

IBM Watson

Predicting Customer Churn

Watson Studio



Lab Guide





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Lab Environment Overview

Software and Tools

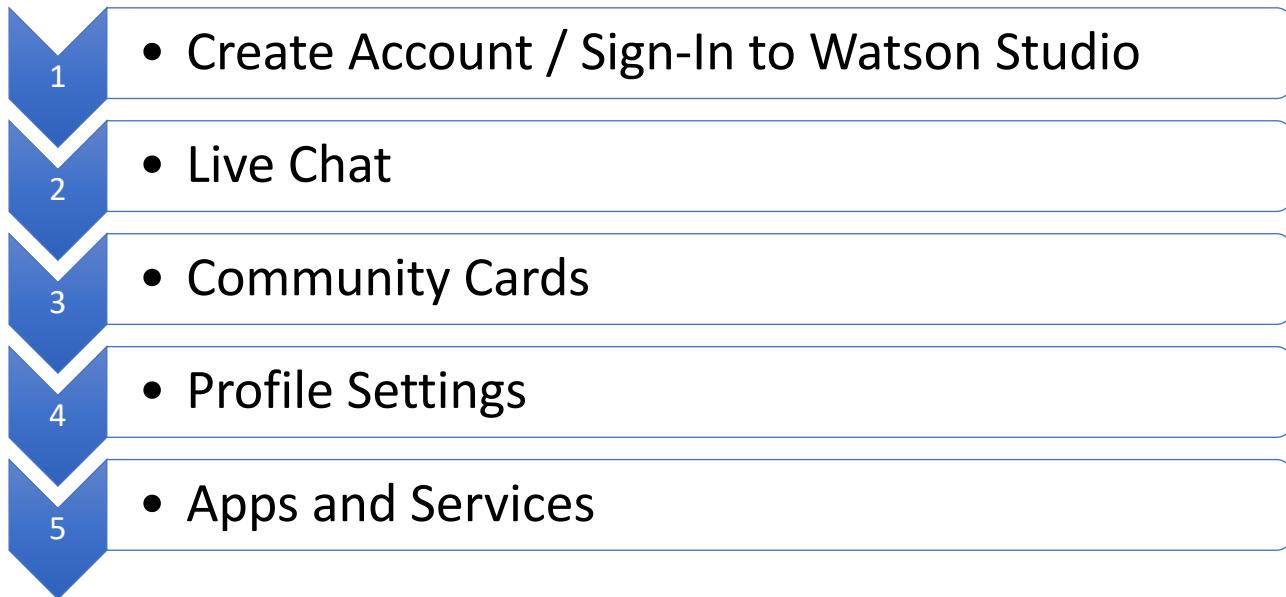
Software	Link
IBM Watson Studio	https://datascience.ibm.com
GitHub	https://github.com/team-wolfpack



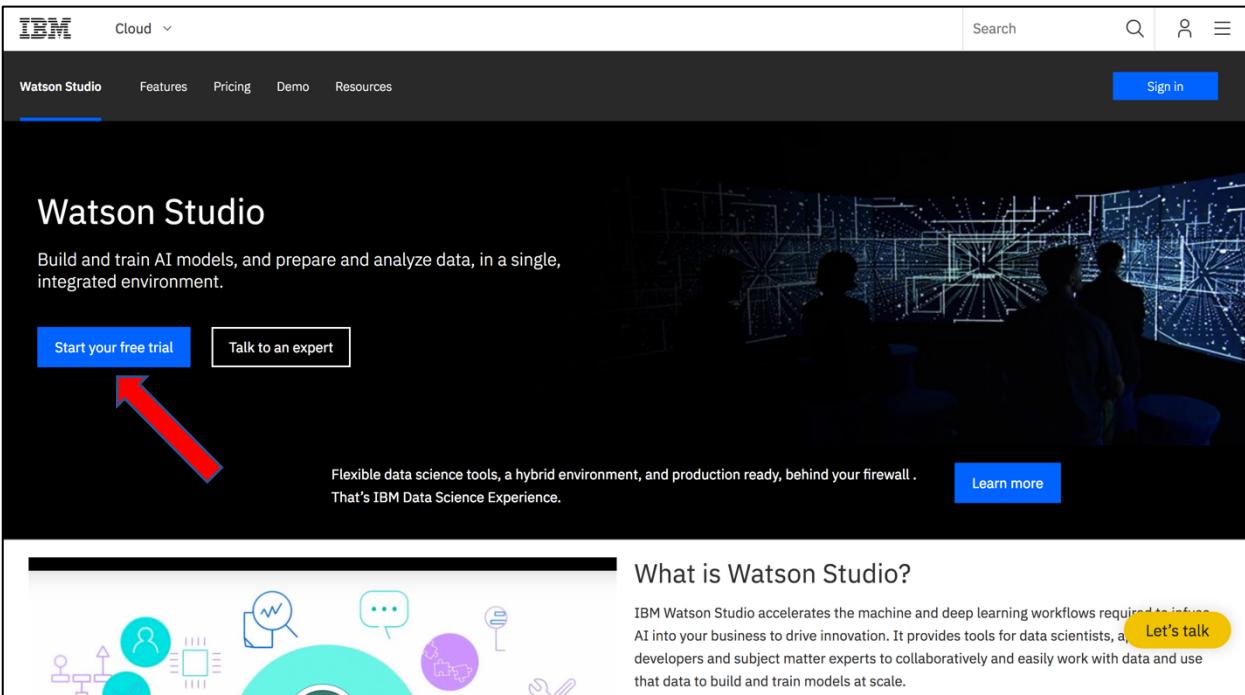
Lesson 1: Watson Studio Signup & Home Page

Purpose:	This lab introduces IBM Watson Studio, 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 Watson Studio 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
<p>1. <u>Create Account/Sign In to Watson Studio</u></p> <ul style="list-style-type: none"> Open web browser and navigate to: https://datascience.ibm.com  <p>The screenshot shows the Watson Studio homepage. At the top, there's a navigation bar with the IBM Cloud logo, a search bar, and a 'Sign in' button. Below the navigation is a large banner with the text 'Watson Studio' and 'Build and train AI models, and prepare and analyze data, in a single, integrated environment.' It features a blue 'Start your free trial' button with a red arrow pointing to it, and a 'Talk to an expert' button. To the right of the text is a dark background image of three people in a modern office setting. Below the banner, there's a section titled 'What is Watson Studio?' with a sub-section about AI accelerating innovation. A yellow call-to-action button labeled 'Let's talk' is highlighted with a yellow oval.</p> <ul style="list-style-type: none"> Click on “Start your free trial” and you will be prompted for several items of information. Once submitted, you will receive a confirmation email. After confirming your email, you will be asked to login to your account which will take you to IBM Cloud. Open a new browser tab and navigate to: https://datascience.ibm.com and click “Sign In”. Login with your account credentials if prompted. You will be prompted to setup some parameters, accept the defaults and click “Confirm”. After a few moments of self-configuration, you will be brought to your Watson Studio Homepage

IBM Watson Projects Tools Community Services US South Get started ▾

Welcome Josh!

Watson Studio is part of IBM Watson.

[Try out other IBM Watson apps.](#)

Get started with key tasks

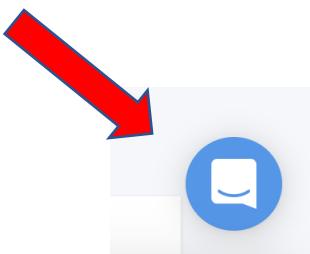
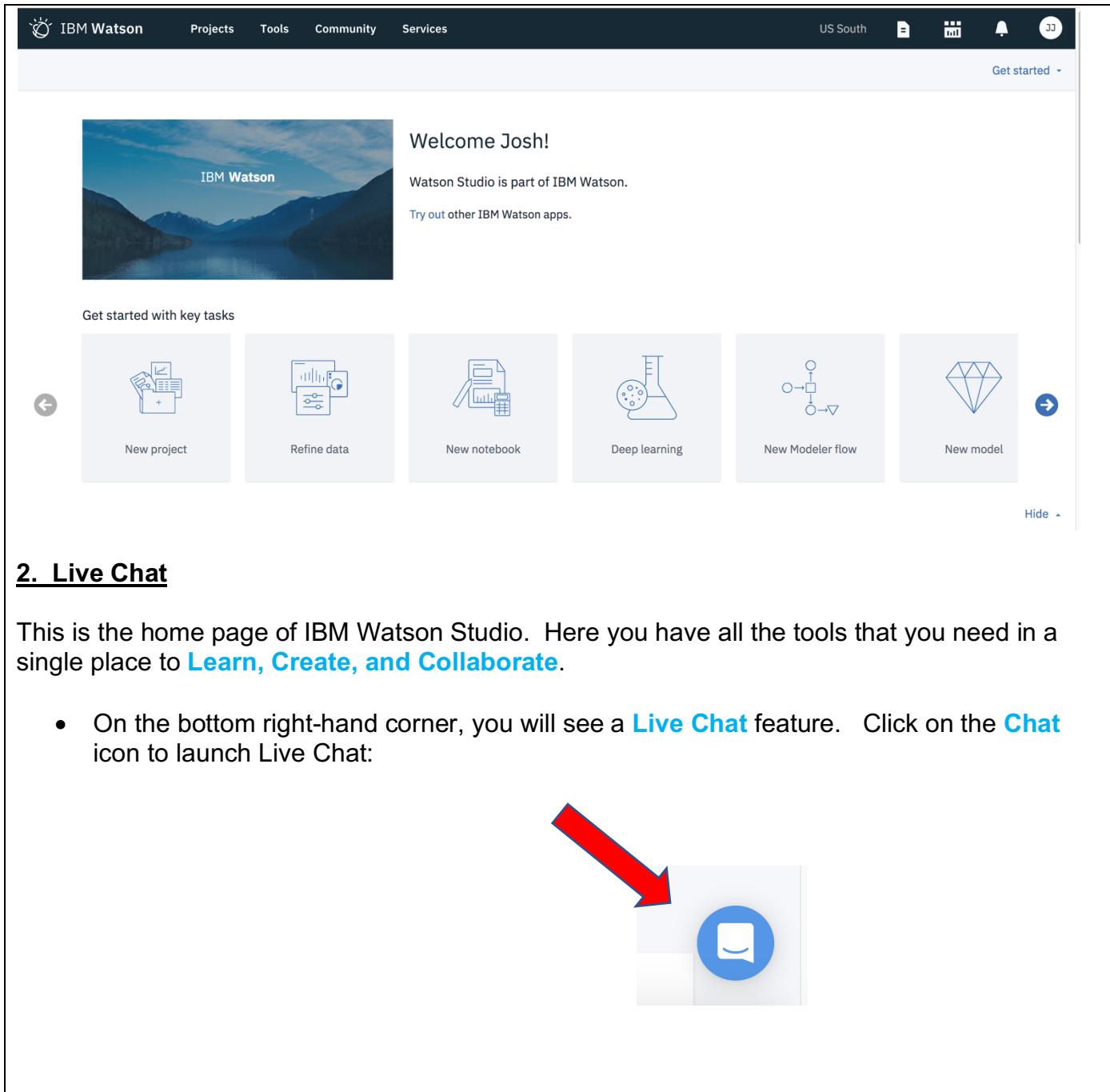
New project Refine data New notebook Deep learning New Modeler flow New model

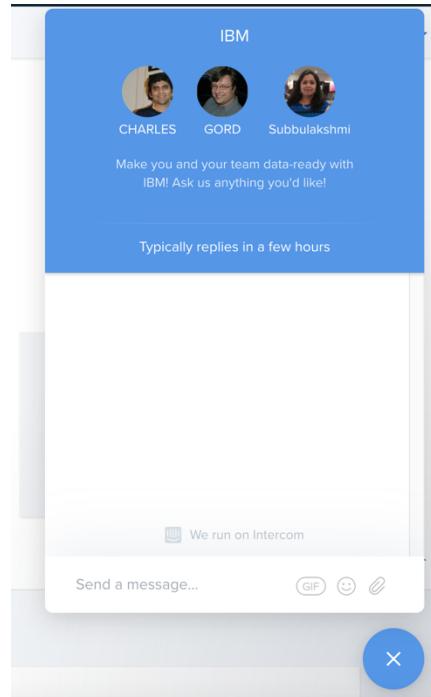
Hide ▾

2. Live Chat

This is the home page of IBM Watson Studio. 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, start typing your message in the [Send a Message](#) box to connect with a live person. Through this Live Chat feature, you can also continue conversations the next time you log into Watson Studio.

We use feedback captured through [Live Chat](#) and the offerings instrumentation to guide our decisions in designing and developing [Watson Studio](#).

3. Community Cards

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



Featured

ARTICLE		ARTICLE		ARTICLE	
Apple, IBM add machine learning to...		Introducing IBM Watson Studio		Webinar: April 11 - Thinking inside the box....	
AUTHOR TechCrunch	DATE Mar 20, 2018	AUTHOR Armand Ruiz	DATE Mar 20, 2018	AUTHOR RStudio	DATE Apr 02, 2018
TOPIC Watson	FORMAT Web page	TOPIC Watson	FORMAT Web page	TOPIC Data Science	FORMAT Web page
 1 		 8 		 0 	

Sort by: Featured 

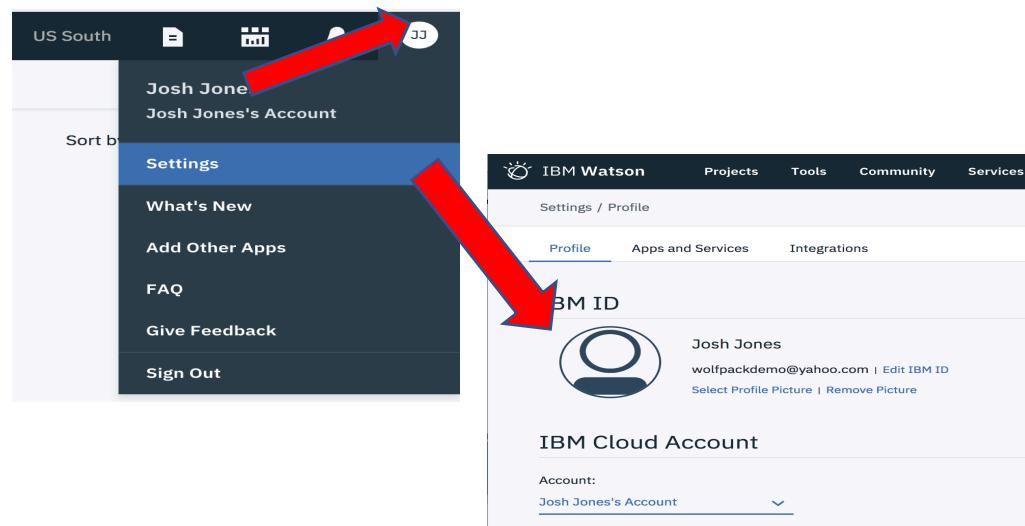
All content

ARTICLE Webinar: April 11 - Thinking inside the box....	NOTEBOOK Watson Assistant Workspace Analysis with...	TUTORIAL Build Deep Learning Architectures With...	NOTEBOOK Connect to Db2 Warehouse on Cloud and Db2...
AUTHOR RStudio	AUTHOR IBM	AUTHOR developerWorks TV	AUTHOR IBM
DATE Apr 02, 2018	DATE Apr 02, 2018	DATE Apr 02, 2018	DATE Mar 29, 2018
TOPIC Data Science	TOPIC Communications	LEVEL Beginner	TOPIC Economy & Business
FORMAT Web page	 0 	 4 	 8 
NOTEBOOK From scikit-learn Model to Cloud with WML...	NOTEBOOK Access MySQL with Python	ARTICLE Using shell scripts to control data flows...	ARTICLE Working with data flows using Watson Data...

