

Data Refinery Lab

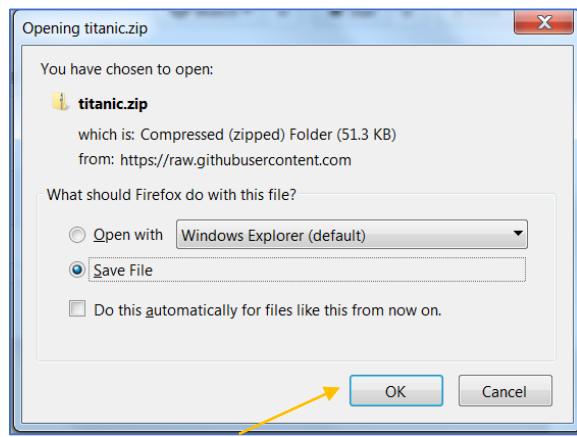
This lab will use the Titanic data set to demonstrate data profiling, data visualization, and data preparation capabilities of the Data Refinery tool. The lab consists of the following steps:

1. Use the Data Refinery Tool to:
 - a. Profile the data to help determine missing values
 - b. Visualize the data to gain a better understanding
 - c. Prepare the data for modeling
 - d. Run the sequence of data preparation operations on the entire data set.


Step 1: Adding a Data Asset to the Watson Studio Labs project

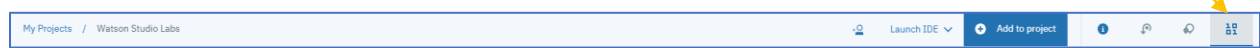
This step can be skipped if the [Titanic Data](#) was already downloaded in a previous lab.

1. Download the Titanic data file from the following location by clicking on the link [Titanic Data](#).
2. Click on the **OK** button in the pop-up dialog.

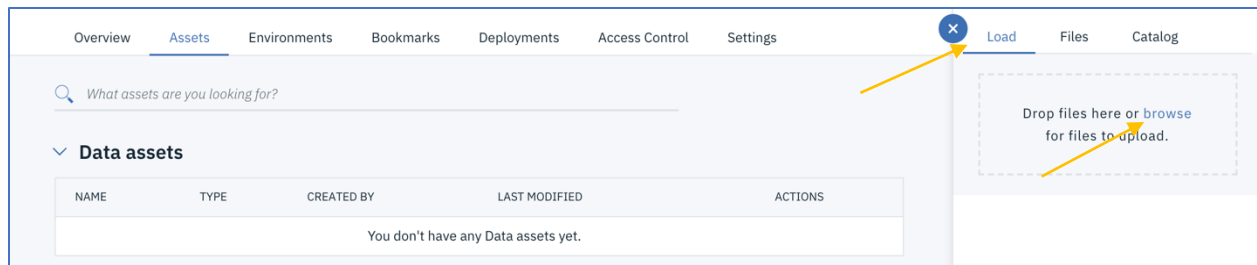


3. Navigate to the directory where the file has been downloaded. Unzip the titanic.zip file. There should be two files (1) titanic_cleansed.csv and (2) titanic.csv. You will use the **titanic.csv** for this lab.

