

IBM Cloud

Predicting Customer Churn

Watson Data Platform



Lab Guide





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Document Revision History

Rev #	File Name	Date
1.0	DSX Hands-on Workshop.docx	11/1/2017
1.1	Predicting Customer Churn with Watson Data Platform Lab.docx	1/21/2018

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Lab Environment Overview

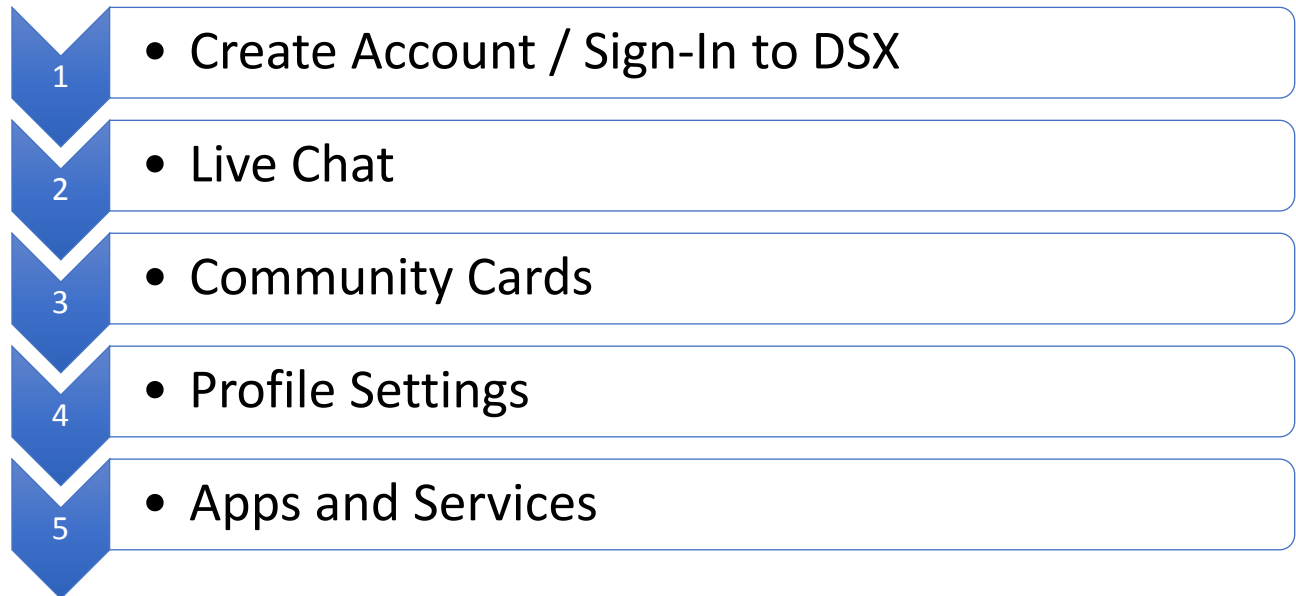
Software and Tools

Software	Link
IBM Data Science Experience (DSX)	https://datascience.ibm.com/
GitHub	https://github.com/team-wolfpack

Lesson 1: DSX Signup & Home Page

Purpose:	This lab introduces DSX, its sign up and walk-through of the features and functions starting at the Home Page.
Tasks:	<p>Tasks you will complete in this lab exercise include:</p> <ul style="list-style-type: none">• Create/Sign-In to DSX Account• Engage Live Chat• Differentiate Four Types of Community Cards• Explore Personal Profile, Apps/Services, and Integrations

Lesson 1: Workflow Overview

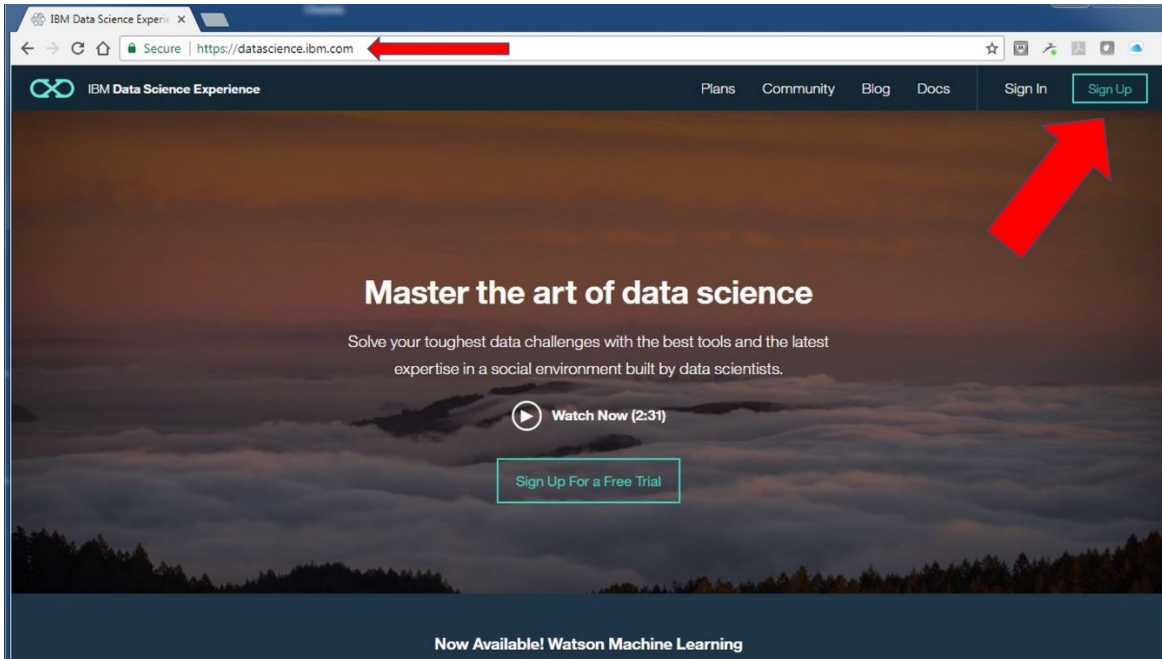


Lesson 1: Instructions

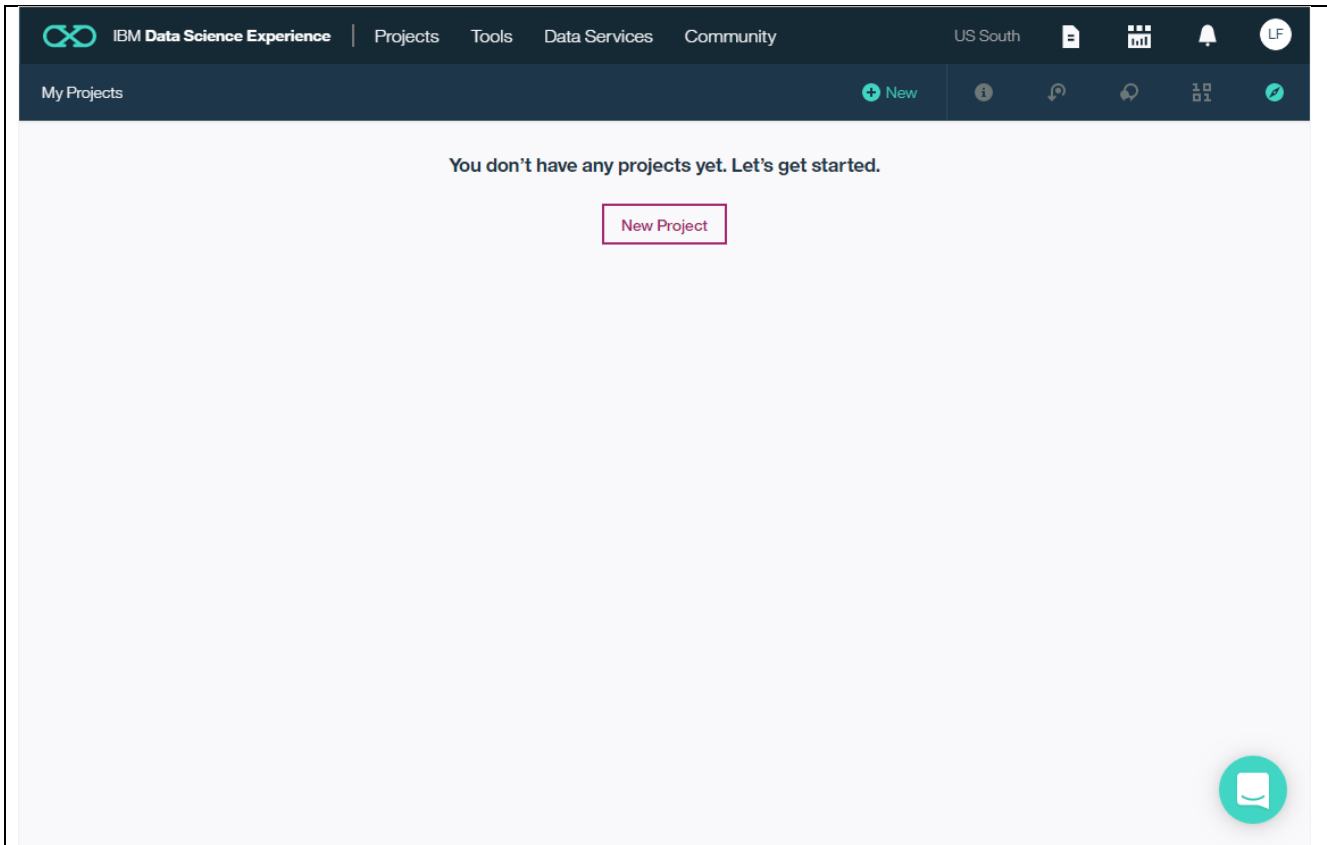
Action

1. Create Account/Sign In to DSX

- Open web browser and navigate to: <https://datascience.ibm.com>



- Click on “Sign Up” and you will be prompted for several items of information. After a few moments of self-configuration, you will be brought to your new Home Page:

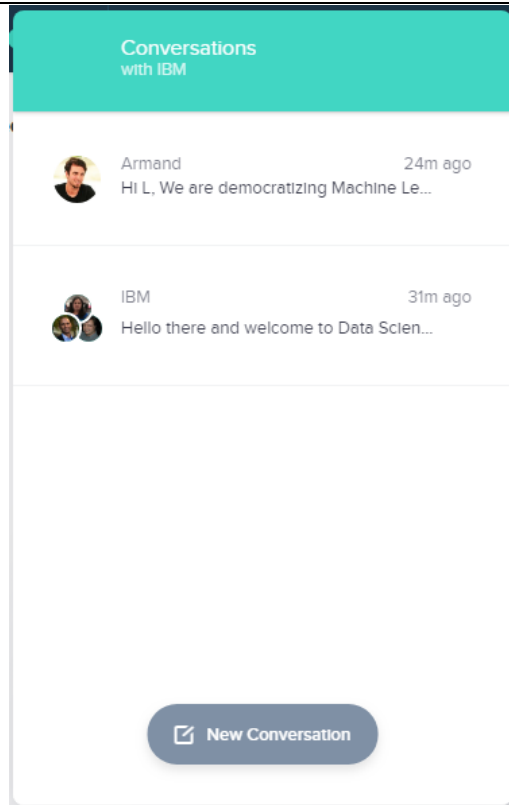


2. Live Chat

This is the home page of IBM Data Science Experience(DSX). Here you have all the tools that you need in a single place to **Learn, Create, and Collaborate**.

- On the bottom right-hand corner, you will see a **Live Chat** feature. Click on the **Chat** icon to launch Live Chat:





If you need assistance, you need only click on [New Conversation](#) to connect with a live person. Through this Live Chat feature, you can also continue conversations the next time you log into DSX.

We use feedback captured through [Live Chat](#) and the offerings instrumentation to guide our decisions in designing and developing [Data Science Experience](#). We perform this analysis using DSX.

3. Community Cards

At the top of the Home Page click on [Community Cards](#):

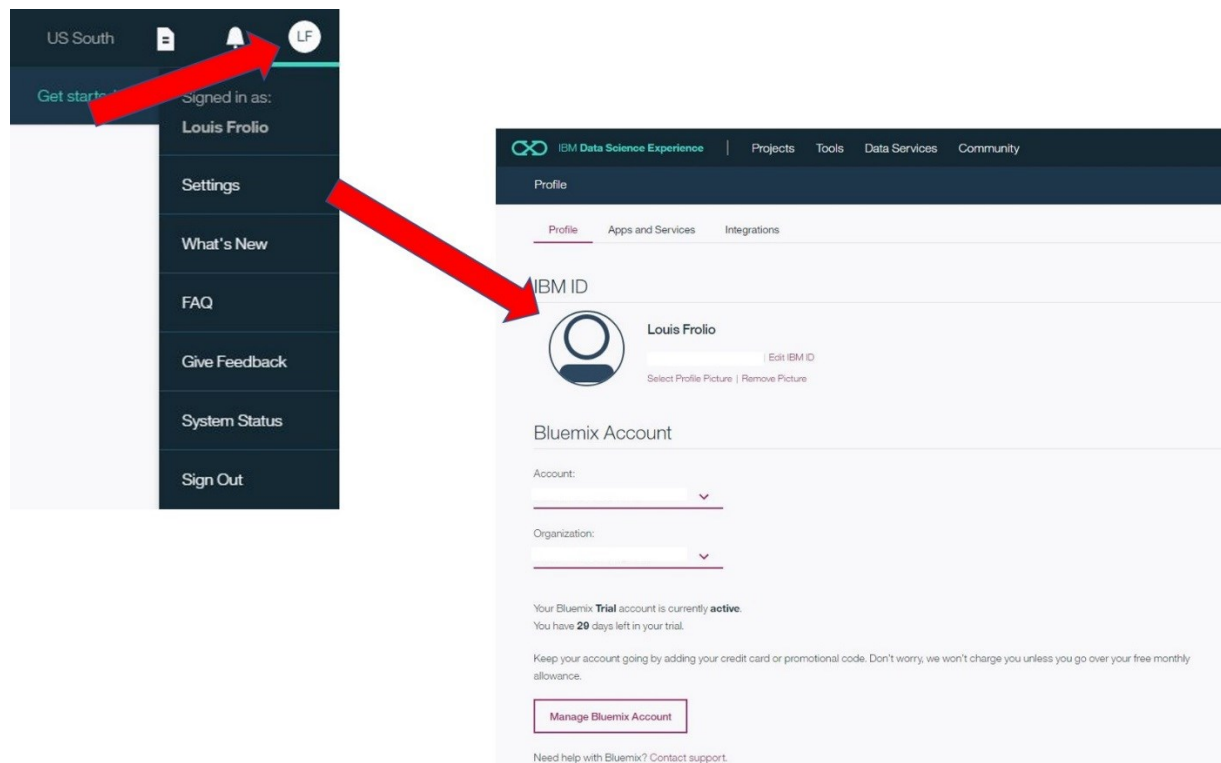
New in the community



There are four types of cards – [Articles](#), [Data Sets](#), [Notebooks](#), and [Tutorials](#). These are designed to make it easier for you to learn about data science and experiment with its various tools and techniques.

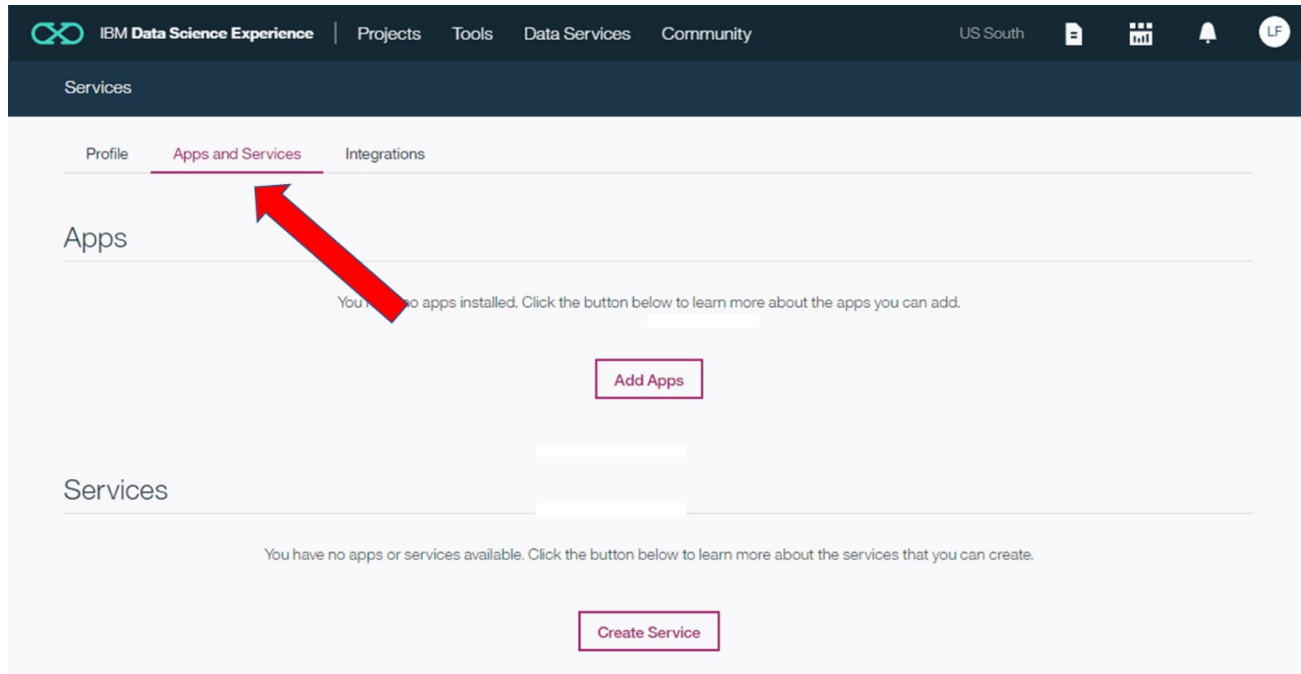
4. Profile Settings

- Click on [Settings](#) to look at your [Profile](#), [Apps and Services](#), and [Integrations](#). This is where you see the details of your Bluemix Account:



5. Apps and Services

- Click on [Apps and Services](#) to view all your current IBM Cloud Apps and Services:



Above is the default for the brand-new account, there are no services or apps deployed.

[Integrations](#) is where you configure DSX for GitHub integration.