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

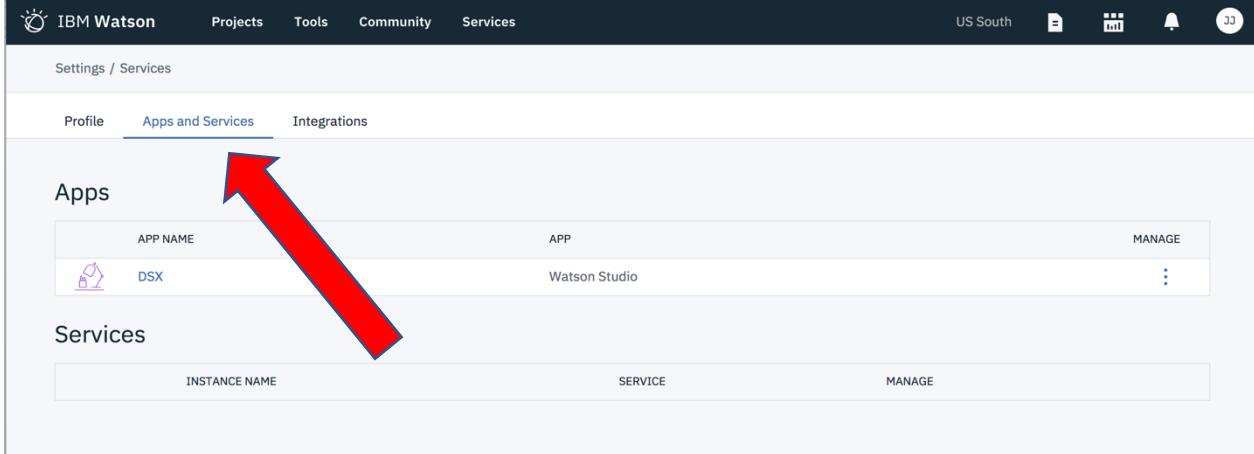
- Click on **Settings** to look at your **Profile, Apps and Services, and Integrations**. This is where you see the details of your IBM Cloud Account:



The screenshot shows the IBM Cloud dashboard interface. On the left, there's a sidebar with a user profile for "Josh Jones" and "Josh Jones's Account". Below the profile, there are links for "Settings", "What's New", "Add Other Apps", "FAQ", "Give Feedback", and "Sign Out". A red arrow points from the top navigation bar to the "Settings" link in the sidebar. Another red arrow points from the "Settings" link to the "IBM Watson" settings page on the right. The "IBM Watson" page has tabs for "Settings / Profile", "Projects", "Tools", "Community", and "Services". The "Profile" tab is selected, showing "BM ID" and a profile picture placeholder for "Josh Jones". Below the profile section, there's an "IBM Cloud Account" section with a dropdown menu set to "Account: Josh Jones's Account".

5. Apps and Services

- Click on **Apps and Services** to view all your current IBM Cloud Apps and Services:



The screenshot shows the IBM Watson Cloud dashboard. At the top, there's a navigation bar with links for IBM Watson, Projects, Tools, Community, and Services. To the right of the navigation bar are icons for US South, a gear, a bar chart, a bell, and a user profile. Below the navigation bar, the page title is "Settings / Services". Underneath that, there are three tabs: Profile, Apps and Services (which is underlined in blue), and Integrations. The main content area is divided into two sections: "Apps" and "Services". The "Apps" section has a table with one row: APP NAME (DSX), APP (Watson Studio), and MANAGE (with a three-dot menu icon). The "Services" section has a table with one row: INSTANCE NAME, SERVICE, and MANAGE. A large red arrow points from the left towards the "Apps and Services" tab.

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

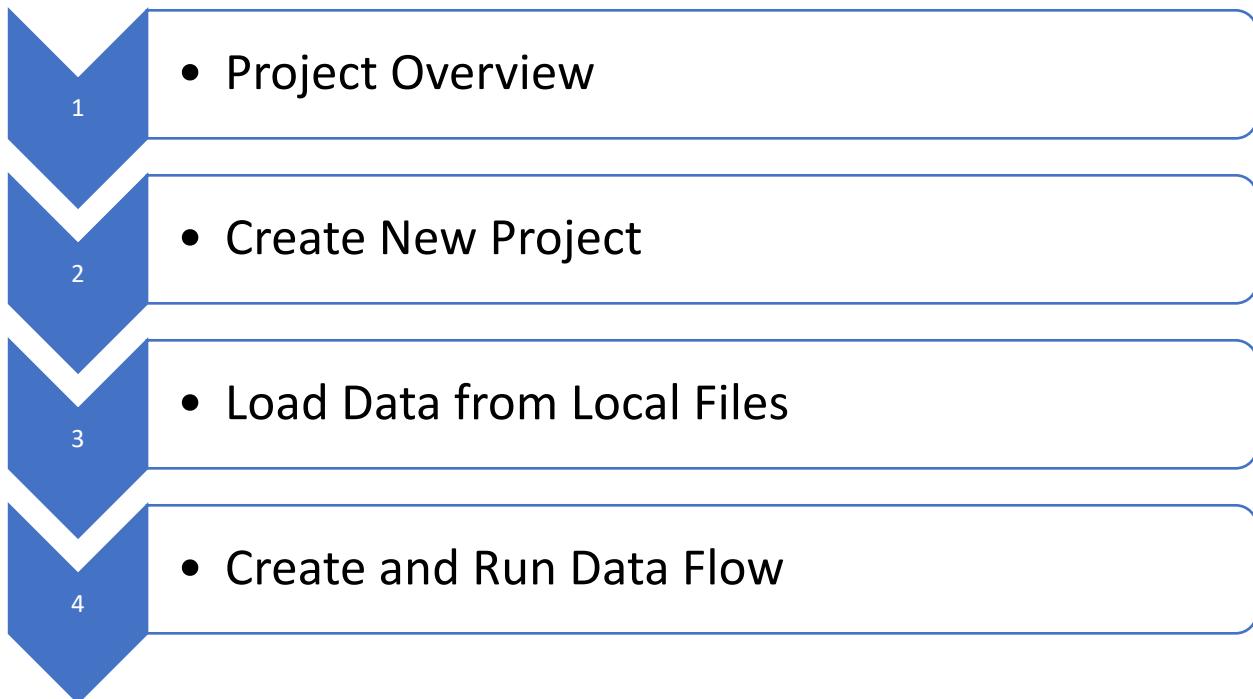
Integrations is where you configure Watson Studio for GitHub integration.

End of Lesson 1

Lesson 2: Data Refinery

Purpose:	This lesson introduces projects within Watson Studio, their purpose, value, and how they are used to support collaboration. Also, data flows are introduced and used to cleanse and transform the data before processing.
Tasks:	Tasks you will complete in this lab exercise include: <ul style="list-style-type: none">• Create and Configure Watson Studio Project• Add Data Flow Asset• Cleanse and Transform Data• Run Data Flow

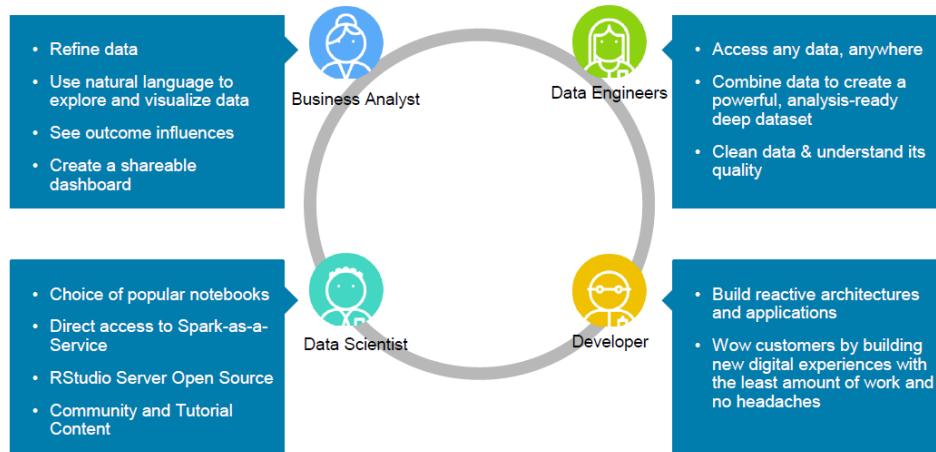
Lesson 2: Workflow Overview



Lesson 2: Instructions

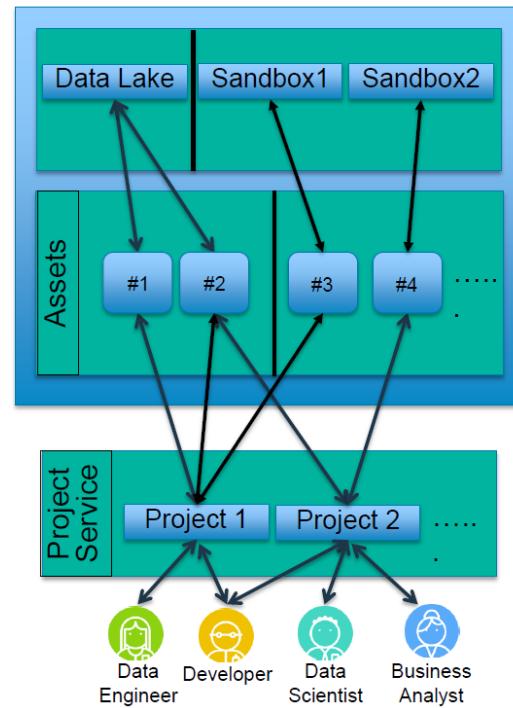
1. Project Overview

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



Projects make collaboration easier by:

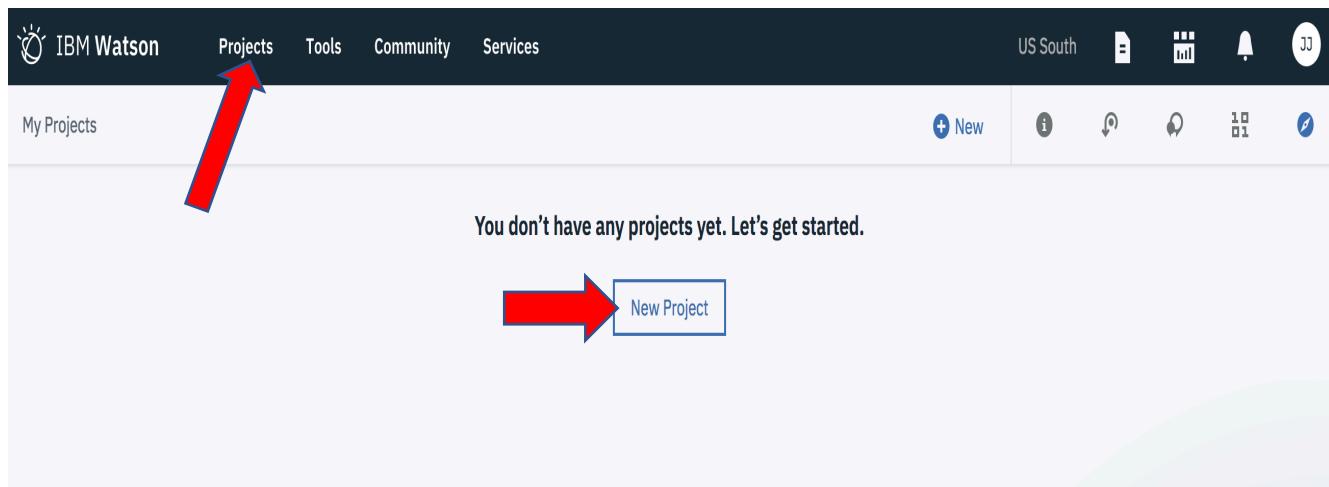
- Allowing different users and personas to share a set of assets
- Enabling users to collaborate and manage their notebooks, artifacts, plus more
- Providing three levels of rights: Viewers, Editors, and Admins



Action

2. Create New Project

- Navigate to <https://datascience.ibm.com>
- Login to Watson Studio
- On the top right side, click **Projects** and select **View All Projects**. Click **New Project**



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

New project

Define project details

Name

Customer Churn



86

Description

Customer churn analysis|



2977

Choose project options

 Restrict who can be a collaborator (i)Project will include integration with [Object Storage](#) for storing project assets.

Define Storage:

- Click **Add**
- Choose **Lite** plan then **Create**
- Verify your options then **Confirm**
- **Refresh**

Storage

cloud-object-storage-pd

- Click **Create**

IBM Watson Projects Tools Community Services US South Add to project Overview Assets Environments Bookmarks Deployments Collaborators Settings My Projects / Customer Churn Overview Assets Environments Bookmarks Deployments Collaborators Settings Customer Churn Last Updated: Apr 02 2018 0 0 1 Assets Bookmarks Collaborators Date created Apr 02 2018 Description Customer churn analysis Storage 0% of 5 GB used Collaborators View all (1) Josh Jones Admin Recent activity Alerts related to this project will show here when the project is active.

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.

3. 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>

- Download and expand **customer_churn_data.zip**. Alternatively, download **customer.csv** and **churn.csv** individually and save both files to 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 **Load**, navigate to the customer.csv and churn.csv files and select them.

IBM Watson Projects Tools Catalog Community Services Docs Support Manage LM

My Projects / Customer Churn + Add to project 0 i 🔍 10 11 🔍

Overview Assets Environments Bookmarks Deployments Collaborators Settings X Load Files Catalog

What assets are you looking for?

Drop files here or browse for files to upload.