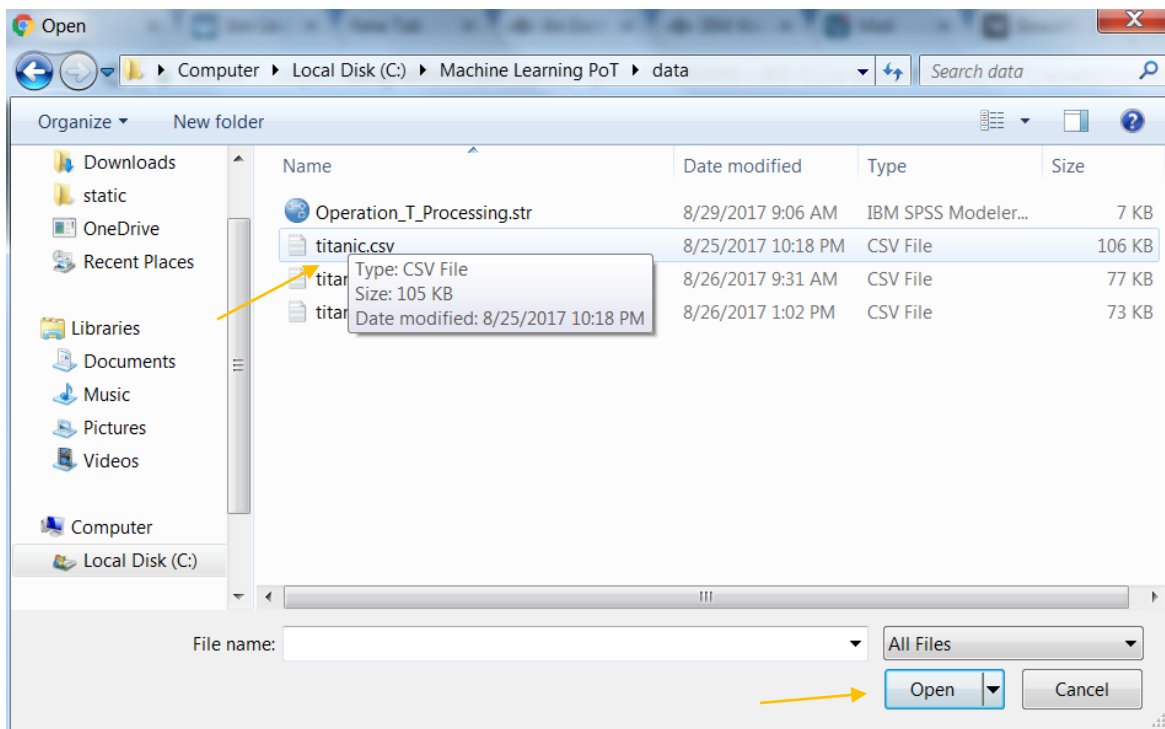
4. Go back to your Watson Studio Labs project. Click on the  icon.



5. Click on the **Load** tab and then click on **browse**.



- Go to the folder where the titanic_csv file is stored. Select the titanic.csv file and then click **Open**.

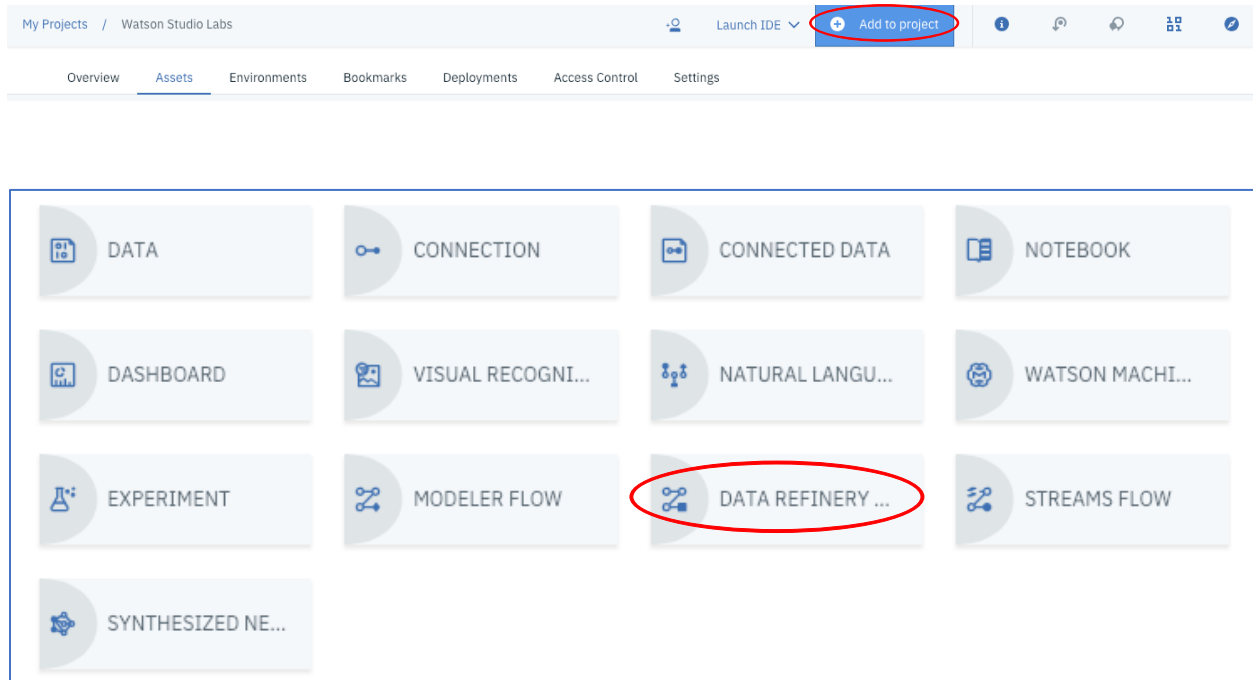


- The file is now added as a Data Asset.