End of Lesson 1

Lesson 2: Jupyter Notebook

Purpose:	This lesson introduces projects within DSX, their purpose, value, and how they are used to support collaboration. Also, Jupyter notebooks are introduced and used as part of a customer churn analysis using Spark.
Tasks:	<p>Tasks you will complete in this lab exercise include:</p> <ul style="list-style-type: none">• Create and Configure DSX Project• Add Notebook Asset• Retrieve Data from External Repository• Predict Customer Churn using Machine Learning Techniques• Evaluate Model Performance

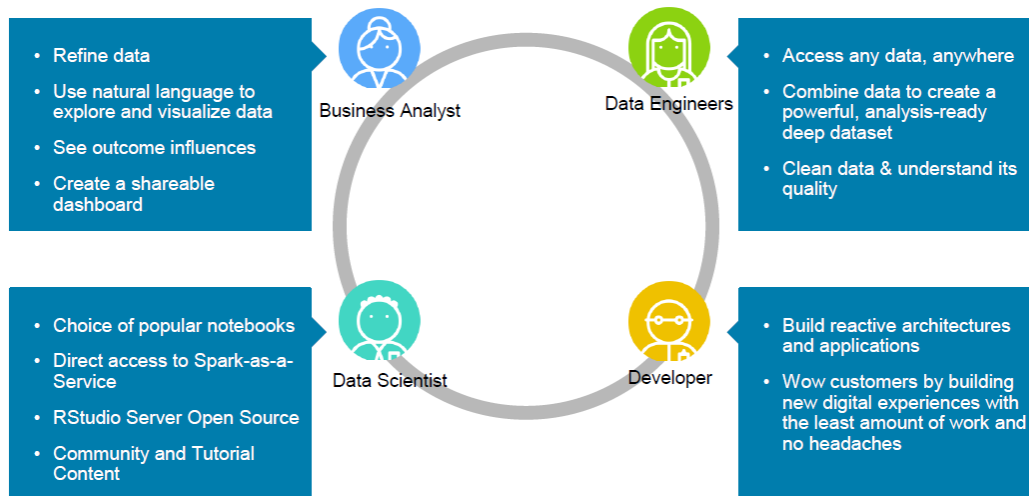
Lesson 2: Workflow Overview

- 1 • Project Overview
- 2 • Create New Project
- 3 • Create Notebook
- 4 • Load Data from Github Repo
- 5 • Create Spark DataFrames
- 6 • Rename Columns
- 7 • Explore Data
- 8 • Create Spark ML pipeline
- 9 • Create Random Forests & Decision Tree Models
- 10 • Evaluate & Invoke Models

Lesson 2: Instructions

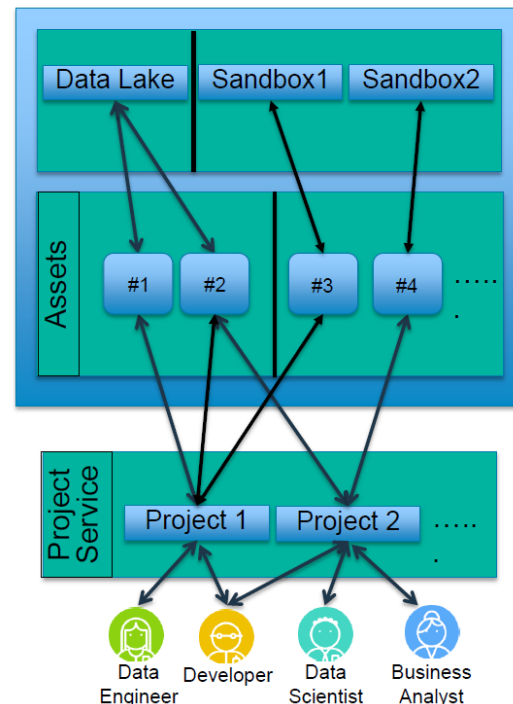
1. Project Overview

Data professionals need purpose-built, self-service communities that enable them to seamlessly collaborate across personas.



Projects make collaboration easier by:

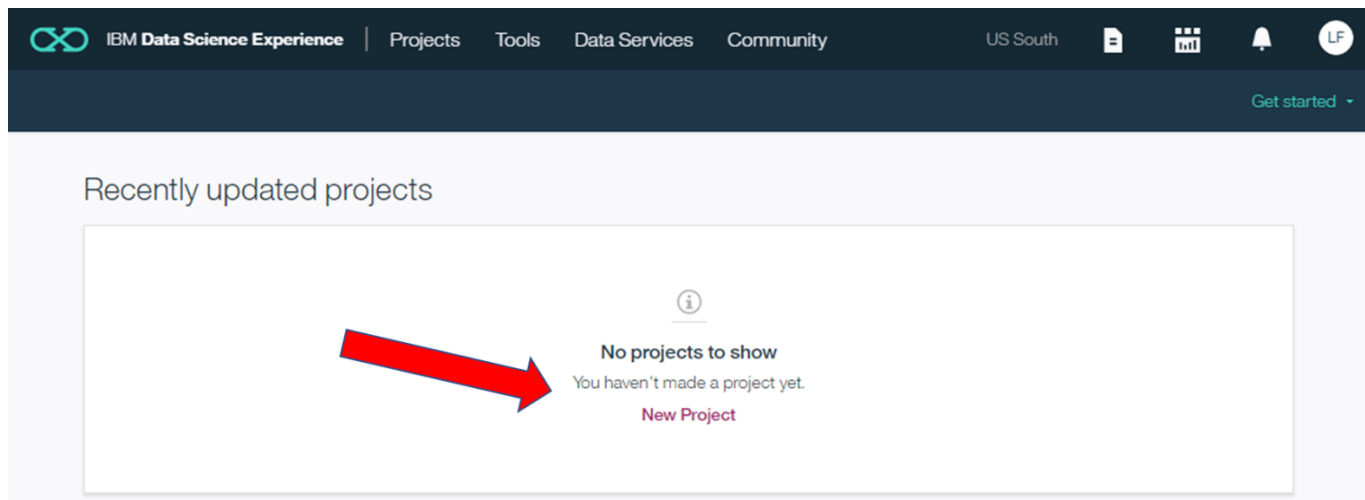
- Allowing different users and personas to share a set of assets
- Enabling users to collaborate and manage their notebooks, artifacts, plus more
- Providing three levels of rights: Viewers, Editors, and Admins



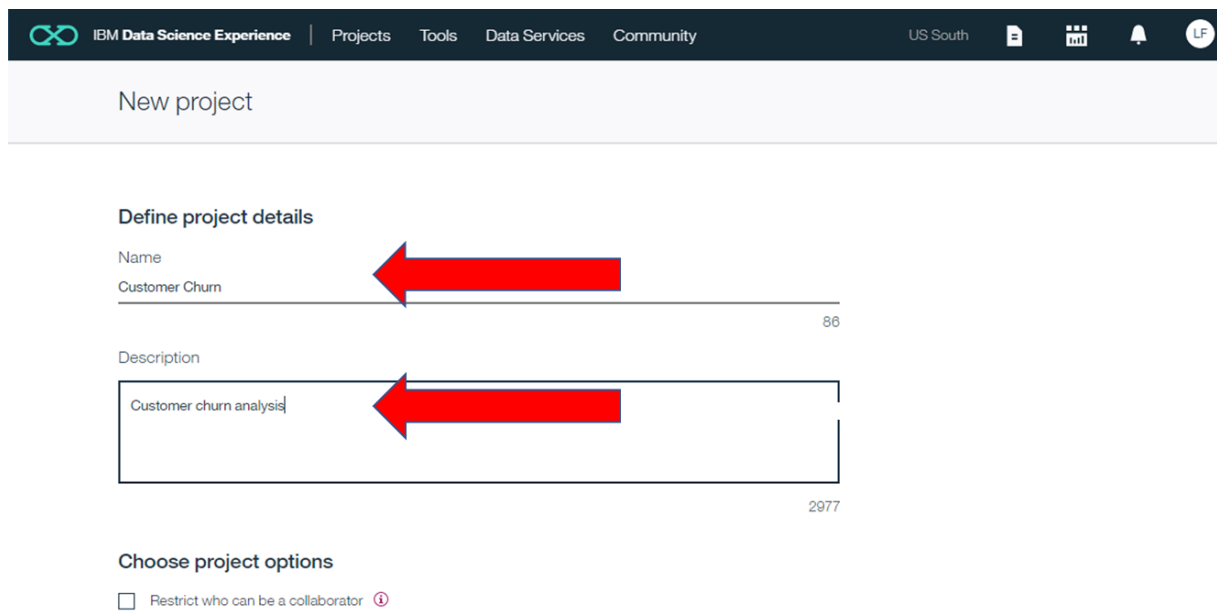
Action

2. Create New Project

- Navigate to <https://datascience.ibm.com>
- Login to DSX
- On the top right side, click **Create New and select project**



- Type the Project Name **Customer Churn**, add a meaningful description:



Action

Define Storage:

- Select **Object IBM Cloud Storage**
- Click Add
- Choose “Lite” plan then “Create”
- Verify your options then “Confirm”

Define Compute Engine:

- Under “Select Spark Service” click on “Add”
- Choose “Lite” plan then “Create”
- Verify your options then “Confirm”

Define storage



Select storage type



Object Storage (Swift API)



