas. Connect the output of the “Linear Regression” module to the left input of the “Train Model” module, and connect the training data output (left port) of the “Split Data” module to the right input of the “Train Model” module.



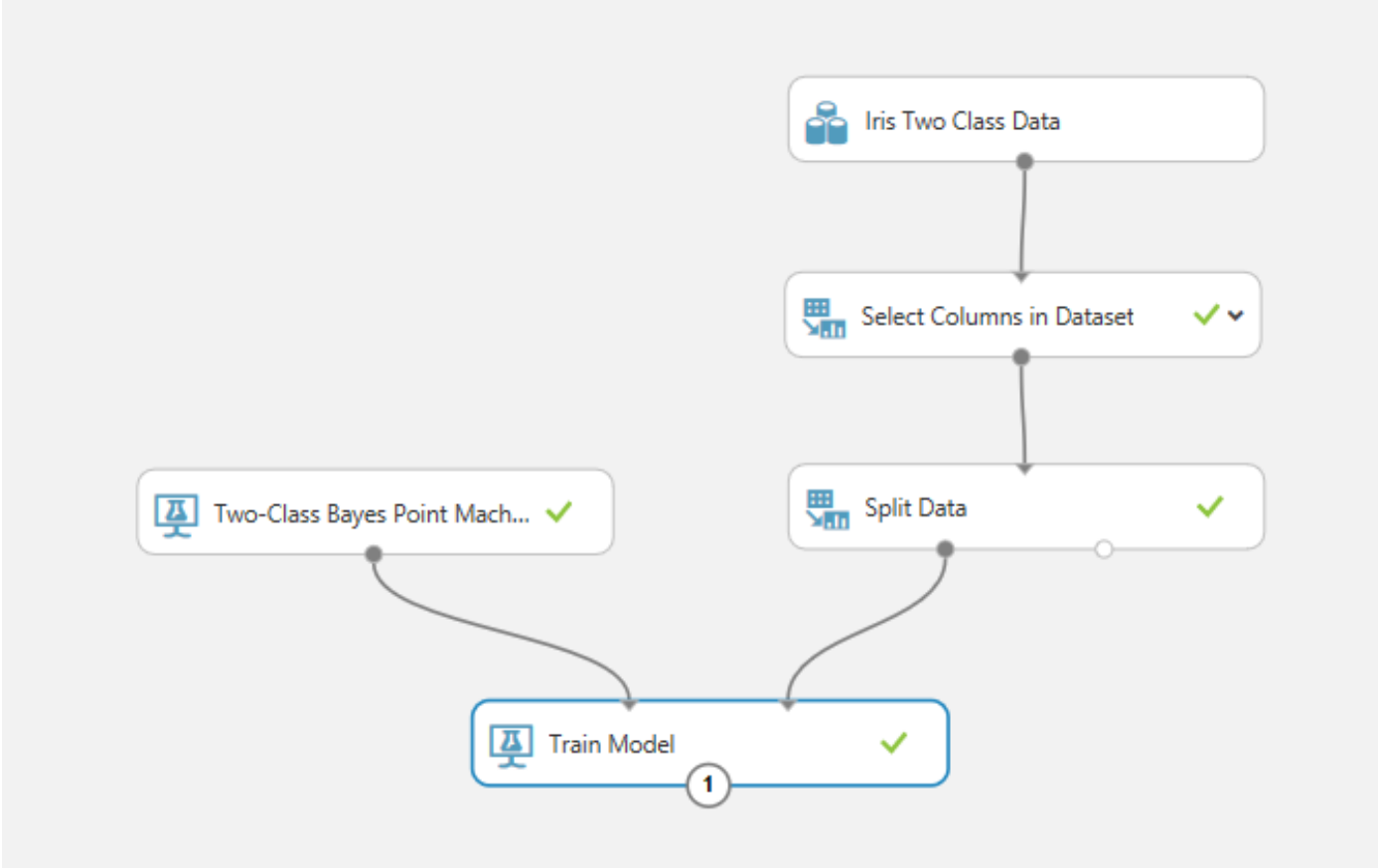
Step 4: Choose and apply a learning algorithm

6. Click the "Train Model" module, click **Launch column selector** in the **Properties** pane, and then select the **class** column. This is the value that our model is going to predict.