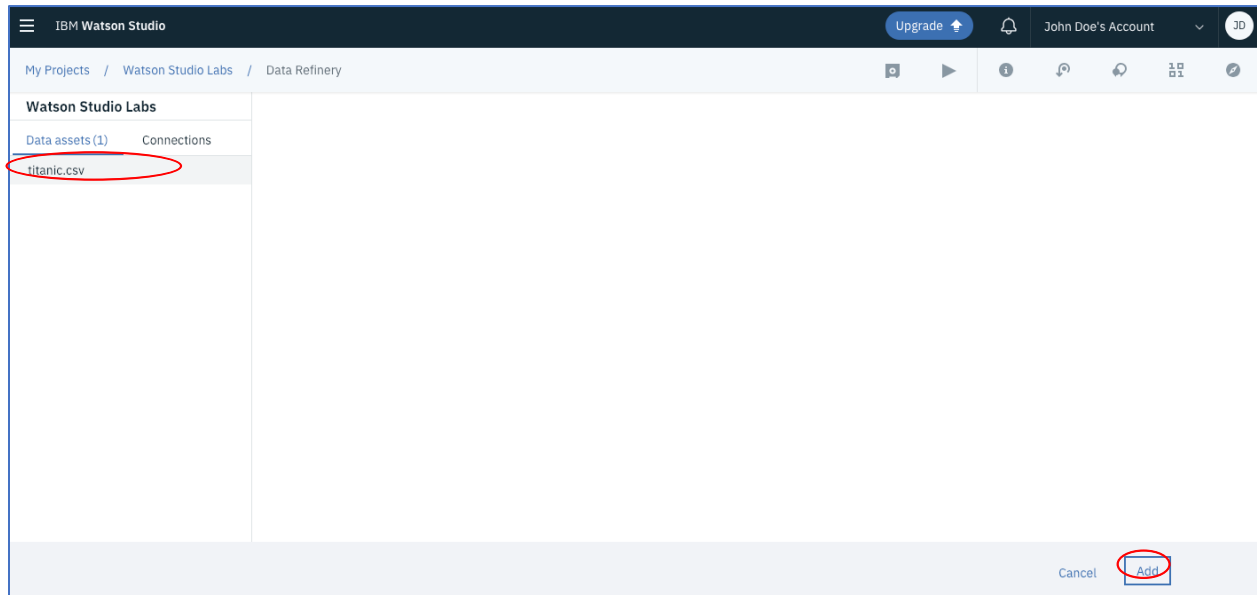


Step 2: Profile the data to help determine missing values.

1. Add a Data Flow by clicking on **Add to project** and then click **Data Refinery flow**.



2. Select **titanic.csv** and then click on **Add**.



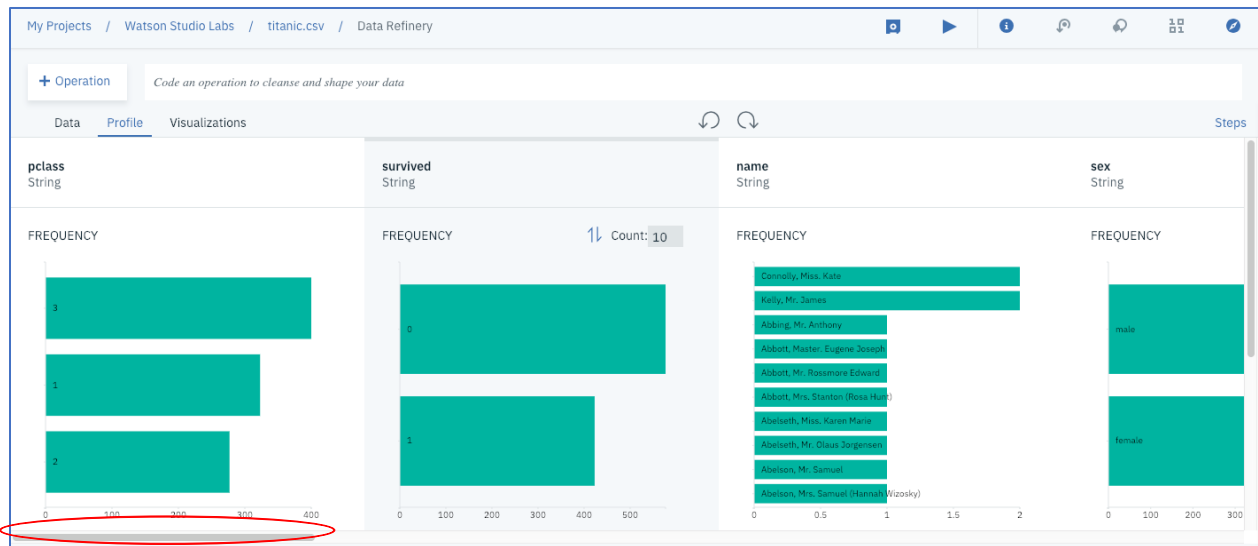
3. The Data Refinery panel will display the Titanic data set. Click on the **Profile** tab.