IBM Cloud Object Storage

Target Cloud Object Storage Instance

cloud-object-storage-eg



Define compute engine



Select Spark service

Spark service

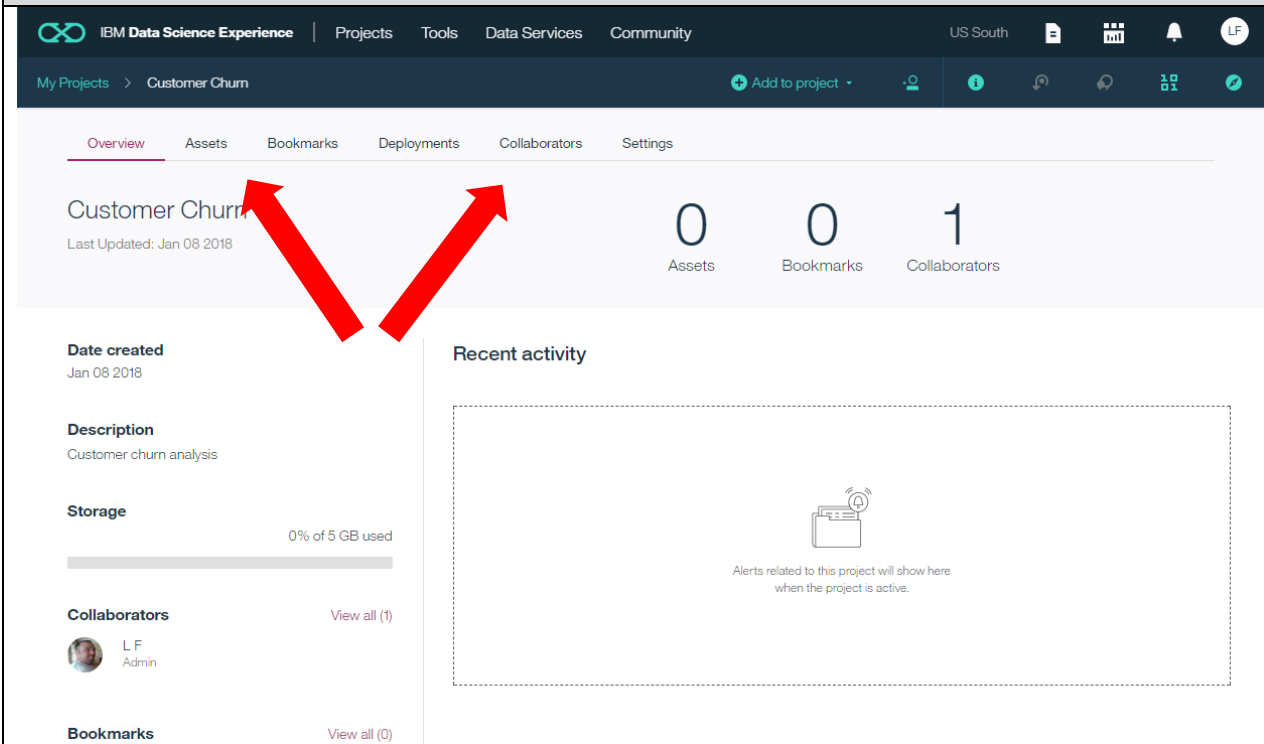
Spark-wn



If you associate the same Spark service with multiple projects, the Spark history server will display job history information for all the projects.

- Click **Create**

Action

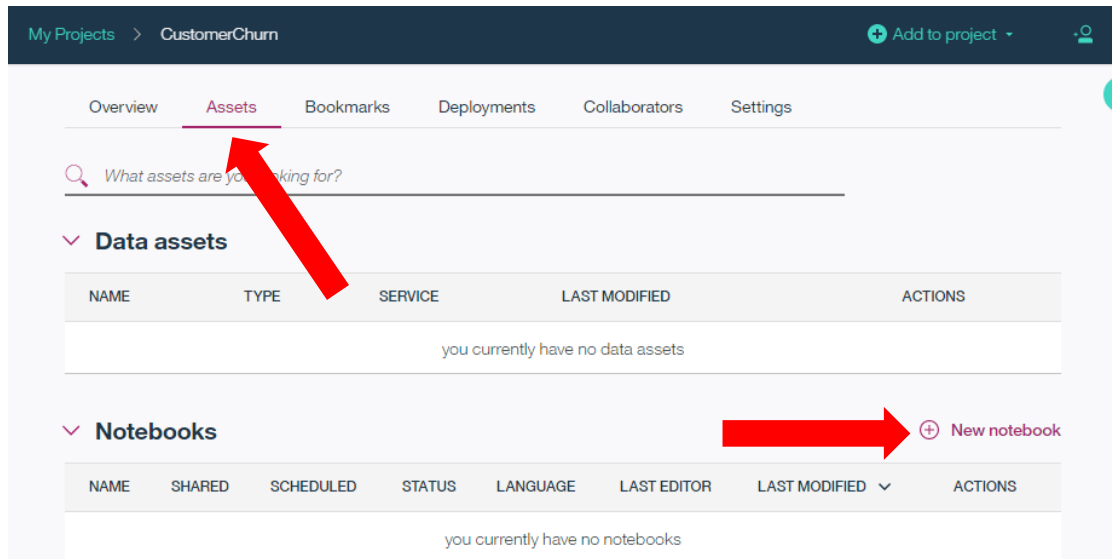


The screenshot displays the IBM Data Science Experience interface. At the top, there's a navigation bar with 'IBM Data Science Experience' and links to 'Projects', 'Tools', 'Data Services', and 'Community'. The user is logged in as 'LF' in the 'US South' region. Below this, a breadcrumb trail shows 'My Projects > Customer Churn'. A secondary navigation bar contains tabs: 'Overview' (selected), 'Assets', 'Bookmarks', 'Deployments', 'Collaborators', and 'Settings'. The main content area for the 'Customer Churn' project shows it was last updated on Jan 08 2018. It features three summary cards: 'Assets' with a count of 0, 'Bookmarks' with a count of 0, and 'Collaborators' with a count of 1. On the left, a sidebar provides details: 'Date created' (Jan 08 2018), 'Description' (Customer churn analysis), 'Storage' (0% of 5 GB used), 'Collaborators' (listing 'L.F. Admin' with a 'View all (1)' link), and 'Bookmarks' (with a 'View all (0)' link). The right side of the main area is titled 'Recent activity' and contains a dashed box with a folder icon and the text: 'Alerts related to this project will show here when the project is active.' Two red arrows point from the 'Assets' and 'Collaborators' summary cards towards the 'Overview' tab.

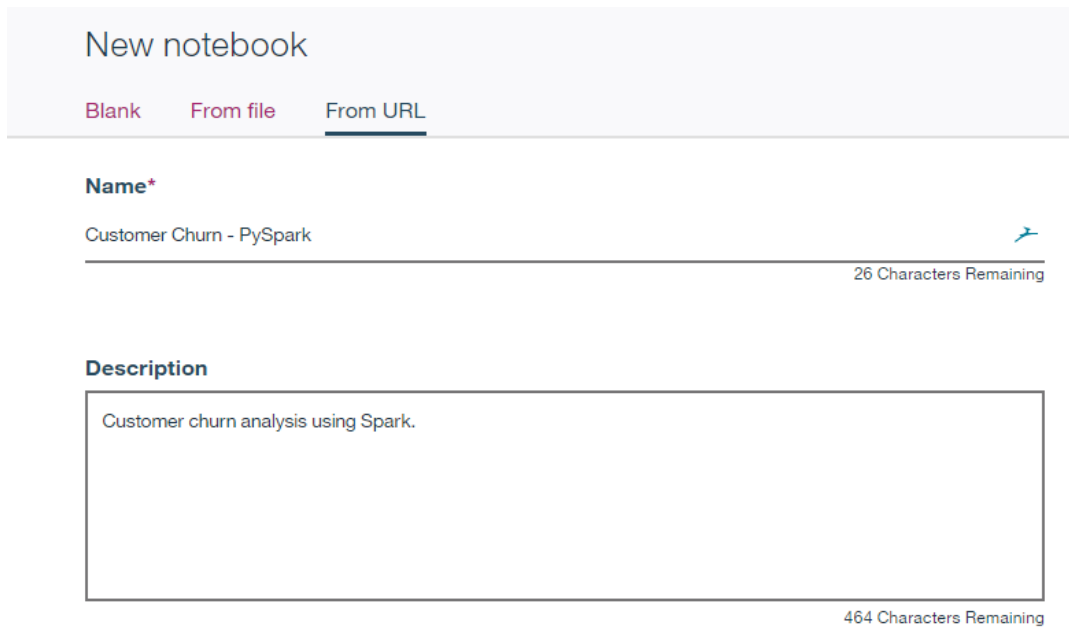
You now have a **Project** that is empty. You can use the tabs along the top to **add assets** to your project such as Connections, Notebooks, Data Assets, etc. You can also **add collaborators** to the Project.

3. Create Notebook

- Click **Assets**, then **Add Notebooks**



- Choose **From URL** from the tab, give the notebook a name and meaningful description:



The 'New notebook' form is shown with the 'From URL' tab selected. The 'Name*' field contains 'Customer Churn - PySpark' and has a character count of '26 Characters Remaining'. The 'Description' field contains 'Customer churn analysis using Spark.' and has a character count of '464 Characters Remaining'.

- In a separate browser window navigate to:
[Predicting Customer Churn with Watson Data Platform](https://github.com/team-wolfpack/Predicting-Customer-Churn-with-Watson-Data-Platform)
 (https://github.com/team-wolfpack/Predicting-Customer-Churn-with-Watson-Data-Platform)

- Click on Notebooks, right click on **CustomerChurn-PySpark.ipynb** then choose **Copy link address**. Go back to the **DSX New Notebook** page.