Data assets

NAME	TYPE	SERVICE	CREATED BY	LAST MODIFIED	ACTIONS
you currently have no data assets					

- You should now see that the customer and churn data files have been imported into the project under the **Files** and they are listed under **Data Assets**

IBM Watson Projects Tools Catalog Community Services Docs Support Manage LM

My Projects / Customer Churn + Add to project 0 i 🔍 10 11 🔍

Overview Assets Environments Bookmarks Deployments Collaborators Settings X Load Files Catalog

What assets are you looking for? Find in storage

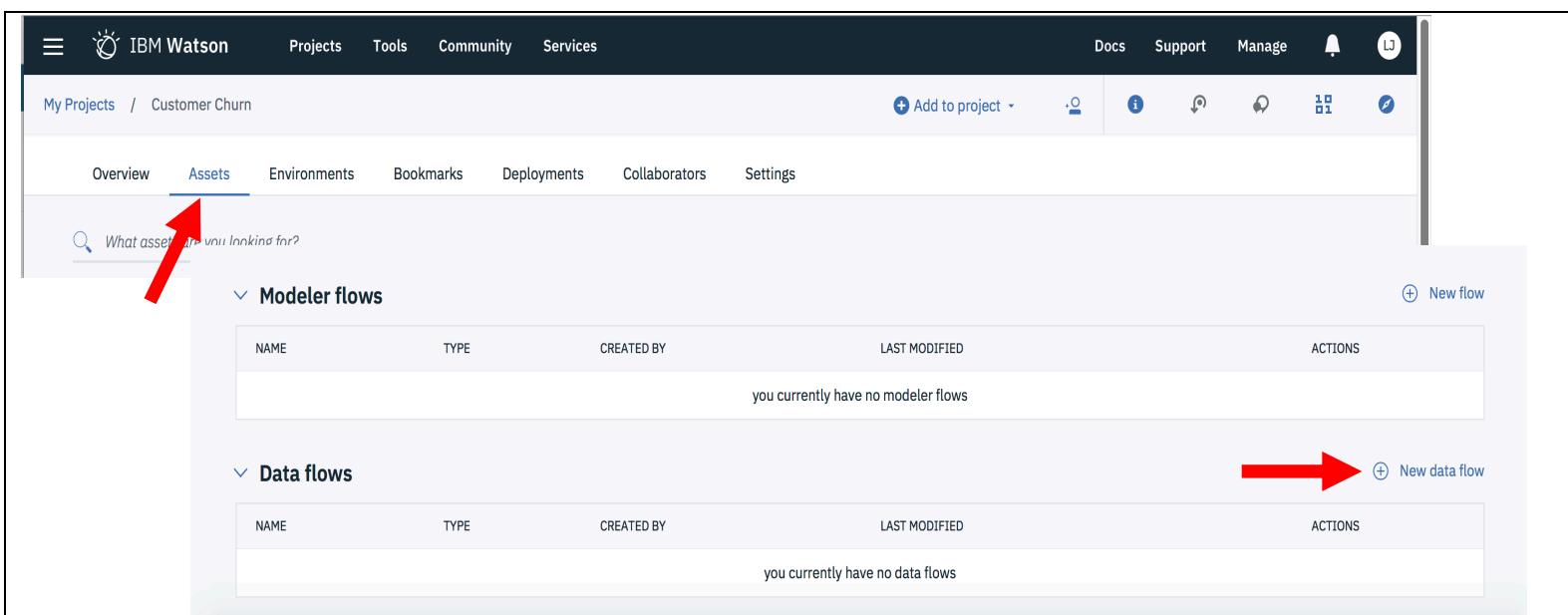
0 assets selected.

customer.csv

churn.csv

4. Create and Run Data Flow

- Under **Assets**, click **New Data Flow**



My Projects / Customer Churn

Overview Assets Environments Bookmarks Deployments Collaborators Settings

What assets are you looking for?

Modeler flows

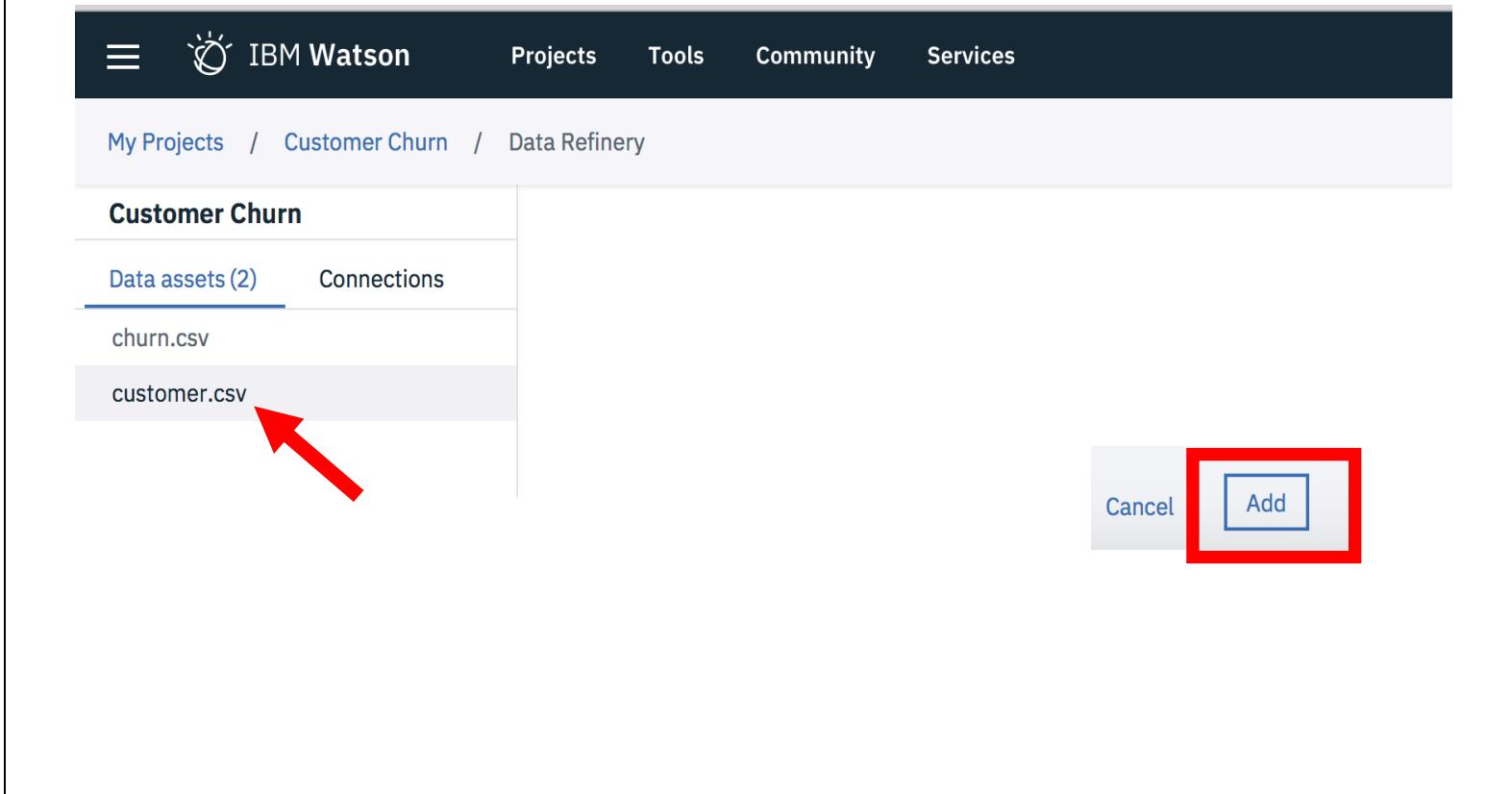
NAME	TYPE	CREATED BY	LAST MODIFIED	ACTIONS
you currently have no modeler flows				

Data flows

NAME	TYPE	CREATED BY	LAST MODIFIED	ACTIONS
you currently have no data flows				

+ New flow + New data flow

- Click **customer.csv** and select **Add** in the lower right corner



My Projects / Customer Churn / Data Refinery

Customer Churn

Data assets (2) Connections

churn.csv

customer.csv

Add Cancel

- A preview of customer data should now be displayed, under the **Data** tab. Only the first 1000 rows are displayed.

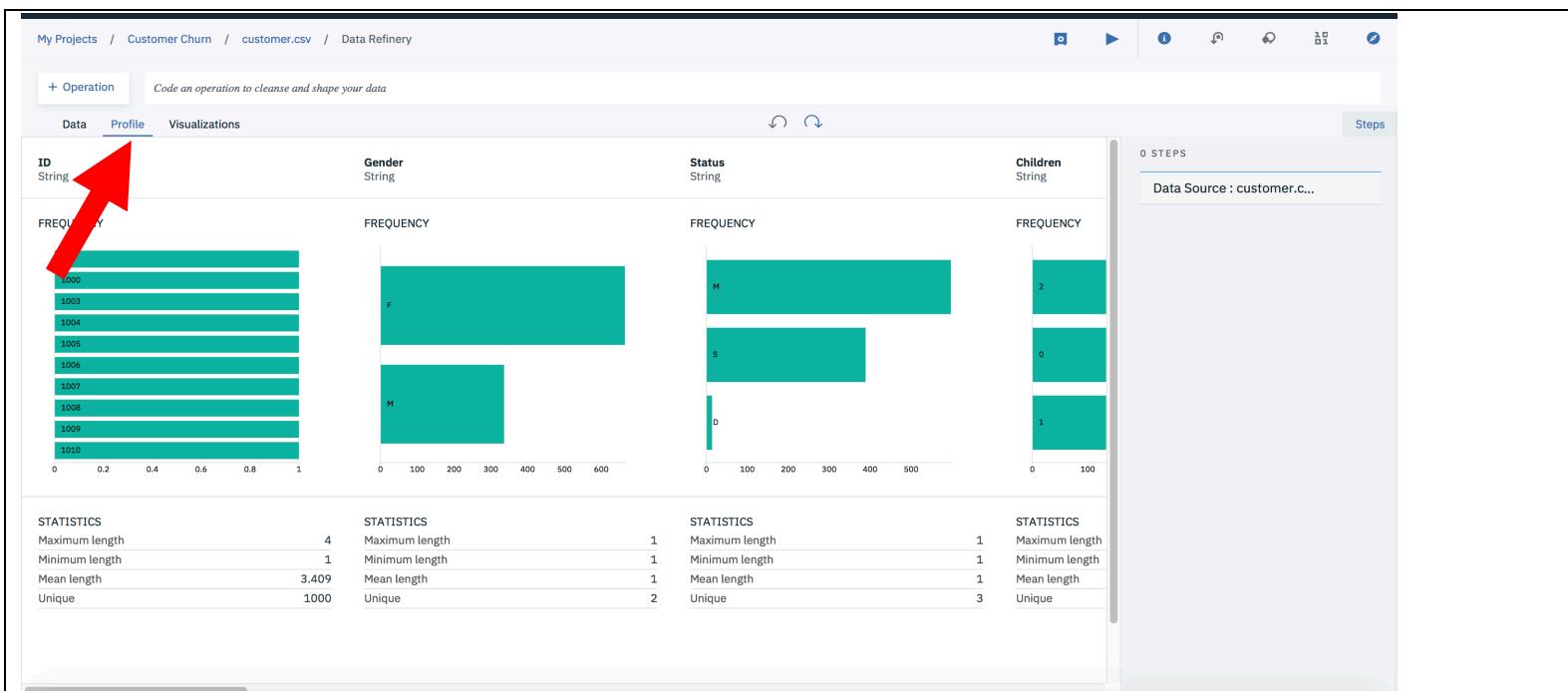
IBM Watson Projects Tools Catalog Community Services

My Projects / Customer Churn / customer.csv / Data Refinery

+ Operation Code an operation to cleanse and shape your data

	ID String	Gender String	Marital Status String	Children String	Est Income String	Car Owner String	Age String	LongDistance String
1	F	S	1	38000	N	24.393333	23.56	
2	M	M	2	29616	N	49.426667	29.78	
3	M	M	0	19732.8	N	50.673333	24.81	
4	M	S	2	96.33	N	56.473333	26.13	
5	F	M	2	52004.8	N	25.14	5.03	
6	M	M	2	53010.8	N	18.84	12.45	
7	M	M	1	75004.5	N	64.8	26.52	

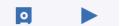
- Select the **Profile** tab. Information about your data, such as frequency, is displayed



- Return to the **Data tab** and click on the **Age** column. Select the **3 dots** beside the column name and select **Convert Column Type**. Click **Decimal**. Notice a grey circle appeared beside Decimal. Based upon the data values, Watson recommended the data type.

+ Operation

Code an operation to cleanse and shape your data



Data Profile Visualizations

Steps

	Est Income String	Car Owner String	Age String	LongDistance String	International String	Local String	Dropped String	Paymeth String
1	38000	N	24.393333					
2	29616	N	49.426667					
3	19732.8	N	50.673333					
4	96.33	N	56.473333					
5	52004.8	N	25.14					
6	53010.8	N	18.84					
7	75004.5	N	64.8					
8	19749.3	N	60.366667					
9	57626.9	Y	43.906667					
10	20078	N	32.846667					
11	47902	N	26.033333					
12	7545.96	Y	16.753333	22.39				
13	78851.3	N	48.373333	0.37				
14	17540.7	Y	62.786667	22.17				
15	83891.9	Y	61.02	28.92				
16	28220.8	N	38.766667	26.49				
17	28589.1	N	15.6	13.19				
18	5237.63	N	48.753333	13.32				
19	89459.9	N	53.28	11.54				

- The **Age** column is now of data type **Decimal** and our conversion action now appears on the left-hand side under **Steps**. Each transformation performed on the data is tracked under Steps

	Children String	Est Income String	Car Owner String	Age Decimal	LongDistance String	Steps
1	38000	N	24.393333	23.56		
2	29616	N	49.426667	29.78		
0	19732.8	N	50.673333	24.81		
2	96.33	N	56.473333	26.13		
2	52004.8	N	25.14	5.03		
2	53010.8	N	18.84	12.45		
1	75004.5	N	64.8	26.52		
0	19749.3	N	60.366667	20.22		
1	57626.9	Y	43.906667	9.38		

- Next, click the **Martial Status** column. Hover over the column name until an edit pencil icon appears. Change the column name to **Status**

+ Operation

Code an operation to cleanse and shape your data

Data Profile Visualizations

	ID String	Gender String	Marital Status String
1	1	F	S
2	6	M	M
3	8	M	M
4	11	M	S
5	14	F	M
6	17	M	M
7	18	M	M
8	21	M	M
9	22	M	S

+ Operation

Code an operation to cleanse and shape your data

Data Profile Visualizations

	ID String	Gender String	Status String
1	1	F	S
2	6	M	M
3	8	M	M
4	11	M	S
5	14	F	M
6	17	M	M
7	18	M	M
8	21	M	M

- Click **Operation** in the upper left corner.

IBM Watson Projects Tools Catalog Community Services Docs Support Manage LM

My Projects / Customer Churn / customer.csv / Data Refinery

x Operation Code an operation to cleanse and shape your data

FREQUENTLY USED

- Calculate
- Convert column type
- Filter
- Math
- Remove
- Rename
- Sort ascending
- Sort descending

Steps

2 STEPS

Data Source : customer.c...