The screenshot shows the IBM Watson Studio Data Refinery panel. The top navigation bar includes 'My Projects / Watson Studio Labs / titanic.csv / Data Refinery'. The left sidebar shows '+ Operation' and 'Code an operation to cleanse and shape your data'. The main panel has tabs for 'Data', 'Profile', and 'Visualizations'. The 'Profile' tab is selected and circled in red. The table displays the Titanic data set with columns: pclass, survived, name, sex, age, and sibsp. The table shows the first 11 rows of data.

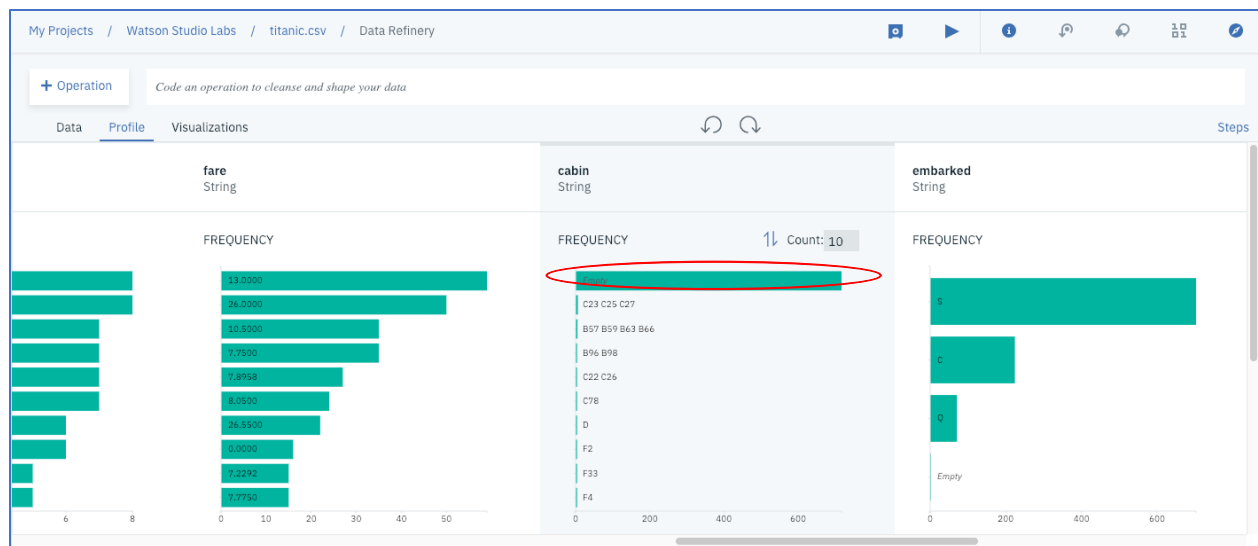
	pclass String	survived String	name String	sex String	age String	sibsp String
1	1	1	Allen, Miss. Elisabeth Walton	female	29	0
2	1	1	Allison, Master. Hudson Trevor	male	0.9167	1
3	1	0	Allison, Miss. Helen Loraine	female	2	1
4	1	0	Allison, Mr. Hudson Joshua Creighton	male	30	1
5	1	0	Allison, Mrs. Hudson J C (Bessie Waldo Daniels)	female	25	1
6	1	1	Anderson, Mr. Harry	male	48	0
7	1	1	Andrews, Miss. Kornelia Theodosia	female	63	1
8	1	0	Andrews, Mr. Thomas Jr	male	39	0
9	1	1	Appleton, Mrs. Edward Dale (Charlotte Lamson)	female	53	2
10	1	0	Artagaveytia, Mr. Ramon	male	71	0
11	1	0	Astor, Col. John Jacob	male	47	1