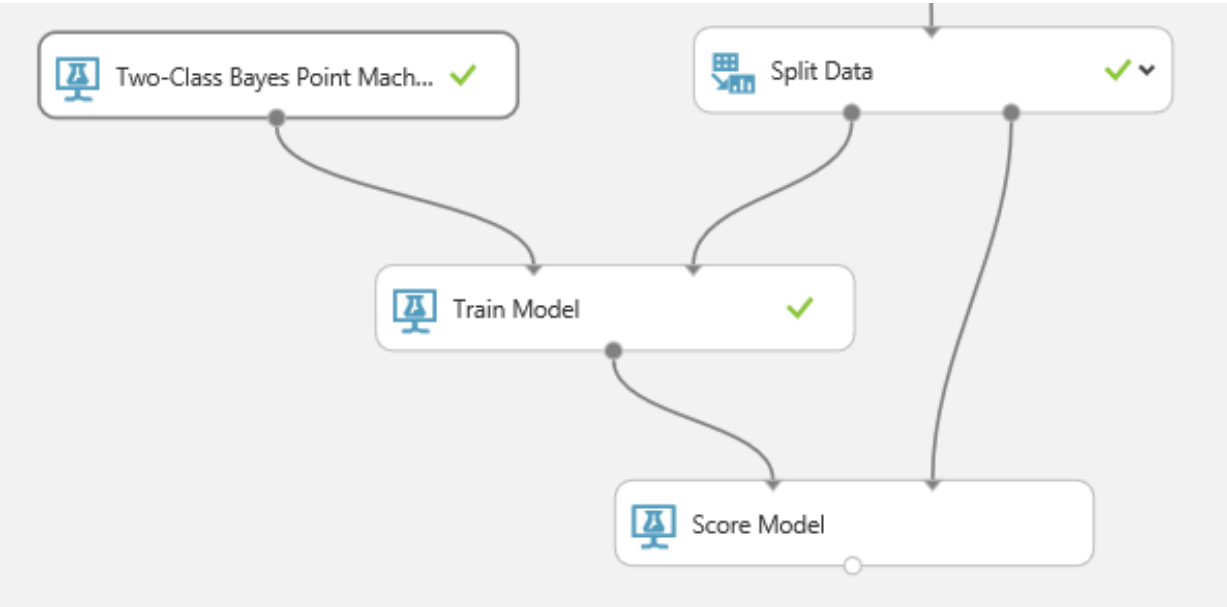
7. Run the experiment.

The computation graph up to this moment:



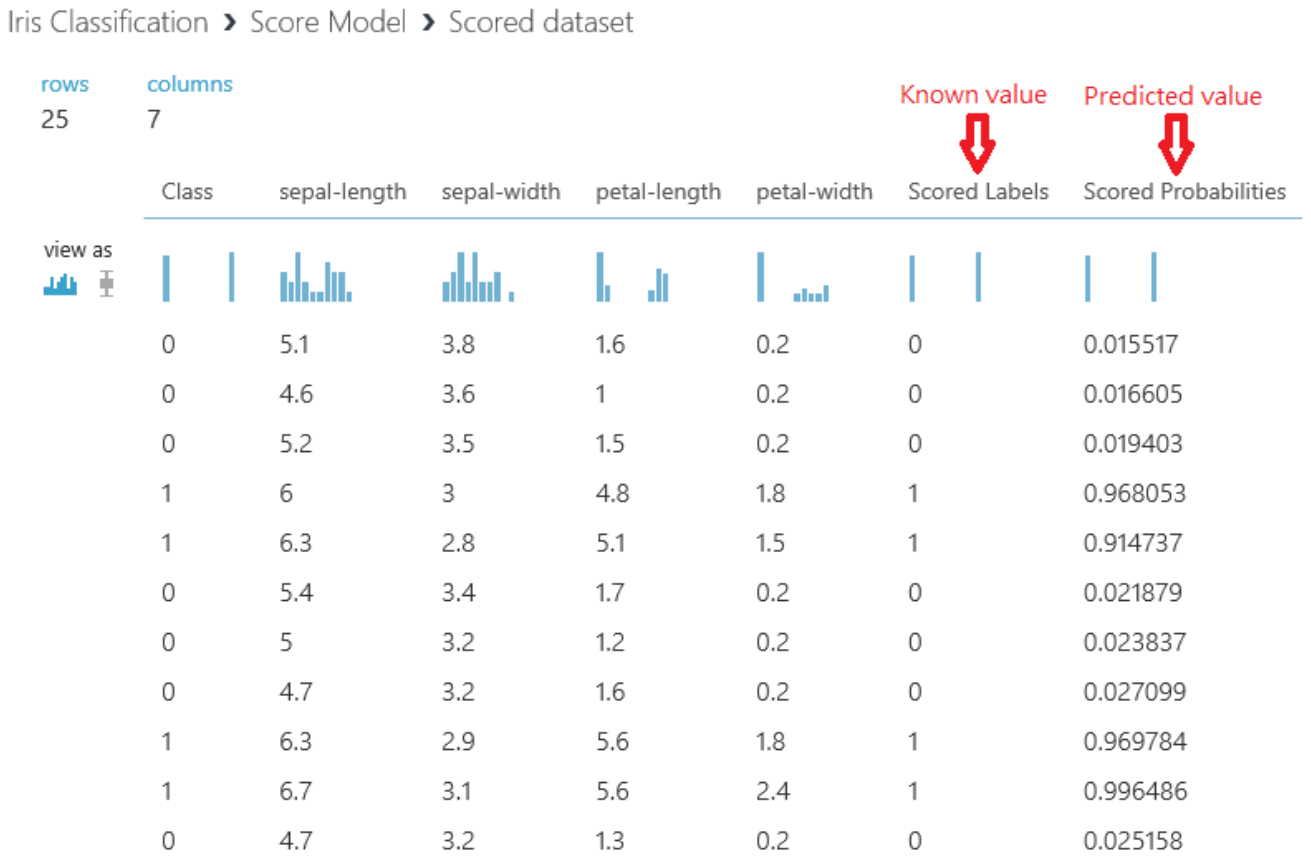
Step 5: Predict new iris label

1. Find and drag the Score Model module to the experiment canvas. Connect the output of the “Train Model” module to the left input port of “Score Model”. Connect the test data output (right port) of the Split Data module to the right input port of “Score Model”.



Step 5: Predict new iris label

2. Run the experiment and view the output from the “Score Model” module (click the output port of Score Model and select Visualize). The output shows the predicted values and the known values from the test data.