Paste URL into **Notebook URL** text box then choose **Create Notebook**:

Customer Churn - PySpark 26 Characters Remaining

Description

Customer churn analysis using Spark. 464 Characters Remaining

Notebook URL*

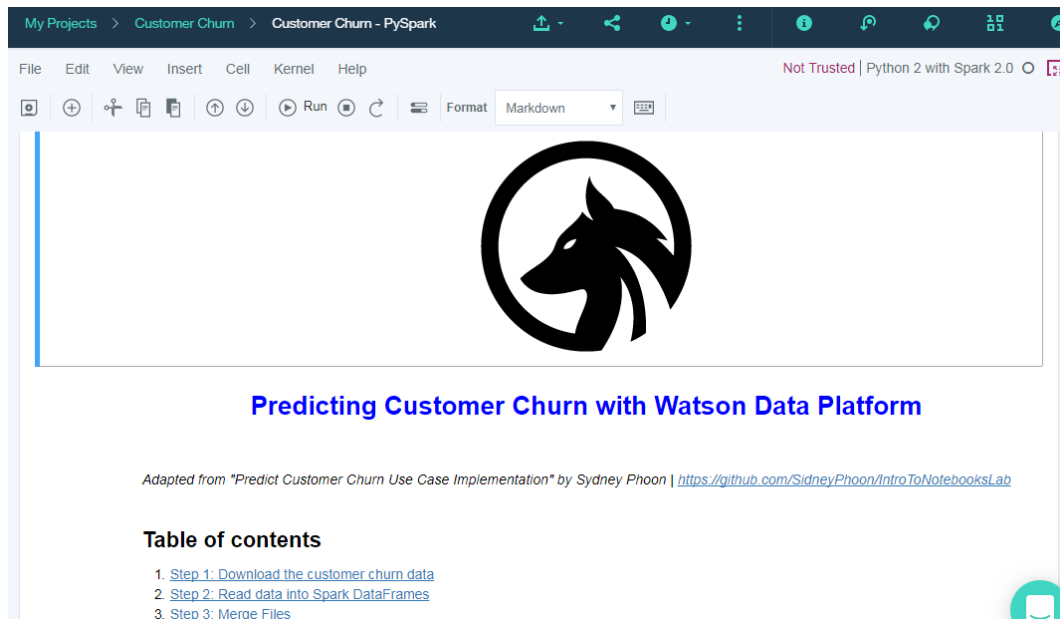
<https://github.com/team-wolfpack/Predicting-Customer-Churn-with-Watson-Data-Platform/blob/master/Notebook/CustomerChurn-PySpark.ipynb>

Spark service*

Spark-of ▼

Cancel Create Notebook

You should now see:



My Projects > Customer Churn > Customer Churn - PySpark

File Edit View Insert Cell Kernel Help Not Trusted | Python 2 with Spark 2.0

Run Format Markdown

Predicting Customer Churn with Watson Data Platform

Adapted from "Predict Customer Churn Use Case Implementation" by Sydney Phoon | <https://github.com/SidneyPhoon/IntroToNotebooksLab>

Table of contents

- [Step 1: Download the customer churn data](#)
- [Step 2: Read data into Spark DataFrames](#)
- [Step 3: Merge Files](#)

Lesson 2 Continued in [Customer Churn – PySpark] Notebook

Lesson 3: Machine Learning Flows

Purpose:	This lesson introduces Machine Learning Flows in DSX. Flows provide a graphical approach to machine learning like that of SPSS Modeler.
Tasks:	<p>Tasks you will complete in this lab exercise include:</p> <ul style="list-style-type: none">• Create Machine Learning Flow• Import Data• Leverage Flows' Palette to Orchestrate Customer Churn Machine Learning Pipeline• Evaluate Customer Churn Model

Lesson 3: Workflow Overview

- 1 • Create Machine Learning Flow
- 2 • Add Data Asset to Project
- 3 • Add & Configure Type Object
- 4 • Add & Configure Model Objects
- 5 • Run Flow to Create Nuggets
- 6 • Add & Configure Analysis Object - Measure Performance
- 7 • Add Second Model Technique to Flow

Lesson 3: Instructions

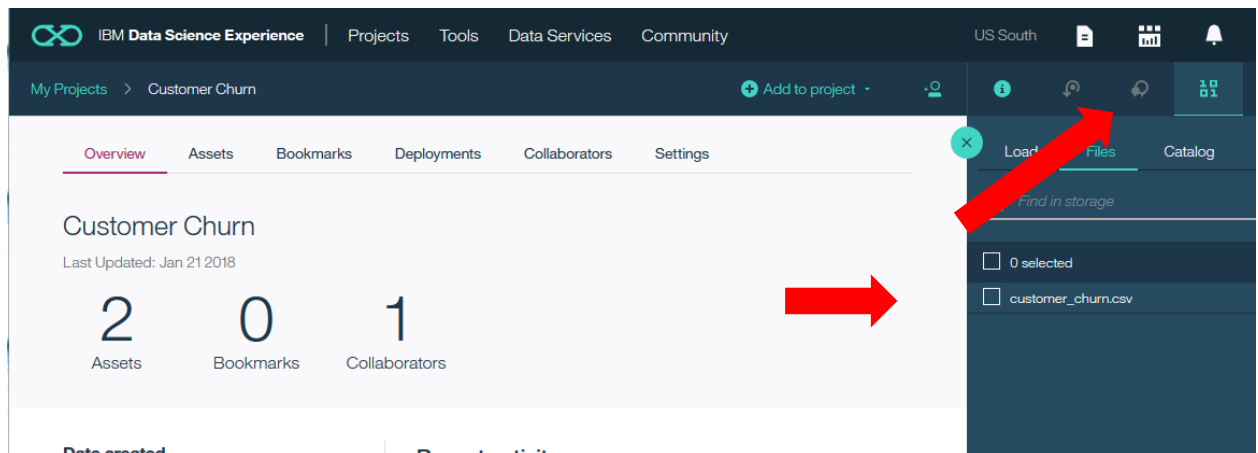
Action

1. Load Data from Local File

- In a separate browser navigate to: [Customer Churn Data](https://github.com/team-wolfpack/Predicting-Customer-Churn-with-Watson-Data-Platform/tree/master/Data):

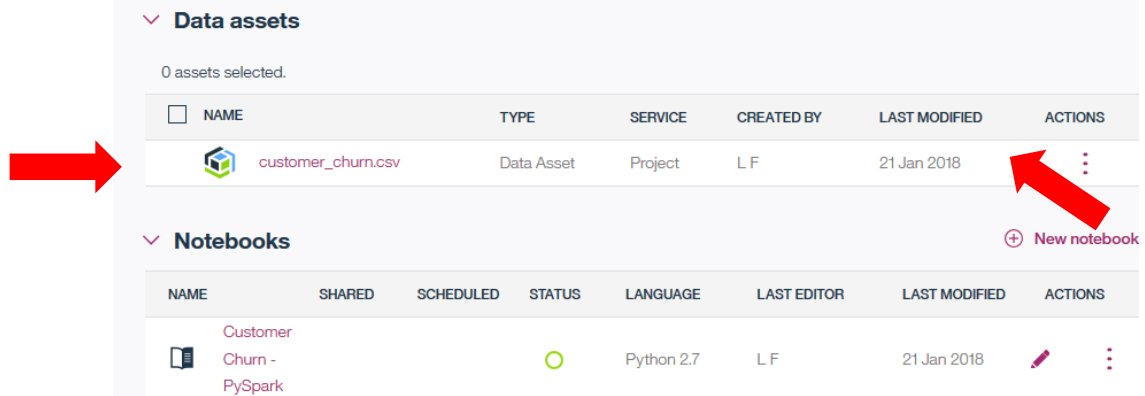
<https://github.com/team-wolfpack/Predicting-Customer-Churn-with-Watson-Data-Platform/tree/master/Data>
- Download **customer_churn_data.zip** file, unzip and place customer_churn.csv in a folder on your computer.
- Go back to the Customer Churn project and then click on the Data icon at the top right of the screen:

A new panel will be presented with Files highlighted. Click on browse, navigate to the customer_churn.csv file and select it. You should now see that the file has been imported into the project:





Navigate back to “Assets” and see the new “Data Asset”:

Action






Data assets

0 assets selected.

NAME	TYPE	SERVICE	CREATED BY	LAST MODIFIED	ACTIONS
 customer_churn.csv	Data Asset	Project	L F	21 Jan 2018	

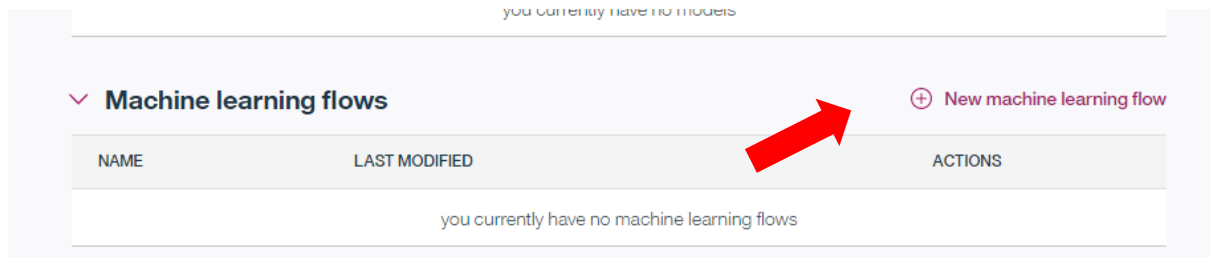
Notebooks

[+ New notebook](#)

NAME	SHARED	SCHEDULED	STATUS	LANGUAGE	LAST EDITOR	LAST MODIFIED	ACTIONS
 Customer Churn - PySpark				Python 2.7	L F	21 Jan 2018	

2. Create Machine Learning Flow

- Navigate to CustomerChurn project page
- Click on “[New machine learning flow](#)”



you currently have no models

Machine learning flows

[+ New machine learning flow](#)

NAME	LAST MODIFIED	ACTIONS
you currently have no machine learning flows		

- Choose “[Create flow](#)” on the top menu. Give the flow a meaningful name and description. For “Runtime” choose “[IBM SPSS Modeler](#)”:

Action

My Projects > CustomerChurn > New Flow

New flow BETA

Create flow
From file

Name*

CustomerChurn-Flow

Description

DSX machine learning flow for customer churn

Runtime

IBM SPSS Modeler

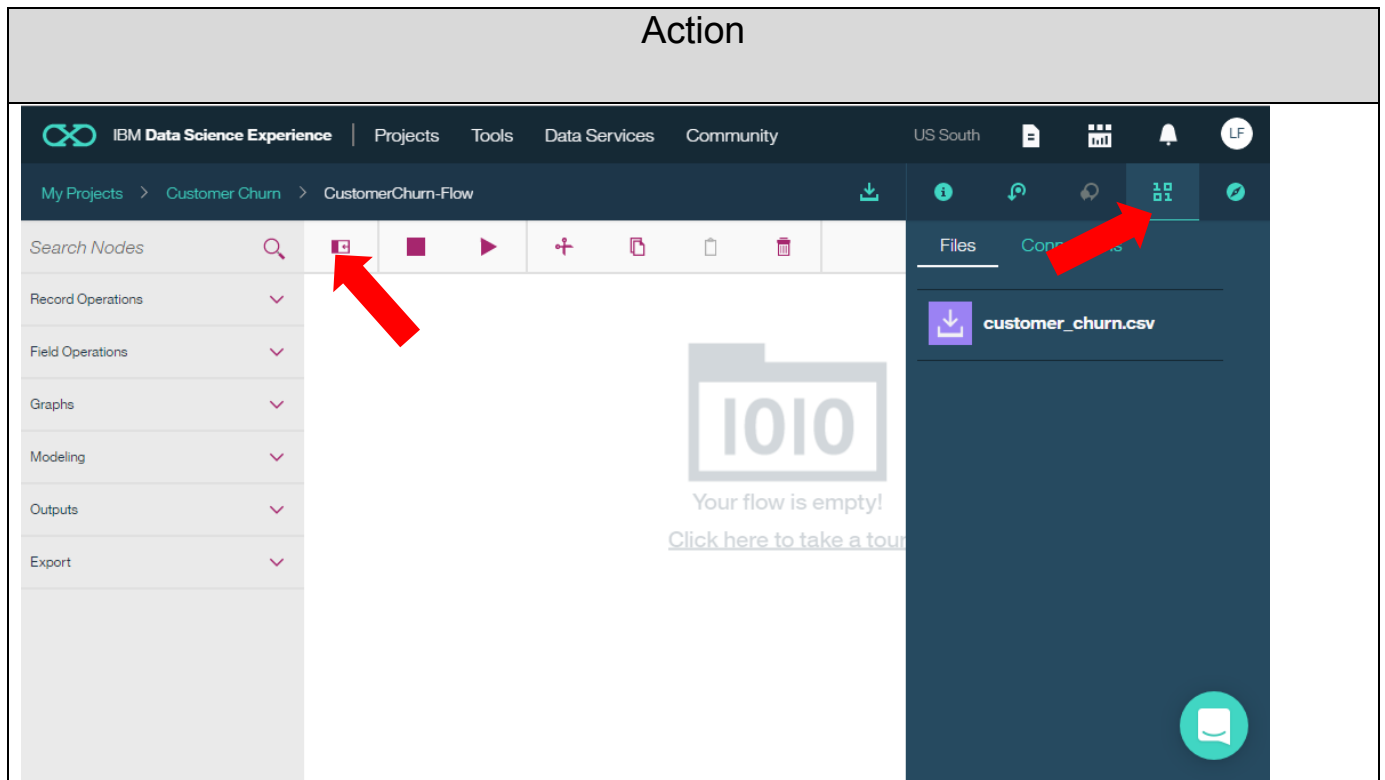
Cancel Create Flow

- Click on “Create Flow”

3. Add Data Asset

You should now see an empty workspace.

- On the top left click on the “Palette” icon, and on the top right click on the “Find and Add Data” icon.



The palette represents the set of tools available for use with DSX flows. The menu of the right should look familiar.

- Let's start by dragging and dropping the "**customer_churn.csv**" file onto the workspace.

3. Add & Configure Type Object

- From the palette, expand "**Field Operations**", then drag and drop "**Type**" onto the workspace and to the right of "customer_churn.csv". Connect the two objects:



- Double click on "Type", click on "**Configure Types**" then "**Add Columns**"
- Add all the columns except for "ID".

Action

← **Select Fields for Type** Reset ↺

Search in column Field name 🔍 Filter: 🔍 🔍 🔍

<input type="checkbox"/>	Field name ^	Data type ^
<input type="checkbox"/>	ID	integer
<input checked="" type="checkbox"/>	CHURN	string
<input checked="" type="checkbox"/>	Gender	string
<input checked="" type="checkbox"/>	Status	string
<input checked="" type="checkbox"/>	Children	double
<input checked="" type="checkbox"/>	Est Income	double
<input checked="" type="checkbox"/>	Car Owner	string
<input checked="" type="checkbox"/>	Age	double
<input checked="" type="checkbox"/>	LongDistance	double
<input checked="" type="checkbox"/>	International	double
<input checked="" type="checkbox"/>	Local	double
<input checked="" type="checkbox"/>	Dropped	double
<input checked="" type="checkbox"/>	Paymethod	string
<input checked="" type="checkbox"/>	LocalBilltype	string
<input checked="" type="checkbox"/>	LongDistanceBilltype	string

- Click on “Select Fields for Type” back arrow
- For the “CHURN” column, change its Role to that of “**Target.**” Leave the default for the remaining columns:

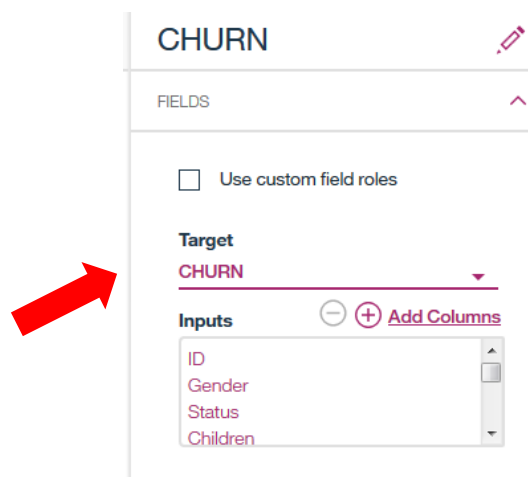
Field ^	Measure ^	Role ^	Value mode ^	Values ^	Check ^
CHURN	Default ▾	Target ▾	Read ▾		None ▾
Gender	Default ▾	Input ▾	Read ▾		None ▾
Status	Default ▾	Input ▾	Read ▾		None ▾
Children	Default ▾	Input ▾	Read ▾		None ▾
Est Income	Default ▾	Input ▾	Read ▾		None ▾

- Click “OK”, then “Save” to exit.

Action

4. Add & Configure Model Object

- From the palette, expand the “**Modeling**” branch then drag “**C&R Tree**” onto the workspace to the right of “Type.”
- Connect the two then double click on “C&R Tree” to edit its properties.
- The C&R Tree object should now say “CHURN”. Double click on this object.
- Click on “FIELDS”, Target should be set to “CHURN”

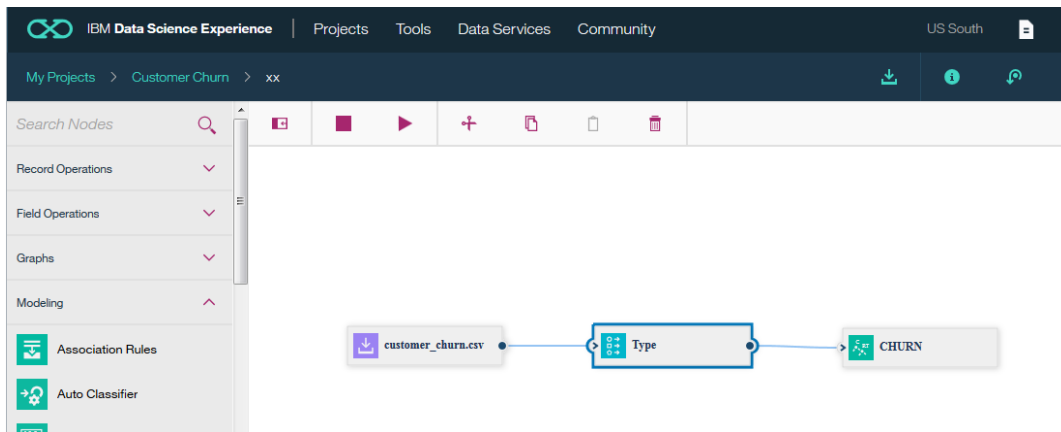


- Click on “Add Columns.” Recall from the notebook exercise you were asked to jot down the top 5 fields that were identified as the greatest influencers. Choose those columns as inputs to the decision tree model. Click “OK” to return to the workspace:
- Click on “Select Fields for CHURN” back arrow then “Save.”
- Your palette should resemble this:



5. Run Flow to Create Nugget

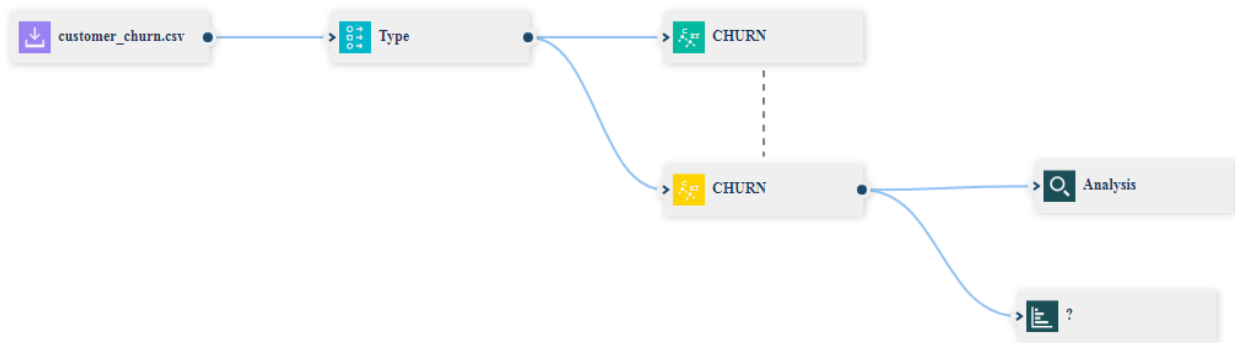
- Run the flow by clicking on the “Run” icon at the top of the workspace.



You should see a new forth object on the workspace, this is called a nugget.