Convert column type

Converted Age from String to Decimal

Rename column JUST ADDED

Renamed column Marital Status to Status

ID String	Gender String	Status String	Children String	Est Income String	Car Owner String
1	F	S	1	38000	N
6	M	M	2	29616	N
8	M	M	0	19732.8	N
11	M	S	2	96.33	N
14	F	M	2	52004.8	N
17	M	M	2	53010.8	N
18	M	M	1	75004.5	N
21	M	M	0	19749.3	N
22	M	S	1	57626.9	Y

- Under the **Organize** section, click **Join**.

x Operation *Code an operation to cleanse and shape your data*

Search operations 

ID	Gender	Status
String	String	String
1	F	S
6	M	M
8	M	M
11	M	S
14	F	M
17	M	M
18	M	M
21	M	M
22	M	S
23	M	M
24	F	M
29	M	M
35	F	S
36	F	S
37	F	M
38	F	M
40	F	S
42	F	M
45	M	S

Filter

Math

Remove

Rename

Sort ascending

Sort descending

Substitute

Text

CLEANSE 

Convert column value to missing

Remove duplicates

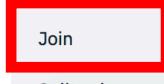
Remove empty rows

Replace missing values

Replace substring

ORGANIZE 

Concatenate

Join 

Split column

- Select **Left Join** and click **Add Data Set**. Select **Churn.csv**, as the data set to join, and click **Apply**

Join

Combine data from two data sets based on a comparison of the values in specified key columns.

Left join ▼

Returns all rows in the original data set and returns only matching rows in the joining data set. Returns one row in the original data set for each matching row in the joining data set.

The default suffix for each data set will be used to differentiate any duplicate column names in the resulting data set.

Source	Data set to join
customer.csv	+ Add Data Set
*Suffix .x	*Suffix .y

JOIN KEYS d⁴ 0

customer.csv	Click to select
Click to select	Click to select

Cancel Next

Data set to join with customer.csv

Data assets (2)	Connections
churn.csv	
customer.csv	

Cancel Apply

- Select **ID** as the Join Key and click **Next**. Select all columns to appear in the resulting data set and click **Apply**.

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< Join

Combine data from two data sets based on a comparison of the values in specified key columns.

Left join

Returns all rows in the original data set and returns only matching rows in the joining data set. Returns one row in the original data set for each matching row in the joining data set.

The default suffix for each data set will be used to differentiate any duplicate column names in the resulting data set.

Source	Data set to join
customer.csv	churn.csv
*Suffix .x	*Suffix .y

JOIN KEYS  1

customer.csv	churn.csv
ID	 ID

 Add Join Key

Cancel **Next**

< Join

Select the columns in the resulting data set

- Clear all selections
- ID
- Gender
- Status
- Children
- Est Income
- Car Owner
- Age
- LongDistance
- International
- Local
- Dropped
- Paymethod
- LocalBilltype
- LongDistanceBilltype

Back **Apply**

• The **Churn** column is now joined to the customer data set. And the **join operation** step is listed.

My Projects / Customer Churn / customer.csv / Data Refinery

+ Operation Code an operation to cleanse and shape your data

Data Profile Visualizations

ID	local_ring	Dropped	Paymethod	LocalBilltype	LongDistanceBi...	Usage	RatePlan	CHURN
1	6.08	0	CC	Budget	Intl_discount	229.64	3	T
2	.5	0	CH	FreeLocal	Standard	75.29	2	F
3	.44	0	CC	FreeLocal	Standard	47.25	3	F
4	.88	1	CC	Budget	Standard	59.01	1	F
5	.11	0	CH	Budget	Intl_discount	28.14	1	F
6	.42	4	CC	FreeLocal	Standard	58.87	1	F
7	.19	0	CC	Budget	Intl_discount	58.72	1	F
8	.94	0	CC	Budget	Standard	34.17	3	F
9	.96	0	CC	Budget	Standard	48.35	2	F
10	.33	0	CC	Budget	Intl_discount	15.98	4	F
11	.92	1	Auto	FreeLocal	Standard	72.31	2	F
12	.836	0	CC	Budget	Standard	200.75	3	T
13	.66	0	CC	FreeLocal	Standard	29.04	4	T

Steps

3 STEPS

- Data Source : customer.csv
- Rename column
 - Renamed column Marital Status to Status
- Convert column type
 - Converted Age from String to Decimal
- Join
 - JUST ADDED
 - left-joined data from churn.csv based on columns ID,ID

- Click the **Save icon** in the upper right to save the data flow

My Projects / Customer Churn / customer.csv / Data Refinery

+ Operation Code an operation to cleanse and shape your data

Details Help

- Before we run the data flow, lets visualize the data. Select the **Visualizations** tab in the upper left

My Projects / Customer Churn / customer.csv_flow / Data Refinery

+ Operation Code an operation to cleanse and shape your data

Data Profile Visualizations

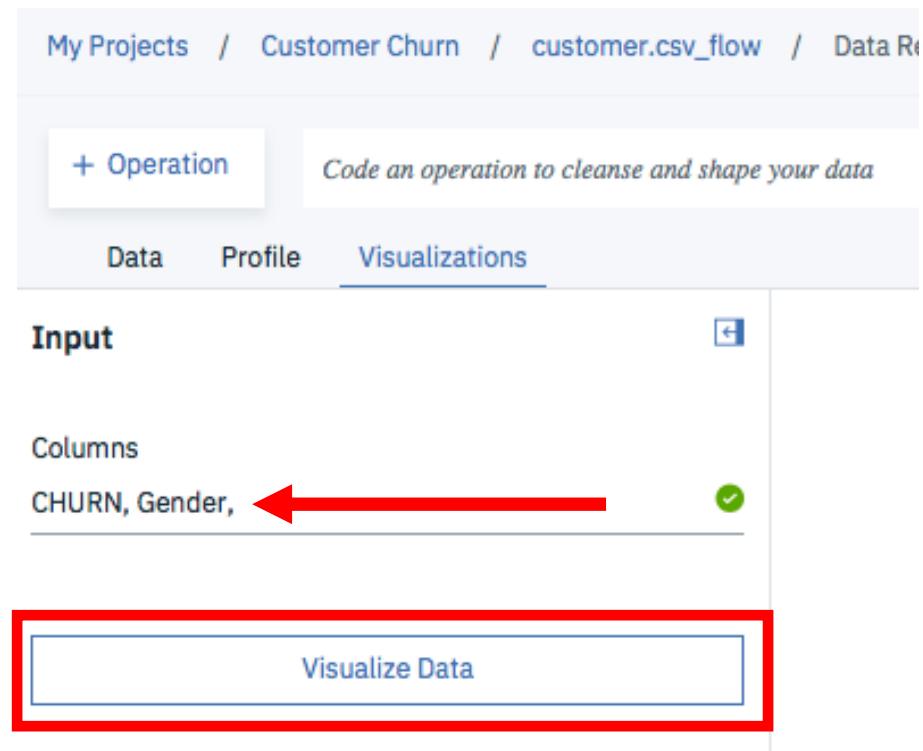
Input

Columns

Use commas to separate columns

Visualize Data

- Select **Churn** and **Gender** as the columns. Click **Visualize Data**



My Projects / Customer Churn / customer.csv_flow / Data Re

+ Operation *Code an operation to cleanse and shape your data*

Data Profile Visualizations

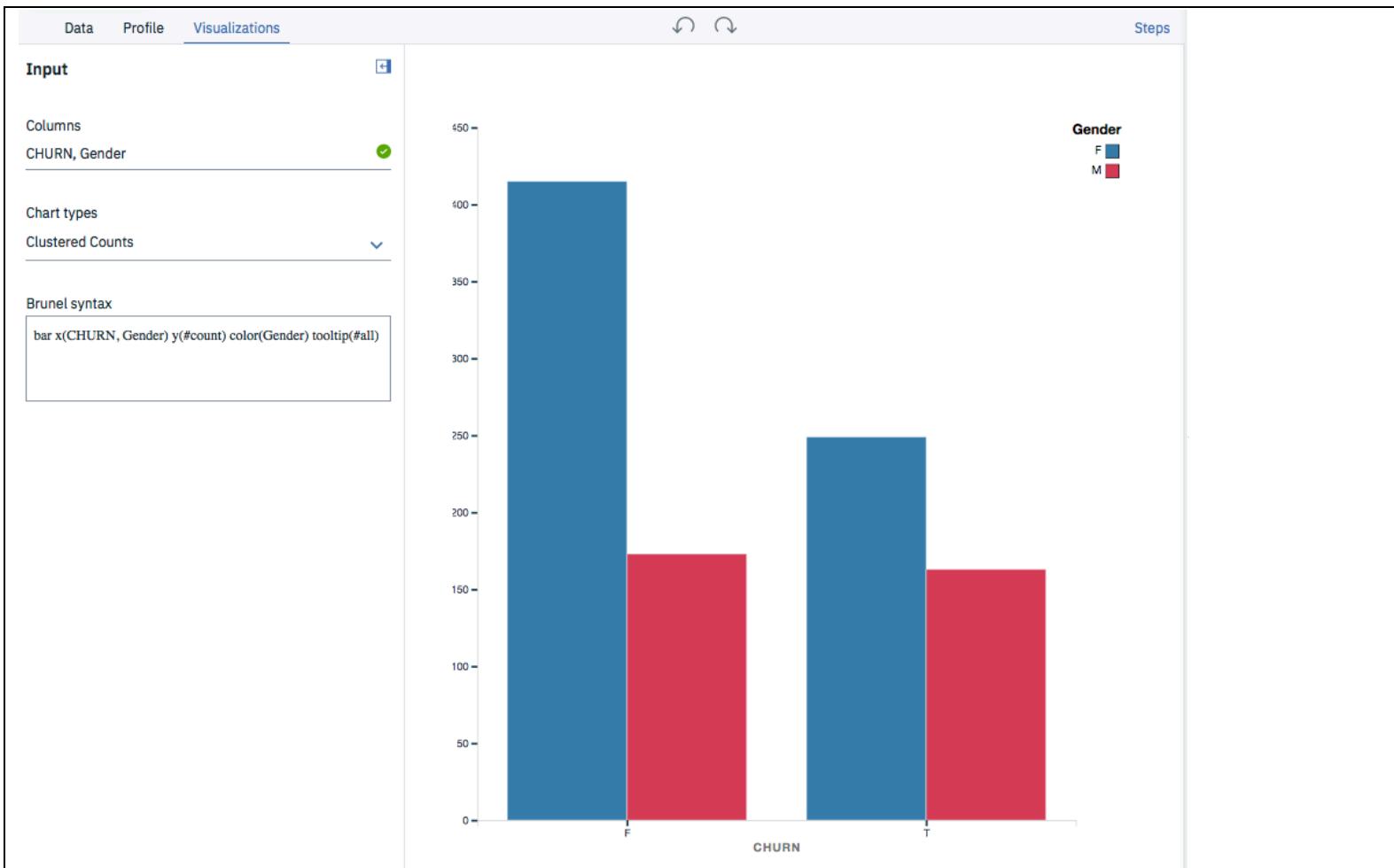
Input

Columns

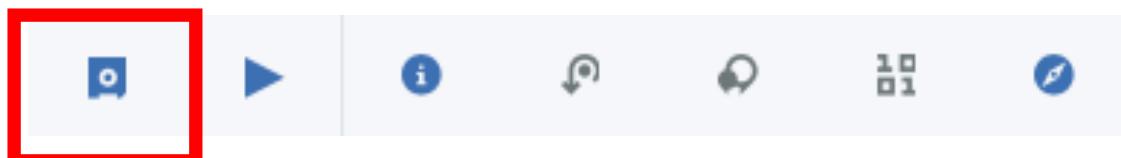
CHURN, Gender, 

Visualize Data

- Select **Clustered Counts** as the **Chart Types**. You should see the following. Notice the Brunel Syntax for the visualization is provided.



- Click the **Save icon** in the upper right to save the data flow



- Click the **Run icon** in the upper right to run the data flow. You should see the following.

The screenshot shows the IBM Watson Data Refinery interface. A red box highlights the play button icon in the top navigation bar. The main view displays 'Data flow details' and 'Data flow output' sections.

Data flow details:

- Name*: customer.csv_flow
- Enter a description of the data flow
- Steps: 3
- Project: Customer Churn
- Schedule: Add Schedule
- Required Fields*

Data flow output:

- Target name*: customer.csv_shape...
- Enter a description of the resulting data set.
- Customer Churn/ Data assets Change Location
- Select impact to existing data set: Recreate the data set
- Target File Format: CSV

Task:

- Under **Data flow output**, hover over the **target name** until the edit pencil appears. Change the target name to **customer_churn.csv**. Click **Apply** .

Details:

The 'Edit output' dialog is shown with two red arrows pointing to the 'Edit' button next to the target name field and the 'customer_churn.csv' input field.

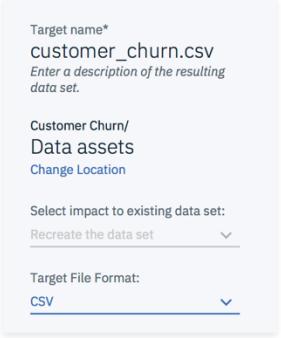
Data flow output (Left Panel):

- Target name*: customer....  
- Enter a description of the resulting data set.
- Customer Churn/ Data assets Change Location
- Select impact to existing data set: Recreate the data set
- Target File Format: CSV

Edit output Dialog (Right Panel):

- LOCATION * undefined/Data assets 
- DATA SET NAME * customer_churn.csv 
- DESCRIPTION Enter a description of the resulting data set.
- FILE FORMAT CSV 
- The first line of the file contains column headers

- Keep location as **Data assets**. You should now have the following. Click **Save and Run** in the lower right corner



Data flow details

Name*
customer.csv_flow
Enter a description of the data flow

Steps:
3

Project
Customer Churn

Schedule
Add Schedule

Required Fields*

Data flow output

Target name*
customer_churn.csv
Enter a description of the resulting data set.

Customer Churn/
Data assets
Change Location

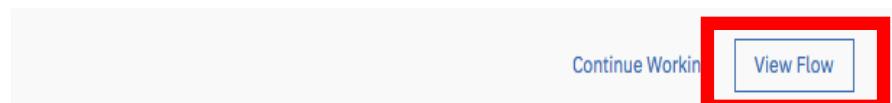
Select impact to existing data set:
Recreate the data set

Target File Format:
CSV

- Select **View Flow**, as the next step, to be redirected to the **Summary** page.

What's next?

Your data flow is currently running. You can view its progress on the Summary and Runs page. When the flow completes, you can view its output from there too.



Continue Working

View Flow

- Within a few seconds, the flow's status will indicate **Completed**. Select **Customer Churn** in the upper left to be taken back to your project workspace.