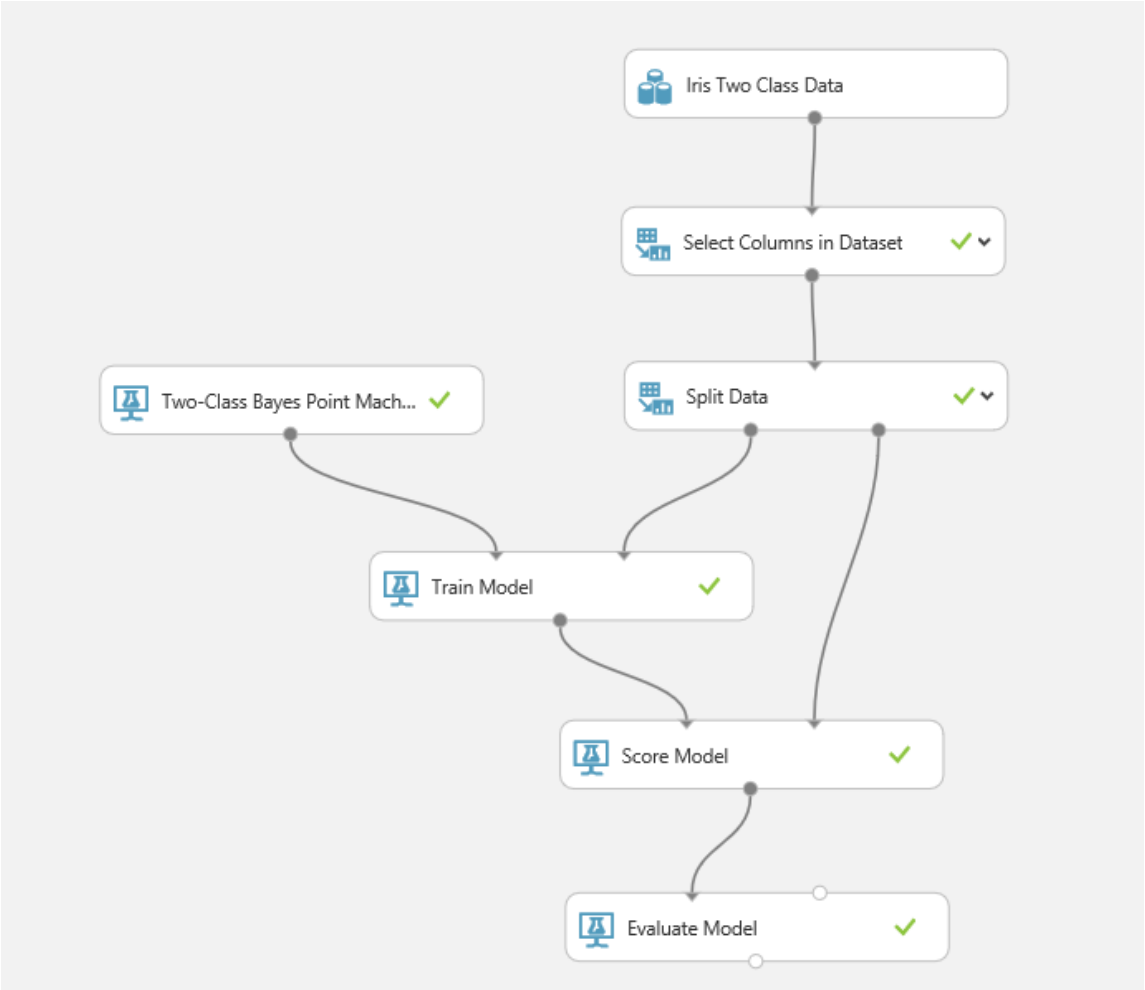


Class	sepal-length	sepal-width	petal-length	petal-width	Scored Labels	Scored Probabilities
0	5.1	3.8	1.6	0.2	0	0.015517
0	4.6	3.6	1	0.2	0	0.016605
0	5.2	3.5	1.5	0.2	0	0.019403
1	6	3	4.8	1.8	1	0.968053
1	6.3	2.8	5.1	1.5	1	0.914737
0	5.4	3.4	1.7	0.2	0	0.021879
0	5	3.2	1.2	0.2	0	0.023837
0	4.7	3.2	1.6	0.2	0	0.027099
1	6.3	2.9	5.6	1.8	1	0.969784
1	6.7	3.1	5.6	2.4	1	0.996486
0	4.7	3.2	1.3	0.2	0	0.025158

Step 5: Predict new iris label

3. Finally, we test the quality of the results. Select and drag the "Evaluate Model" module to the experiment canvas, and connect the output of the "Score Model" module to the left input of "Evaluate Model".
4. Run the experiment.
5. Visualize the "Evaluate Model"

The final computation graph



Optional Exercises

- What is the “Random seed” in “Split data”? Why is it useful?
- What would be the potential implications if we increase or decrease the fraction of rows split in “Split Data”.
- Try out other classification algorithms. (Further question: How can you compare the performances of two different models? (Refer to the demo of breast cancer detection in “reference and further reading”))
- Try out the Machine learning tutorial (in “reference and further reading”). See what regression problem is and how the data preprocessing is done.

Reference and Further Reading

- Machine learning tutorial: Create your first data science experiment in Azure Machine Learning Studio: available in `https://docs.microsoft.com/en-us/azure/machine-learning/studio/create-experiment`
- Demo of breast cancer detection using two-class naive Bayes classifier in Azure ML Studio: available in `https://gallery.cortanaintelligence.com/Experiment/Breast-cancer-detection`