- From the palette add an “**Analysis**” object to the workspace, you will find it under the “Outputs” drop down. Also, from the “**Graphs**” drop down add a “**Distribution**” object to the workspace. Connect the nugget to each of them:



6. Add & Configure Analysis Object – Measure Model Performance

- Double click on “**Analysis**” and check off the four checkboxes, leave the rest as default:

Analysis

SETTINGS

- ☒ Coincidence matrices (for symbolic targets)
- ☒ Performance evaluation
- ☒ Evaluation metric (AUC & Gini, binary classifiers only)
- ☒ Confidence figures (if available)

Threshold for pct. correct
90

Improve accuracy multiplier
2

Find predicted/predictor fields using

- Click “OK” to return to the workspace.
- Double click on “Plot” and configure it as depicted below:

?

Plot Appearance Annotations

Plot

☒ Specified ☐ All flags (true values)

Field (discrete)
CHURN

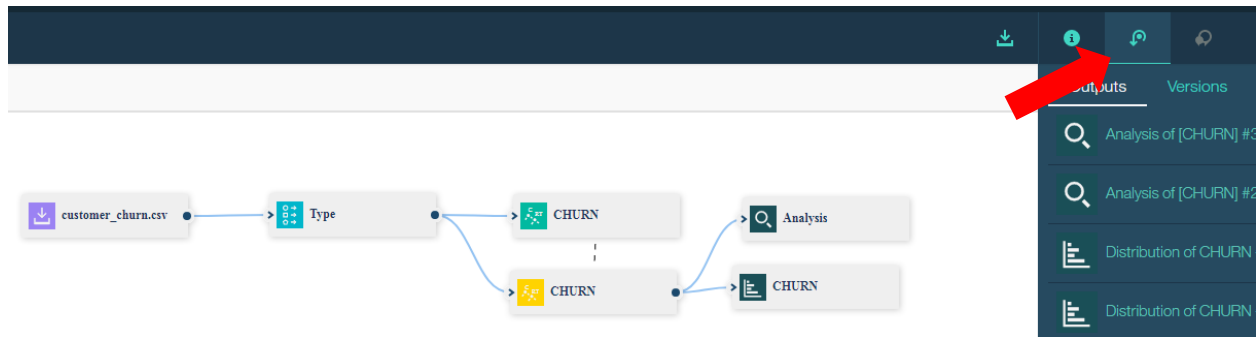
Color (discrete)
SR-CHURN

☒ Normalize by color

☐ Use proportional scale

- Click on “Save” to return to the workspace.

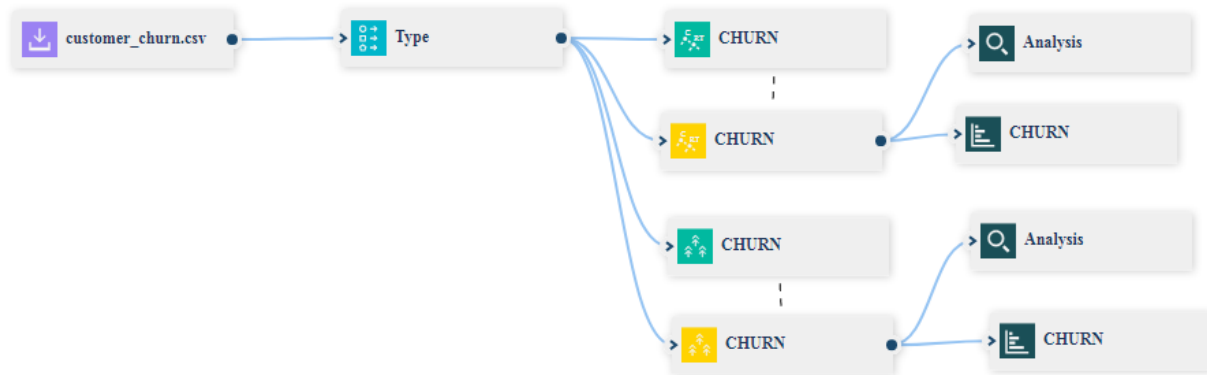
- Run the flow again.
- On the right side of the workspace click on the “**Outputs and Versions**” icon to see the resulting analysis:



- Explore the results

7. Add Second Modeling Technique to Flow

- To the palette repeat the process for “**Random Trees**” that you did for “C&R Trees.” Your resulting workspace should look like the following:



- Explore the results.

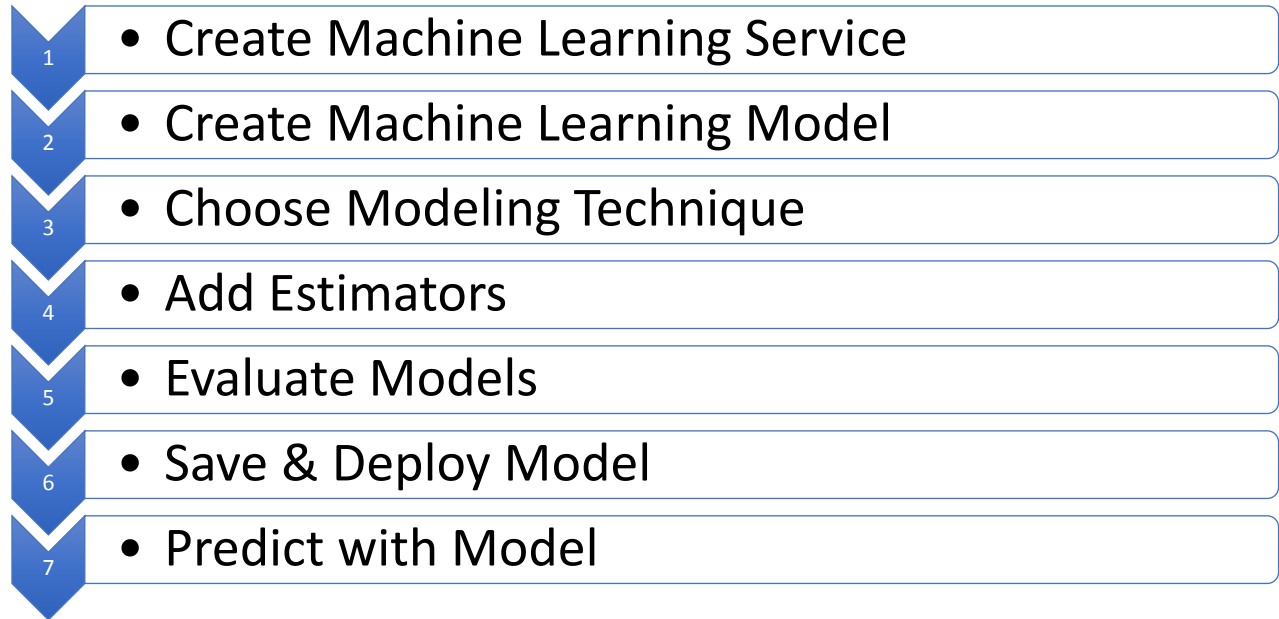
End of Lesson 3



Lesson 4: Watson Machine Learning

Purpose:	This lab introduces Watson Machine Learning in DSX. Watson Machine Learning makes the task of machine learning easy with as little as a few clicks of the mouse.
Tasks:	<p>Tasks you will complete in this lab exercise include:</p> <ul style="list-style-type: none">• Creation of requisite services to support Watson Machine Learning• Creation of Watson Machine Learning Models• Model Performance Evaluation• Deployment and Prediction of Model