IBM Watson Projects Tools Catalog Community Services Refine Docs Support

My Projects / Customer Churn / customer.csv_flow

Summary Source Data flow Output

customer.csv 3 steps customer_churn.csv

Runs History Schedule

TIMESTAMP	STATUS	DURATION	ROWS READ / WRITTEN	SIZE
12 May 2018 - 08:19 am	Completed	13 sec	4132 / 2066	0.120 MB

- The [customer_churn.csv](#) file will now appear under [Data Assets](#)

IBM Watson Projects Tools Catalog Community Services Add to project

Overview Assets Environments Bookmarks Deployments Collaborators Settings

What assets are you looking for?

Data assets

0 assets selected.

NAME	TYPE	SERVICE	CREATED BY	LAST MODIFIED	ACTIONS
customer_churn.csv	Data Asset	Project	Loren Murphy	12 May 2018, 8:19:47 am	⋮
churn.csv	Data Asset	Project	Loren Murphy	11 May 2018, 11:04:45 pm	⋮
customer.csv	Data Asset	Project	Loren Murphy	11 May 2018, 11:04:22 pm	⋮

Lesson 3: Jupyter Notebook

Purpose:	This lesson introduces Jupyter notebooks and are used as part of a customer churn analysis using R.
Tasks:	<p>Tasks you will complete in this lab exercise include:</p> <ul style="list-style-type: none"> Add Notebook Asset Retrieve Data from External Repository Predict Customer Churn using Machine Learning

- | | |
|--|--|
| | <p>Techniques</p> <ul style="list-style-type: none">• Evaluate Model Performance |
|--|--|

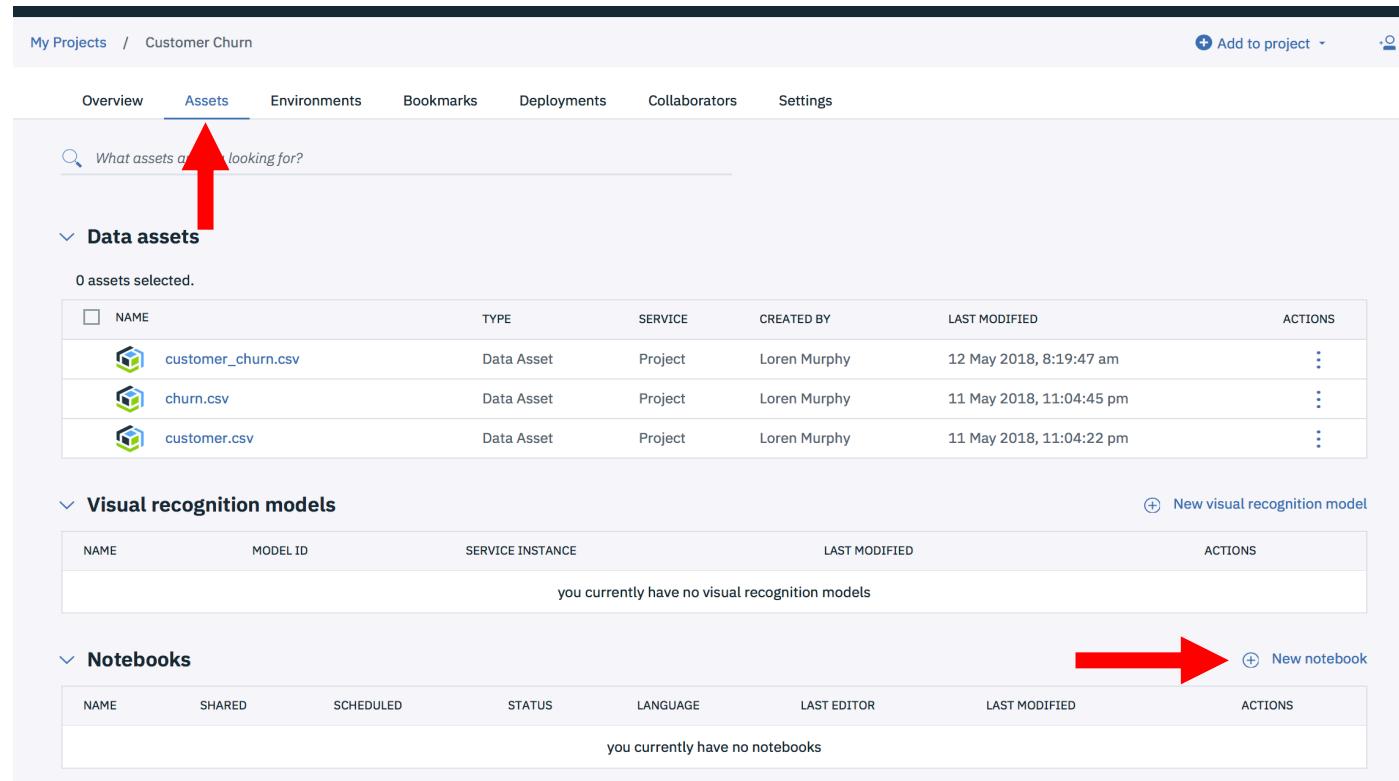
Lesson 3: Workflow Overview

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

Lesson 3: Instructions

1. Create Notebook

- Click **Assets**, then **New Notebook**



My Projects / Customer Churn + Add to project

Overview Assets Environments Bookmarks Deployments Collaborators Settings

What assets are you looking for?

Data assets

0 assets selected.

NAME	TYPE	SERVICE	CREATED BY	LAST MODIFIED	ACTIONS
customer_churn.csv	Data Asset	Project	Loren Murphy	12 May 2018, 8:19:47 am	⋮
churn.csv	Data Asset	Project	Loren Murphy	11 May 2018, 11:04:45 pm	⋮
customer.csv	Data Asset	Project	Loren Murphy	11 May 2018, 11:04:22 pm	⋮

Visual recognition models

+ New visual recognition model

NAME	MODEL ID	SERVICE INSTANCE	LAST MODIFIED	ACTIONS
you currently have no visual recognition models				

Notebooks

+ New notebook

NAME	SHARED	SCHEDULED	STATUS	LANGUAGE	LAST EDITOR	LAST MODIFIED	ACTIONS
you currently have no notebooks							

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

New notebook

Blank From file From URL

Name*

Customer Churn - R

32 Characters Remaining

Description

Customer churn analysis using R.

468 Characters Remaining

- In a separate browser window navigate to:

[Machine Learning for Customer Churn](#)

<https://github.com/team-wolfpack/Predicting-Customer-Churn-with-Watson-Data-Platform>

- Click on **Notebooks**, right click on **Customer Churn-R.ipynb** then choose **Copy link address**. Go back to the **Watson Studio New Notebook** page.

Paste URL into **Notebook URL** text box. Select **Default R Environment XS (2 vCPU and 8GB RAM)** as the runtime. Then click **Create Notebook**:

Notebook URL*

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

Select runtime* Includes notebook environments [\(i\)](#)

Default R Environment XS (2 vCPU and 8 GB RAM)

The selected Runtime has 2 vCPU and 8 GB RAM and consumes 1 capacity units per hour.

[Learn more about capacity unit hours and Watson Studio pricing plans.](#)

- You should now see:

The screenshot shows a Jupyter Notebook interface with the following details:

- Header:** My Projects / Customer Churn / Customer Churn - R
- Toolbar:** File, Edit, View, Insert, Cell, Kernel, Help, Trusted | R | O | F
- Format Bar:** Includes icons for code, cell, file, etc., and dropdowns for Run, Format, and Markdown.
- Content:**
 - Section Header:** IBM WolfPack
 - Image:** A black silhouette of a wolf's head inside a circle.
 - Text:** Predicting Customer Churn with Watson Studio

- Scroll down in the notebook until **Step 3: Read Customer_Churn Data into R Dataframe / Simple Analysis**. Click on the notebook cell.

Step 3: Read Customer_Churn Data into R Dataframe / Simple Analysis

```
# Insert customer_churn.csv file into code HERE!!!
```

- Click on the **Data Icon** in the upper right corner. Under the **Files** tab, click the **Insert to code** dropdown for **customer_churn.csv** file. Select **Insert R DataFrame**.

IBM Watson Projects Tools Catalog Community Services Docs Support Manage LM

My Projects / Customer Churn / Customer Churn

File Edit View Insert Cell Kernel Help Not Trusted | R O

set.seed(3842)

Step 3: Read Customer_Churn Data into R Dataframe / Simple Analysis

In [2]: # Insert customer_churn.csv file into code HERE!!

In [16]: # Primary data set row count
cat(sprintf("[custDataRaw] has %d rows:\n", nrow(custDataRaw)))
[custDataRaw] has 2066 rows:

In [17]: # Summary Stats for entire data set
summary(custDataRaw)

Files Connections

Drop your file here or browse your files to add a new file

churn.csv
Insert to code

customer.csv
Insert to code

customer_churn.csv
Insert to code

Insert R DataFrame

Insert Credentials

• The R DataFrame code is automatically generated and should now appear within the notebook cell

Step 3: Read Customer_Churn Data into R Dataframe / Simple Analysis

```
# Insert customer_churn.csv file into code HERE!!!
library("aws.s3")

# @hidden_cell
# The following code accesses a file in your IBM Cloud Object Storage. It includes your credentials.
# You might want to remove those credentials before you share your notebook.
Sys.setenv("AWS_ACCESS_KEY_ID" = "e1428a9a59da4701a9a6dba582ec95a0", "AWS_SECRET_ACCESS_KEY" = "d0594edbaba71cafccff929835fafaf08a1030bdclf457a4ab")
url <- "s3-api.us-geo.objectstorage.service.networklayer.com"
bucket <- "customerchurn-donotdelete-pr-sbl2y1mzd0umgn"
headers <- list(`x-amz-content-sha256`="e3b0c44298fc1c149afbf4c8996fb92427ae41e4649b934ca495991b7852b855")

obj <- s3HTTP(
  verb = "GET",
  bucket = bucket,
  headers = headers,
  path = "data_asset/customer_churn_N6zh3vK5T46YBzOyFOx5lw.csv",
  key = Sys.getenv("AWS_ACCESS_KEY_ID"),
  secret = Sys.getenv("AWS_SECRET_ACCESS_KEY"),
  check_region = FALSE,
  base_url = url)

df.data.1 <- read.csv(text = rawToChar(obj$content))
head(df.data.1)
```

• Change the name of the R DataFrame from df.data.1 to **custDataRaw**. It should look like the following

```
custDataRaw <- read.csv(text = rawToChar(obj$content))
head(custDataRaw)
```

- Your final notebook cell should look like the following. The Object Storage connection information will be different. Run the cell to view the first few rows of data.

Step 3: Read Customer_Churn Data into R Dataframe / Simple Analysis

```
# Insert customer_churn.csv file into code HERE!!!
library("aws.s3")

# @hidden_cell
# The following code accesses a file in your IBM Cloud Object Storage. It includes your credentials.
# You might want to remove those credentials before you share your notebook.
Sys.setenv("AWS_ACCESS_KEY_ID" = "e1428a9a59da4701a9a6dba582ec95a0", "AWS_SECRET_ACCESS_KEY" = "d0594edbaba71cafccff929835fafa08a1030bdclf457a4ab")
url <- "s3-api.us-geo.objectstorage.service.networklayer.com"
bucket <- "customerchurn-donotdelete-pr-sbl2yimzd0umqm"
headers <- list(`x-amz-content-sha256` = "e3b0c44298fc1c149afbf4c8996fb92427ae41e4649b934ca495991b7852b855")

obj <- s3HTTP(
  verb = "GET",
  bucket = bucket,
  headers = headers,
  path = "data_asset/customer_churn_N6zH3vK5T46YBzOyFOx5lw.csv",
  key = Sys.getenv("AWS_ACCESS_KEY_ID"),
  secret = Sys.getenv("AWS_SECRET_ACCESS_KEY"),
  check_region = FALSE,
  base_url = url)

custDataRaw <- read.csv(text = rawToChar(obj$content))
head(custDataRaw)
```

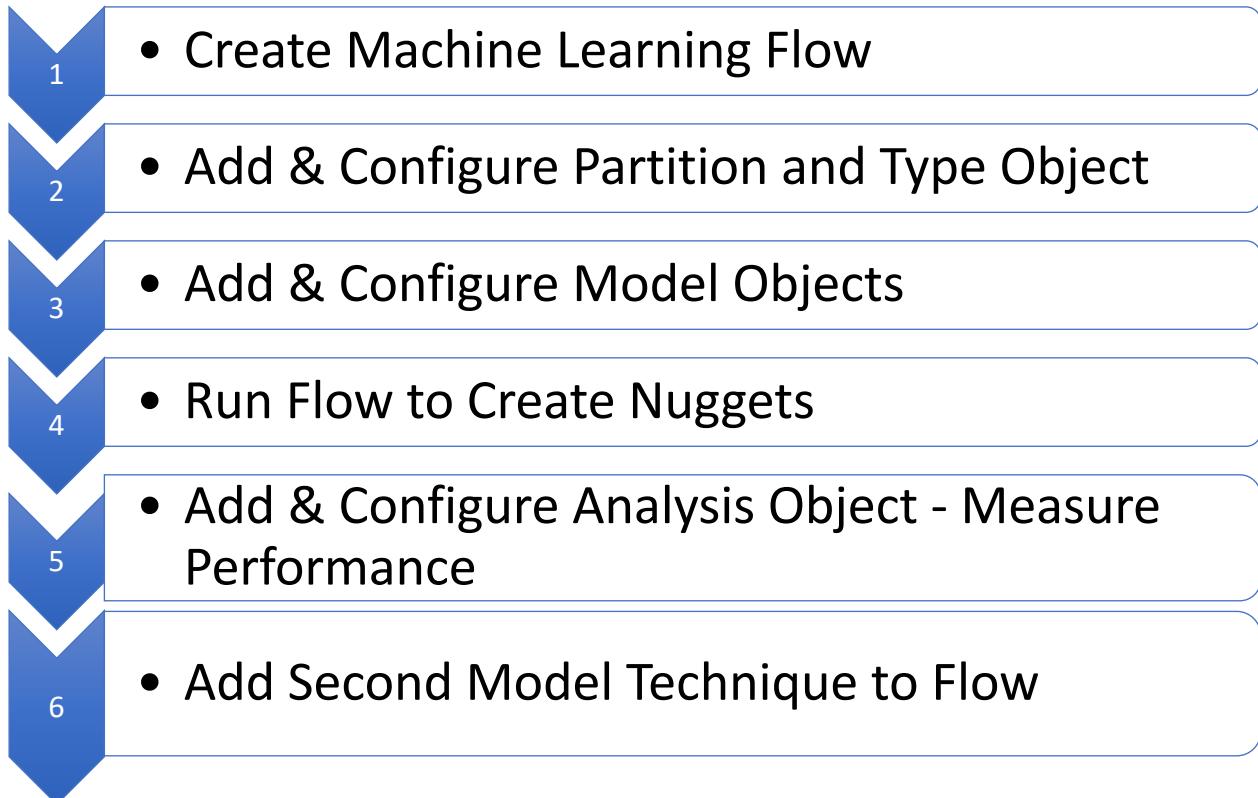
ID	Gender	Status	Children	Est.Income	Car.Owner	Age	LongDistance	International	Local	Dropped	Paymethod	LocalBilltype	LongDistanceBilltype	Usage	RatePlan	CHURN
1	F	S	1	38000.00	N	24.39333	23.56	0	206.08	0	CC	Budget	Intl_discount	229.64	3	TRUE
1003	F	M	0	55221.00	N	43.00000	0.49	0	15.20	0	CC	FreeLocal	Standard	15.69	1	FALSE
1004	F	M	1	8073.11	N	46.00000	28.70	0	60.35	0	Auto	FreeLocal	Standard	89.05	4	FALSE
1018	F	S	0	95786.80	Y	52.64667	21.33	0	87.46	0	CC	Budget	Standard	108.79	1	FALSE
1020	M	S	0	90321.60	N	55.11333	0.87	0	11.52	0	CC	FreeLocal	Intl_discount	12.39	3	TRUE
1030	M	M	2	29616.00	N	49.42667	29.78	0	45.50	0	CH	FreeLocal	Standard	75.29	4	FALSE

Lesson 3 Continued in [Customer Churn – R] Notebook

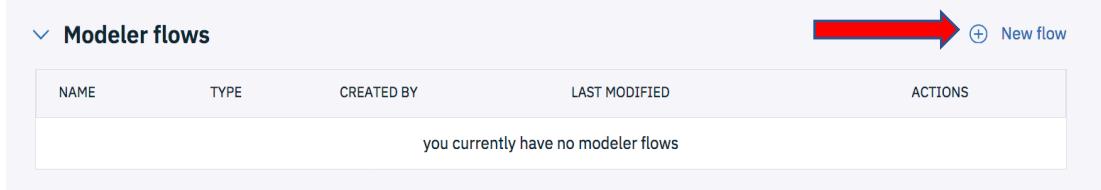
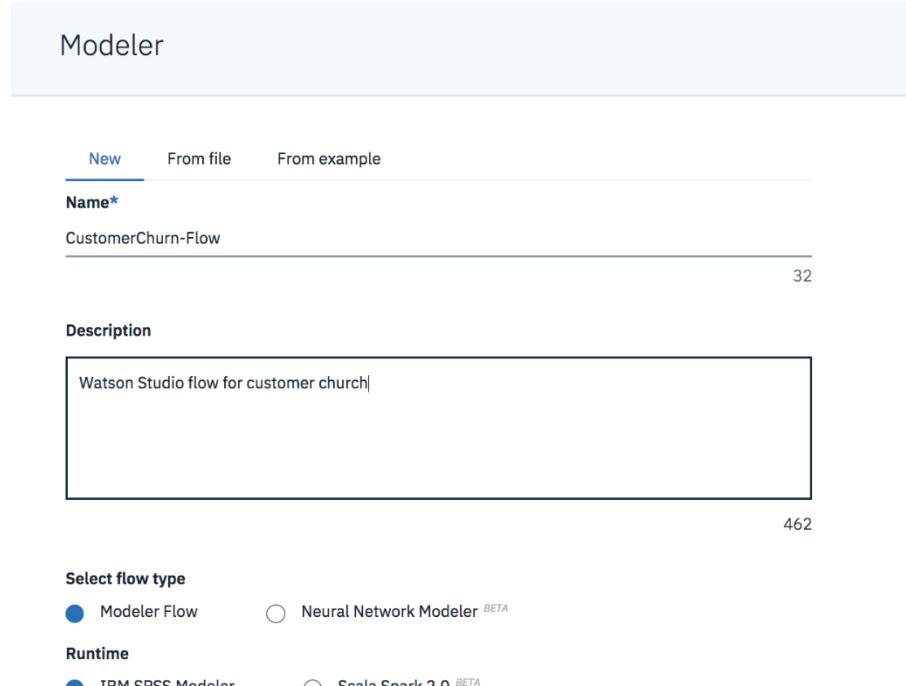
Lesson 4: Machine Learning Flows

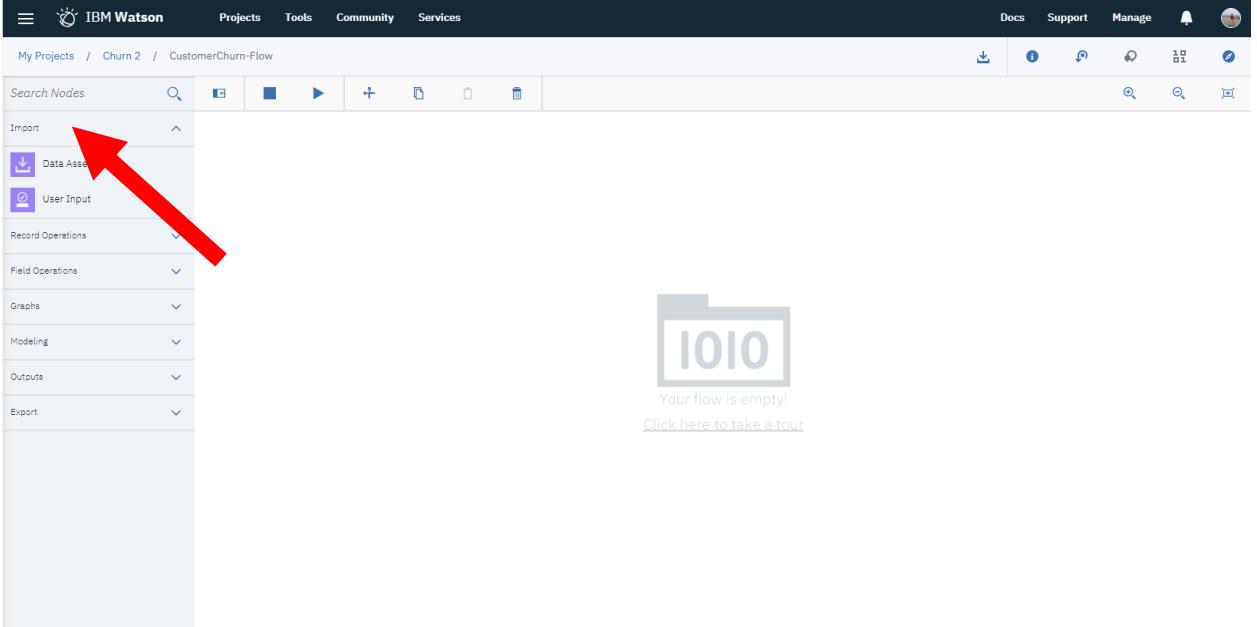
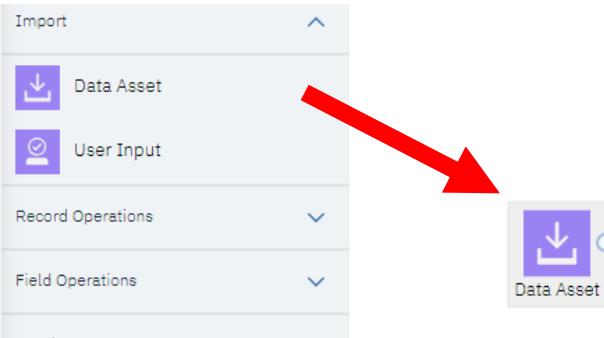
Purpose:	This lesson introduces Machine Learning Flows in Watson Studio. Flows provide a graphical approach to machine learning like that of SPSS Modeler.
Tasks:	Tasks you will complete in this lab exercise include: <ul style="list-style-type: none">• Create Machine Learning Flow• Import Data• Leverage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

Lesson 4: Workflow Overview



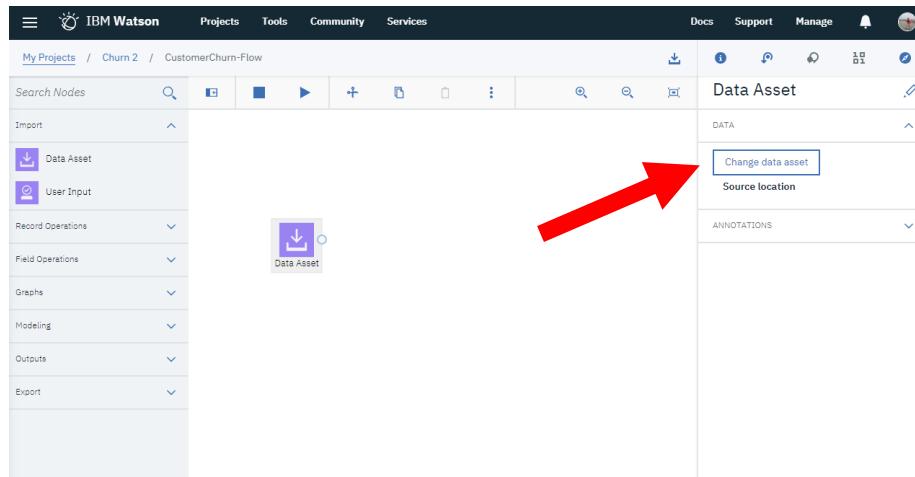
Lesson 4: Instructions

Action
1. Create Machine Learning Flow
<ul style="list-style-type: none"> • Navigate to Customer Churn project page • Click on “New flow” 
<ul style="list-style-type: none"> • Choose “New” on the top menu. Give the flow a meaningful name and description. For “Flow Type” choose “Modeler Flow”. For “Runtime” choose “IBM SPSS Modeler”: 
<ul style="list-style-type: none"> • Click on “Create”

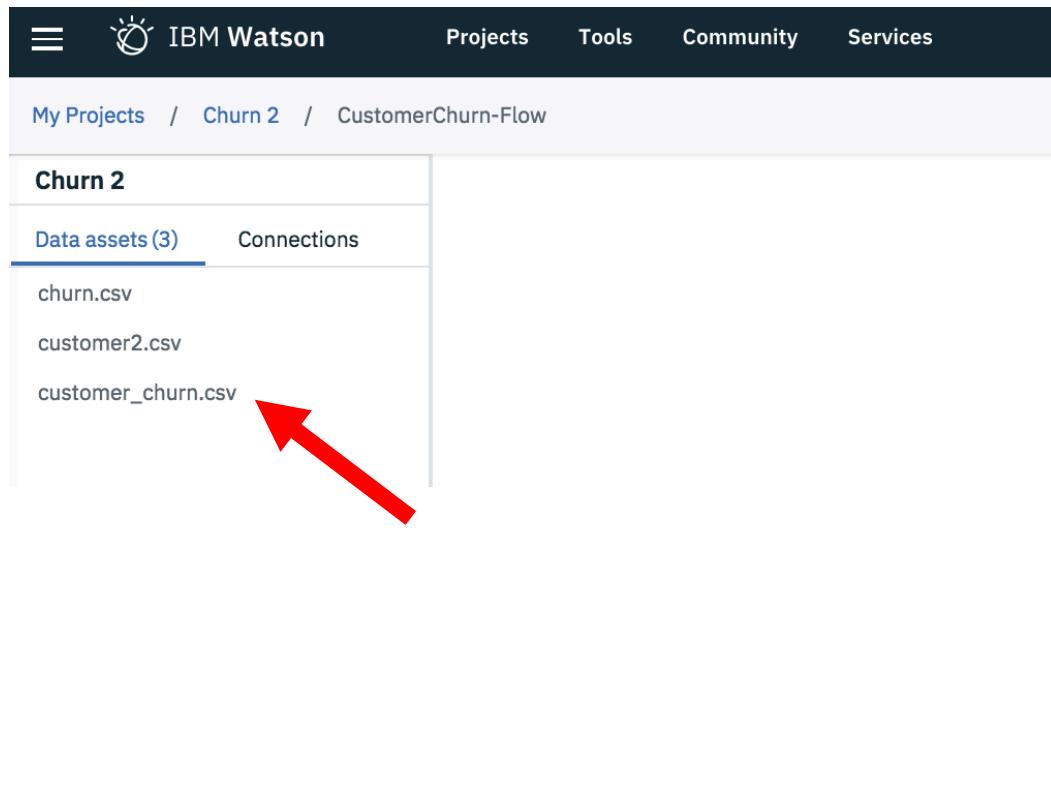
Action
3. Add Data Asset
You should now see an empty workspace.
<ul style="list-style-type: none"> On the top left click on the “Palette” icon, then click on the “Import” the icon. 
The palette represents the set of tools available for use with Watson Studio flows. The menu of the right should look familiar.
<ul style="list-style-type: none"> Let's start by dragging and dropping the “Data Asset” node onto the workspace. 

Action

- Double click on the “**Data Asset**” node. In the top right-hand corner click on the “**Change data asset**” icon.



- At the next dialog click on the “Data assets” icon. Choose the “customer_churn.csv” file then click on OK to select that dataset then “Save”.



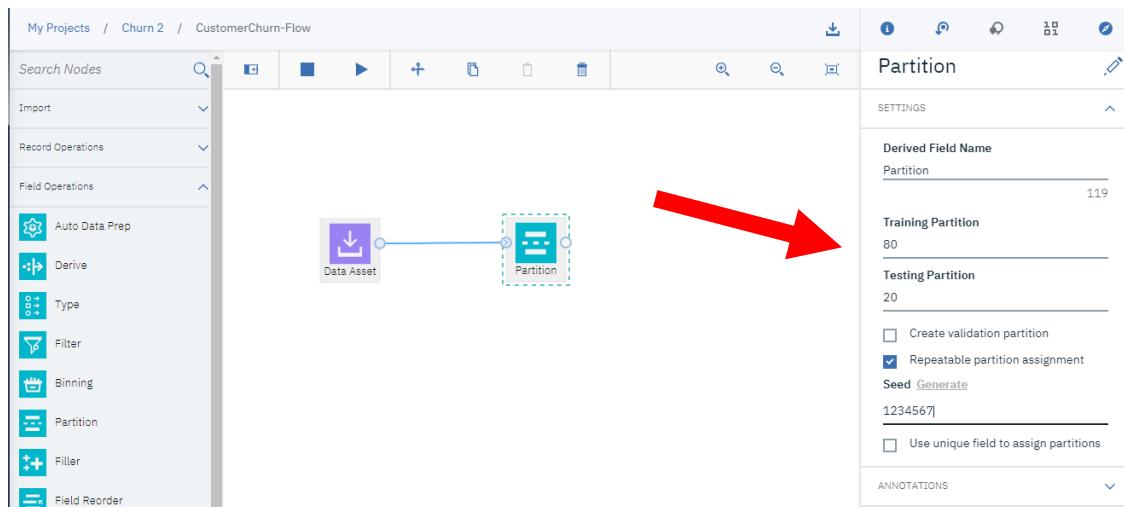
Action

3. Add & Configure Partition and Type Object

- From the palette, expand “**Field Operations**”, then drag and drop “**Partition**” onto the workspace and to the right of “Data Asset”. Connect the two objects:



- Double click on “**Partition**” then “**Settings**”.
- Set “**Training Partition**” to 80 and “**Testing Partition**” to 20. Click on Save.