Lesson 4: Workflow Overview

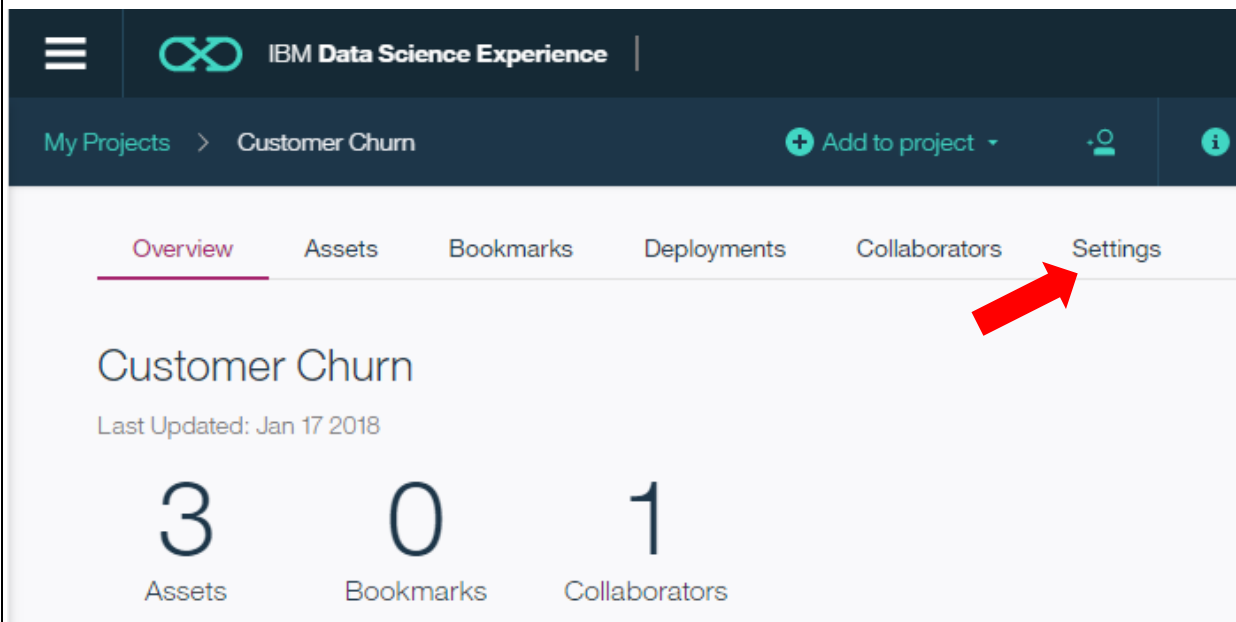


Lesson 4: Instructions

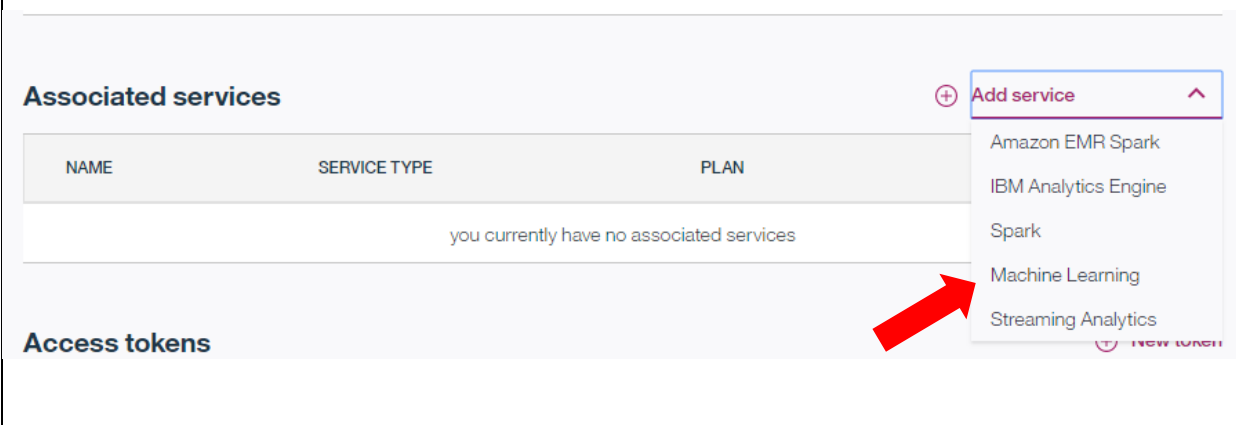
Action

1. Create Machine Learning Service

- Navigate to Customer Churn project page
- At the top click on the “Settings” icon:



Scroll to the middle of the page and click on “Add service” then choose “Machine Learning”:



Action

- On the Machine Learning page make sure that the tab is set to “New”, for the plan choose “Lite”:

Machine Learning

Existing
New

Machine Learning

IBM Watson Machine Learning is a full-service Bluemix offering that makes it easy for developers and data scientists to work together to integrate predictive capabilities with their applications. The Machine Learning service is a set of REST APIs that you can call from any programming language to develop applications that make smarter decisions, solve tough problems, and improve user outcomes.

Features

SPSS analytics platform features

SPSS streams management and deployment with realtime scoring and batch processing options.

Integration with Data Science Experience

Visit <http://datascience.ibm.com>. Create and train predictive analytics models with the best tools and the latest expertise in a social environment built by data scientists.

Spark and Python Machine Learning features

Take advantage of Spark MLlib and scikit-learn machine learning models management and deployment - online, batch and streaming.

Pricing Plan: Monthly Process shown above reflect the: **United States**

Plan	Features	Pricing
<div> <div></div> Lite </div>	Service instance (5 models per instance) 5,000 predictions 5 compute hours	Free

- Click on “**Create**”
- At the confirmation page you can give your service a meaningful name:

Confirm Creation

Organization: louisfrolio@gmail.com

Plan

Lite

Space

dev

Service name

dsx-wml-lab

Cancel Confirm

- Click “Confirm” to create Watson Machine Learning Service.

2. Create Machine Learning Model

- In the Project click on “**Assets**” at the top of the window.
- In the middle of the page you will see “**Models**”, click on “New model”:

Models

+ New model

NAME	STATUS	RUNTIME	LAST MODIFIED	ACTIONS
you currently have no models				

- In the “New model” window give your model a meaningful name and description, you should also see the machine learning service you just created. Click on “**Manual**” then “**Create**”:

New model BETA

Define model details

Name
CustomerChurn-WML

Description
Customer churn using Watson Machine Learning

Machine Learning Service
dsx-wml-lab

Select model type

☒ Model builder
☐ From sample

Spark Service
Spark-wm

Automatic
Prepare my data and create a model automatically

Manual
Let me prepare my data and select which models to train

Need something more flexible? Create a **notebook** or design an **SPSS Modeler flow**.



Cancel Create

- When complete you will be prompted for a data asset, choose “customer_churn.csv”, then click “Next.”

Select data asset

The model builder currently supports CSV files and IBM Db2 Warehouse on Cloud data assets.

What asset are you looking for?

NAME	TYPE	SERVICE
  customer_churn.csv	Data Asset	Project


3. Choose Modeling Technique

- At the “**Select a Technique**” screen select “**CHURN**” as the “**Column value to predict**”, and for the feature columns choose 5 -9 identified in the Jupyter notebook lab. Also, make sure “**Binary Classification**” is highlighted:

Select a technique


Column value to predict (Label Col)
CHURN (String) ▼

Feature columns
Gender (String), Status (String), Children (Integer), Est Income (Decimal), Car Owner (String), Paymethod (String), LongDistanceBilltype (String), Usage (Decimal), RatePlan (Integer) ⓧ ▼




Binary Classification

Classify new data into defined categories based on existing data. Choose if your label column contains two distinct categories.



Multiclass Classification

Classify new data into defined categories based on existing data. Choose if your label column contains a discrete number of categories.



Regression

Predict values from a continuous set of values. Choose if your label column contains a large number of values.

Validation Split

Train: 60

Test: 20

Holdout: 20

+ Add Estimators


Configured estimators

4. Add Estimators


- In the upper right-hand corner of the screen you will see “**Add Estimators**”, click on the icon. In the “Select estimator(s)” screen choose **Decision Tree Classifier**, and **Random Forest Classifier**:

Select estimator(s)


What type of estimator are you looking for?




Logistic Regression
Analyzes a data set in which there are one or more independent variables that determine one of two outcomes. Only binary L...



Decision Tree Classifier
Maps observations about an item (represented in the branches) to conclusions about the item's target value (represented in...



Random Forest Classifier
Constructs multiple decision trees to produce the label that is a mode of each decision tree. It supports both binary and ...



Gradient Boosted Tree Classifier
Produces a classification prediction model in the form of an ensemble of decision trees. It only supports binary labels, a...

- Click “Add”:

Select a technique


You cannot change label column, feature columns, model type, or validation split after adding an estimator.
You must first delete all estimators in order to make changes to these attributes.

Column value to predict (Label Col)


CHURN (String)

Feature columns


Est Income (Decimal), Age (Decimal), LongDistance (Decimal), Status (S



Binary Classification
Classify new data into defined categories based on existing data. Choose if your label column contains two distinct categories.



Multiclass Classification
Classify new data into defined categories based on existing data. Choose if your label column contains a discrete number of categories.




Regression
Predict values from a continuous set of values. Choose if your label column contains a large number of values.

Validation Split




+ Add Estimators

Configured estimators



Decision Tree Classifier
Not Yet Trained



Random Forest Classifier
Not Yet Trained

- Click “Next” to train models. This will take 1-2 minutes with the data set we are using:


5. Evaluate Models

Select model							
	ESTIMATOR TYPE	STATUS	PERFORMANCE	AREA UNDER ROC CURVE	AREA UNDER PR CURVE	LAST EVALUATION	ACTIONS
<input type="radio"/>	RandomForestClassifier	Trained & Evaluated	Excellent	0.94229	0.92568	17 Jan 2018, 10:42 AM	⋮
<input checked="" type="radio"/>	DecisionTreeClassifier	Trained & Evaluated	Good	0.87427	0.85758	17 Jan 2018, 10:42 AM	⋮

[Close](#)
[Previous](#)
[Save](#)

6. Save & Deploy Model

- Pick which model you want to keep then click “Save:”

CustomerChurn-WML 	
Overview	Evaluation
Deployments	Test
Summary	
Machine learning service	DSX-Lab-Machine_Learning
Runtime environment	spark-2.0
Training date	30 Oct 2017, 5:40 PM
Label column	CHURN
Latest version	15233fc3-28a0-485d-9f09-445bac5bcd11
Model builder details	View

The overview page provides useful information about the model. This includes the ability to deploy and predict with the model.

- Click on “Deployments” then “[Add Deployment](#)”:

CustomerChurn-WML

Overview Evaluation Deployments

NAME STATUS DEPLOYMENT TYPE ACTIONS			
Your model is not deployed.			

 Add Deployment

- For deployment type choose “**Batch Prediction**” then give the deployment a useful name:

Create Deployment

Web Service Batch Prediction Real-time Streaming Predictions

Name

CustChurnRandForestDeployed

Description

Deployed Random Forests model to predict customer churn

245

- Click “Save”


7. Predict with Model

- Choose newly created deployed model:

CustomerChurn-WML

Overview Evaluation **Deployments**

 Add Deployment



NAME	STATUS	DEPLOYMENT TYPE	ACTIONS
CustChurnRandForestDeployed	ACTIVE	Web Service	

- Click on “**Test**” to test the model.

The input features will be pre-populated, but you can change them to see different outcomes. Just be sure that the values you add are valid as per the data set. [See “Summary Statistics”](#) from the Jupyter notebook exercise:

CustChurnRandForestDeployed

Overview Implementation **Test**

Enter input data  

ID

1

Gender

F


Status

S

Children

1

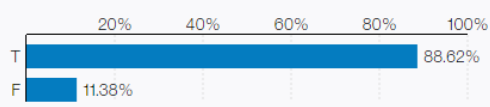
Est Income



Predict

Predicted value for CHURN

T



Category	Percentage
T	88.62%
F	11.38%

End of Lesson 4

End of Hands-on Workshop

Thank You