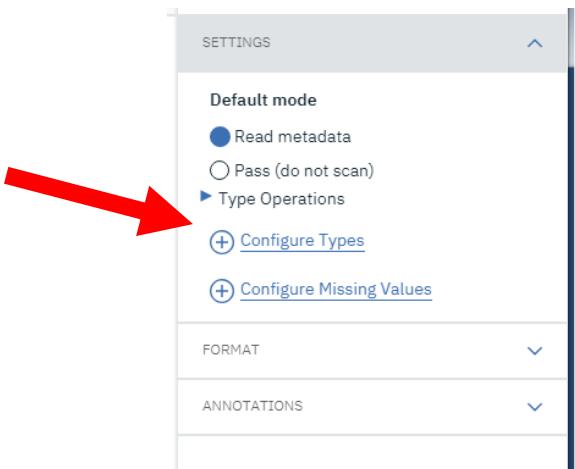
Partition	
SETTINGS	
Derived Field Name Partition	
119	
Training Partition 80	
Testing Partition 20	
<input type="checkbox"/> Create validation partition <input checked="" type="checkbox"/> Repeatable partition assignment Seed <input type="text" value="1234567"/> <input type="checkbox"/> Use unique field to assign partitions	
ANNOTATIONS	

- Next, drag and drop a “**Type**” node onto the canvas. Connect it to the “**Partition**” node.

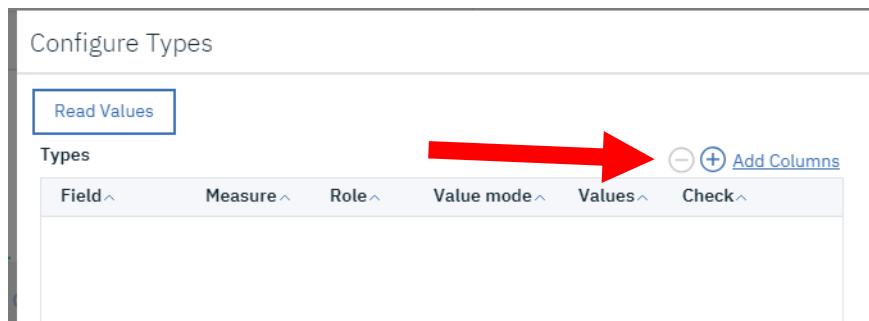


Action

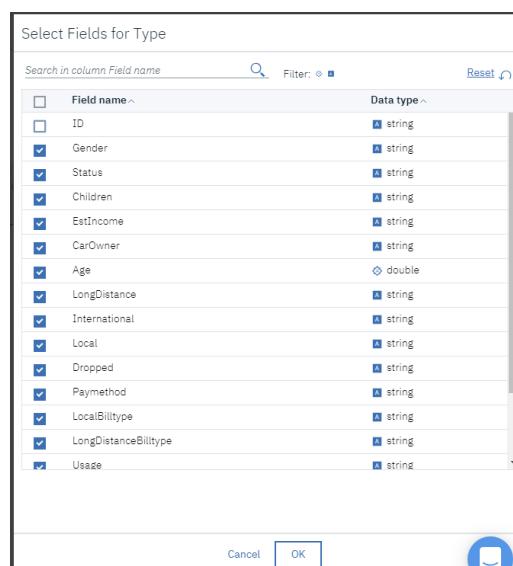
- Double click on “Type”. On the top right click on “Configure Types”:



- Click on “Add Columns”:



- Choose all of the fields except for “ID” then click on OK.



Action

- For the “**CHURN**” column, change its Role to that of “**Target.**” Leave the default for the remaining columns:

Configure Types

Read Values

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	...

(-) (+) Add Columns



- Click “**OK**”.
- Click “**Save**” to exit

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”

Action

CHURN

Use custom field roles

Target
CHURN

Inputs (-) (+) Add Columns

ID
Gender
Status
Car Owner

• Click on “Save.”

MODEL OPTION

ANNOTATIONS

Cancel Save

• Your palette should resemble this:

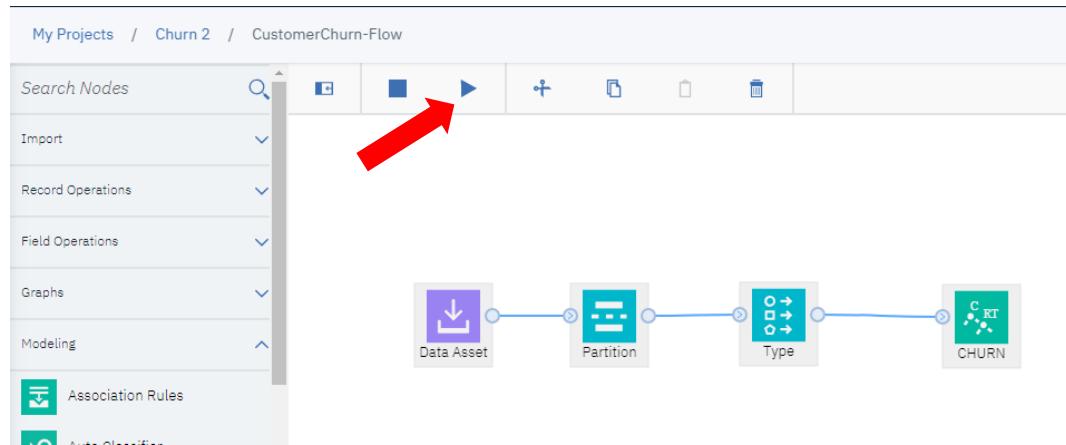
```

graph LR
    DA[Data Asset] --> P[Partition]
    P --> T[Type]
    T --> CHURN[CHURN]
  
```

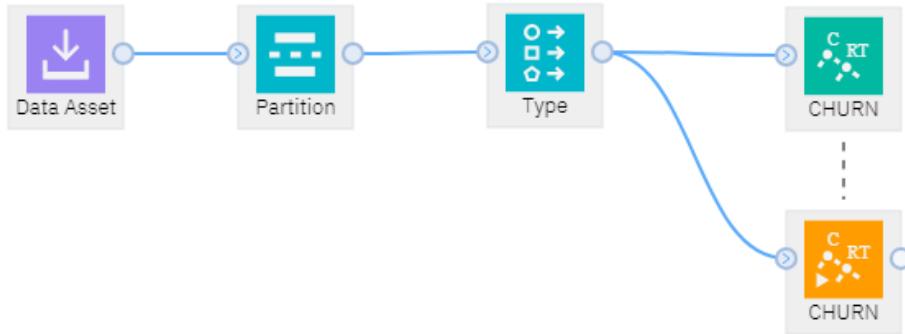
Action

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.

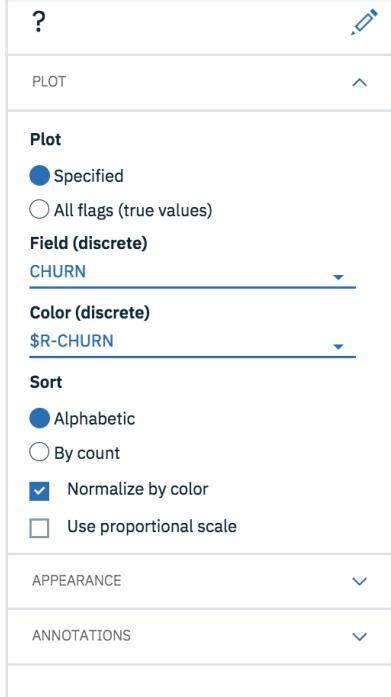


6. Add & Configure Analysis Object – Measure Model Performance

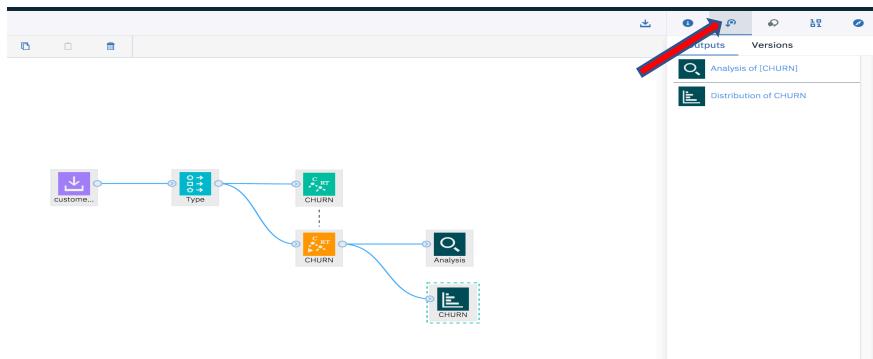
- From the palette add an “**Analysis**” object to the workspace, you will find it under the “Outputs” drop down. Also, from the “Graphs” drop down add a “**Distribution**” object to the workspace. Connect the nugget to each of them:

Action
<pre> graph LR DA[Data Asset] --> P[Partition] P --> T[Type] T --> CHURN1[CHURN] T --> CHURN2[CHURN] CHURN1 -.-> CHURN2 CHURN1 --> A[Analysis] CHURN2 --> A </pre>
<ul style="list-style-type: none"> Double click on “Analysis” and check off the four checkboxes, leave the rest as default:
<ul style="list-style-type: none"> Click “Save” to return to the workspace. Double click on the “Distribution” object and configure it as depicted below:

Action



- 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

End of Lesson 4

Lesson 5: 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:	Tasks you will complete in this lab exercise include: <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 5: Workflow Overview

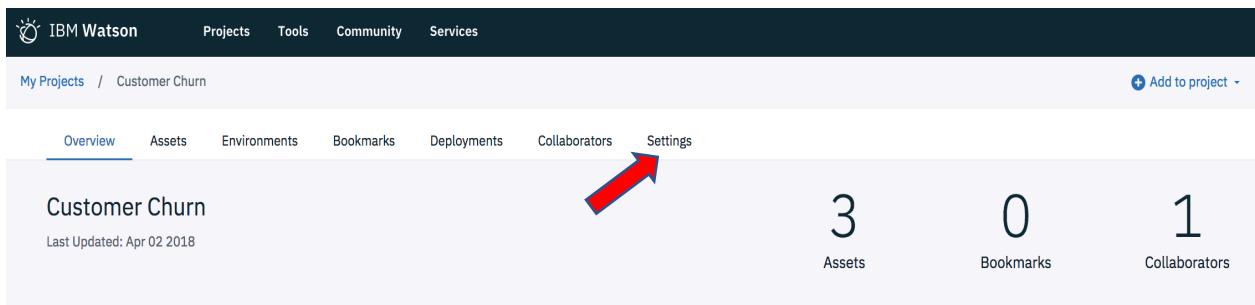
- 1 • Create Machine Learning Service
- 2 • Create Machine Learning Model
- 3 • Choose Modeling Technique
- 4 • Add Estimators
- 5 • Evaluate Models
- 6 • Save & Deploy Model
- 7 • Predict with Model

Lesson 5: Instructions

Action

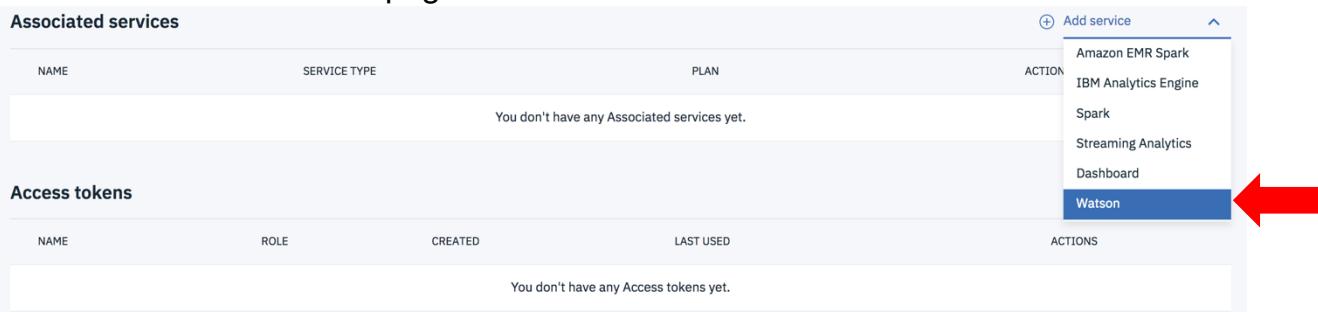
1. Create Machine Learning Service

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



The screenshot shows the 'Customer Churn' project page. At the top, there's a navigation bar with links for 'IBM Watson', 'Projects', 'Tools', 'Community', and 'Services'. Below the navigation bar, the project name 'Customer Churn' is displayed along with its last update date ('Apr 02 2018'). The main area shows summary statistics: 3 Assets, 0 Bookmarks, and 1 Collaborator. Below these stats, there are sections for 'Date created' (Apr 02 2018) and 'Recent activity'. A red arrow points to the 'Settings' icon in the top navigation bar.

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



The screenshot shows the 'Associated services' section. It includes tables for 'Associated services' and 'Access tokens', both of which are currently empty. To the right, a dropdown menu titled '+ Add service' is open, listing several service options: 'Amazon EMR Spark', 'IBM Analytics Engine', 'Spark', 'Streaming Analytics', 'Dashboard', and 'Watson'. The 'Watson' option is highlighted with a blue background and a red arrow points to it.

- Click “**Add**” under “**Machine Learning**”

Action

 Discovery Unlock hidden value in data to find answers, monitor trends and surface patterns with the world's most advanced machine learning. Add	 Knowledge Studio Build custom models to teach Watson the language of your domain. Add	 Language Translator Translate text from one language to another, adapt translation models to your custom domain. Add
 Machine Learning IBM Watson Machine Learning - make smarter decisions, solve tough problems, and improve user outcome. Add	 Natural Language Classifier Natural Language Classifier performs natural language classification on question texts. A user would be able Add	 Natural Language Understanding Analyze text to extract meta-data from content such as concepts, entities, emotion, relations, sentiment. Add

- 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.

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

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.

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

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

Action

- 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

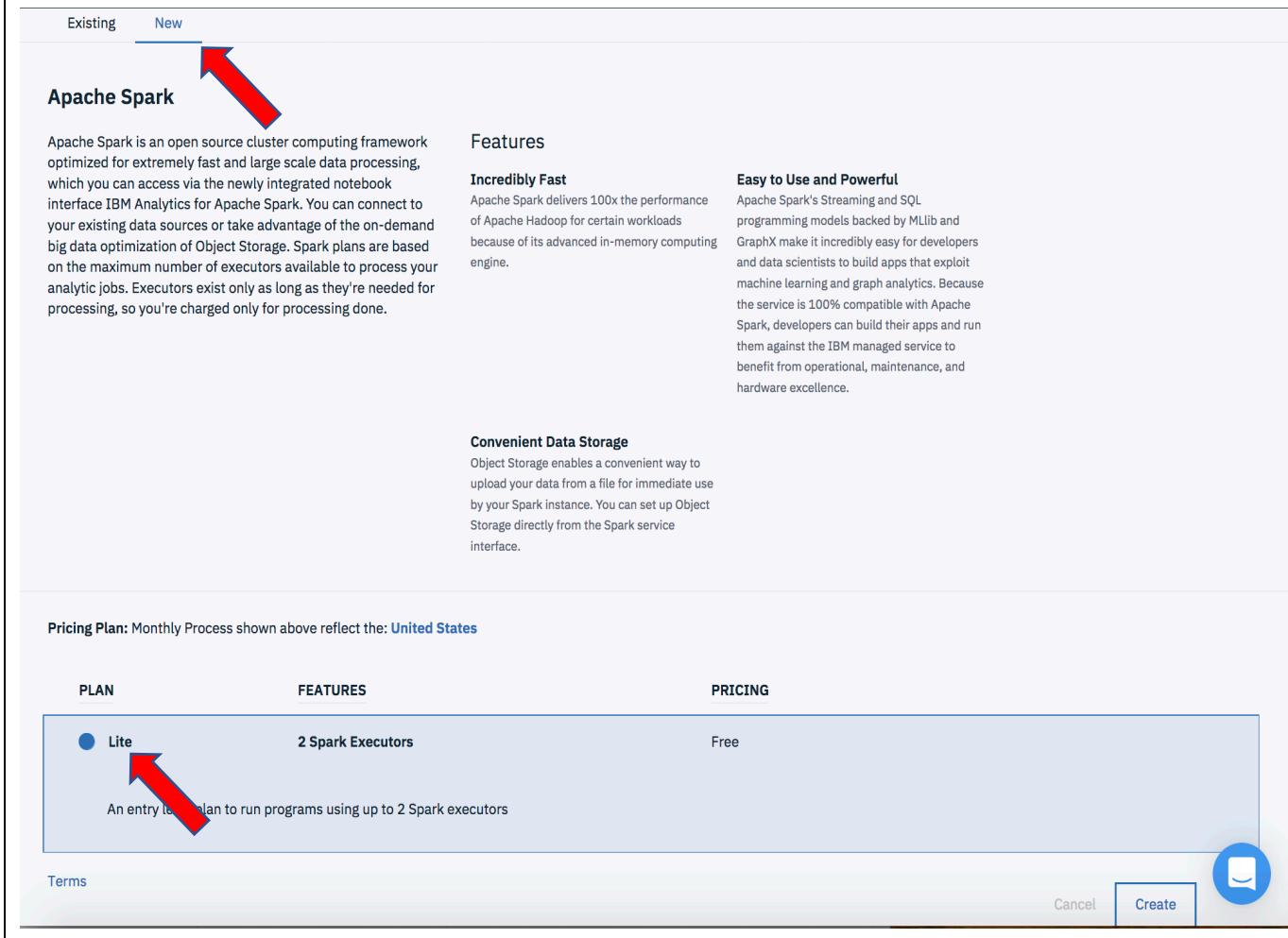
- Click “**Confirm**” to create Watson Machine Learning Service.

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**”:

Action

• In the “New model” window, associate an **IBM Analytics for Apache Spark instance**. On the Machine Learning page make sure that the tab is set to “**New**”, for the plan choose “**Lite**”. Select **Create**.

Pricing Plan: Monthly Process shown above reflect the: [United States](#)

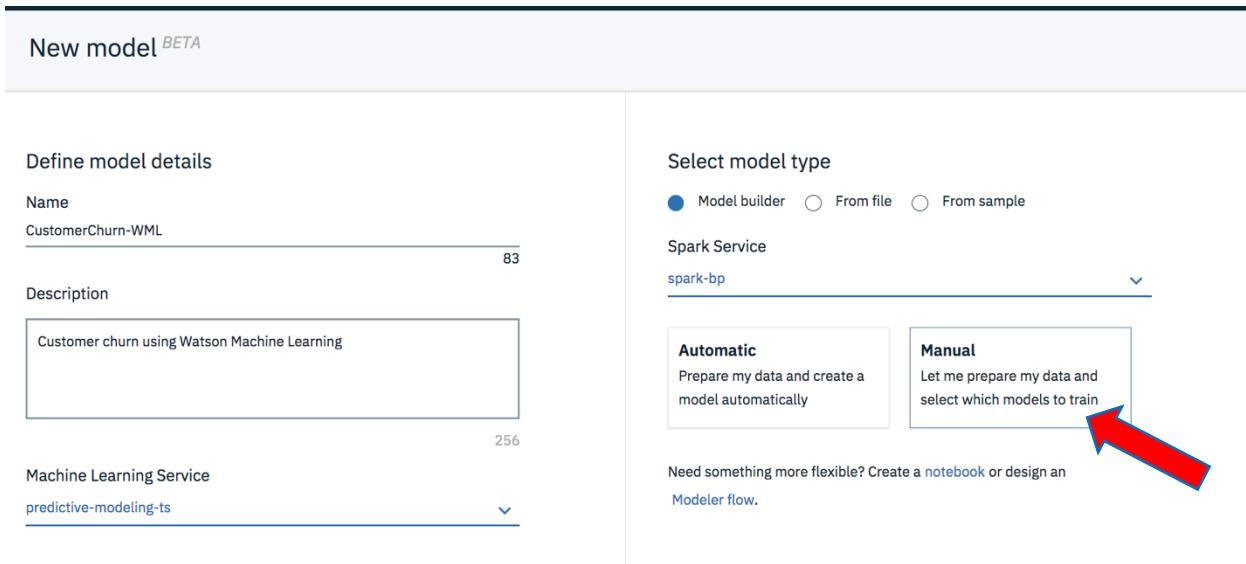
PLAN	FEATURES	PRICING
<input checked="" type="radio"/> Lite	2 Spark Executors An entry level plan to run programs using up to 2 Spark executors	Free

Cancel Create 

• At the confirmation page you can give your service a meaningful name. Click **Confirm**

Action

- In the “New model” window give your model a meaningful name and description, you should also see the machine learning service and spark 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
predictive-modeling-ts

Select model type

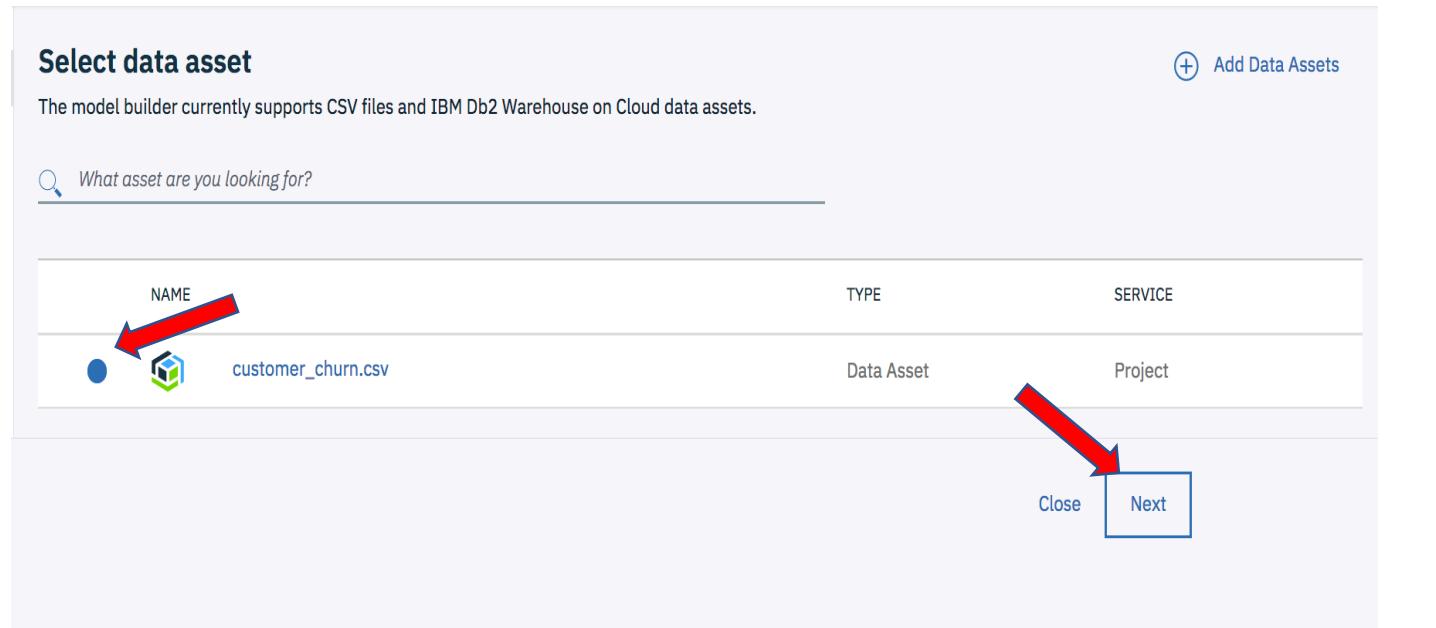
Spark Service
spark-bp

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 [Modeler flow](#).

- 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

Close Next

Action

3. Choose Modeling Technique

- At the “**Select a Technique**” screen select “**CHURN**” as the “**Column value to predict**”, and select the following feature columns: Gender, Status, Children, Est Income, Car Owner, Paymethod, LongDistanceBilltype, Usage, RatePlan
- Make sure “**Binary Classification**” is highlighted.

Select a technique

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

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

 Suggested technique.

 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**:

Action

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...

Cancel

Add

- Click “Add”

Action

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

Gender (String), Status (String), Children (Decimal), Est Income (Decimal), C

Suggested technique.

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.

Add Estimators

Configured estimators

	Decision Tree Classifier	
	Random Forest Classifier	

Not Yet Trained

Validation Split



[Close](#) [Previous](#) [Next](#)

- 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	0.94129	0.91694	3 Apr 2018, 10:28 AM
<input checked="" type="radio"/>	DecisionTreeClassifier	Trained & Evaluated	Excellent	0.90718	0.86968	3 Apr 2018, 10:28 AM

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

6. Save & Deploy Model

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

Action															
	CustomerChurn-WML  Overview Evaluation Deployments Summary <table border="1"> <tr><td>Machine learning service</td><td>predictive-modeling-ts</td></tr> <tr><td>Model Type</td><td>wml-1.1</td></tr> <tr><td>Runtime environment</td><td>spark-2.0</td></tr> <tr><td>Training date</td><td>3 Apr 2018, 10:30 AM</td></tr> <tr><td>Label column</td><td>CHURN</td></tr> <tr><td>Latest version</td><td>3bc1d323-ab9a-40d4-8d72-0728d7e3ea0d</td></tr> <tr><td>Model builder details</td><td>View</td></tr> </table> Input Schema	Machine learning service	predictive-modeling-ts	Model Type	wml-1.1	Runtime environment	spark-2.0	Training date	3 Apr 2018, 10:30 AM	Label column	CHURN	Latest version	3bc1d323-ab9a-40d4-8d72-0728d7e3ea0d	Model builder details	View
Machine learning service	predictive-modeling-ts														
Model Type	wml-1.1														
Runtime environment	spark-2.0														
Training date	3 Apr 2018, 10:30 AM														
Label column	CHURN														
Latest version	3bc1d323-ab9a-40d4-8d72-0728d7e3ea0d														
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
Your model is not deployed.  + Add Deployment		

- For deployment type choose “**Web Service**” then give the deployment a useful name:

Action

Create Deployment

[Web Service](#)

[Batch Prediction](#)

[Real-time Streaming Predictions](#)

Name

CustChurnRandForestDeployed

Description

Deployed Random Forests model to predict customer churn|

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- Click “[Save](#)”

7. Predict with Model

- Choose newly created deployed model:

CustomerChurn-WML

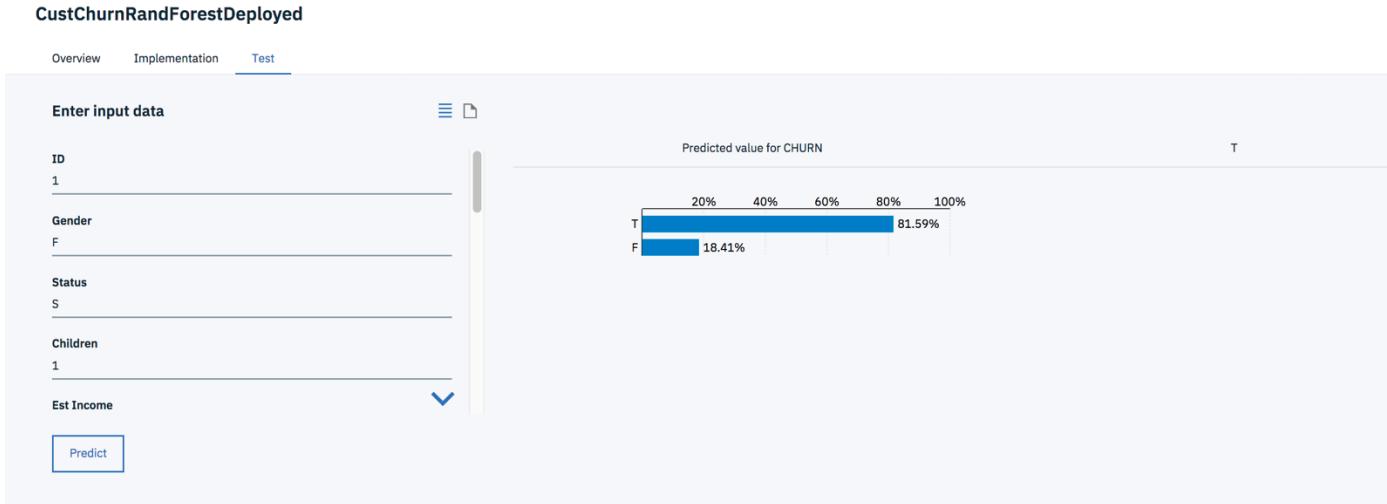
Overview	Evaluation	Deployments	
		<div style="display: flex; align-items: center;"> NAME CustChurnRandForestDeployed ↗ Add Deployment </div>	STATUS DEPLOY_SUCCESS

- Click on “[Test](#)” to test the model.

Open the `customer_churn.csv` from your local computer (it will be located where you expanded the `customer_churn_data.zip` file). Use a row in the file as an example of values to provide to the test

Action

form. Click “**Predict**” to return results. Adjust the values and submit again to see different outcomes. The results will look similar to below:



End of Lesson 5

End of Hands-on Workshop

Thank You