SOURCE FILE: titanic.csv SAMPLE SIZE: First 1000 rows

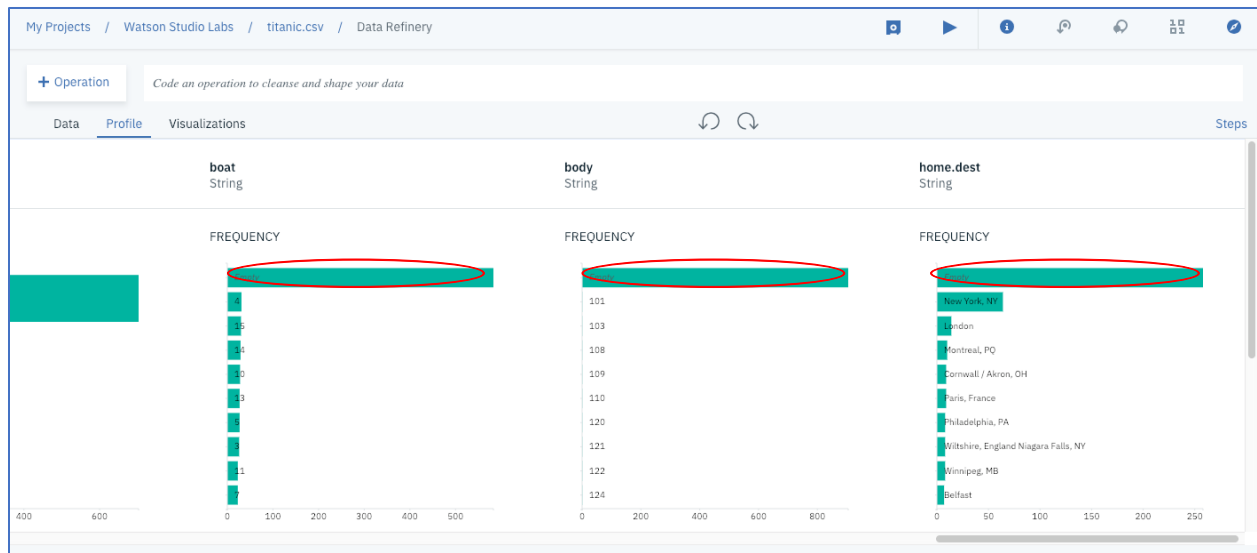
4. The Profile panel displays the counts of the top 10 count values for each column. Note that you can change 10 to another number if desired. You can also switch to the bottom 10 counts for a column. Scroll to the right to view the cabin column.



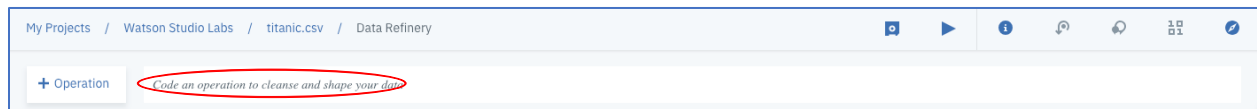
- Note that the cabin column has many missing values and should be removed as part of the data preparation step.



- In a similar fashion, scroll to the right to examine the boat, body, and home.dest columns. These also have many missing values and should be removed as part of the data preparation step.

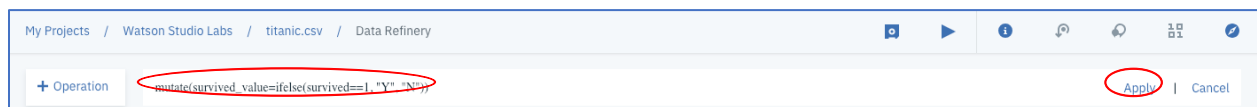


7. Age and Embarked also have missing values. Embarked has very few missing values. Age has over 100 missing values, but we will keep that column in the analysis. As part of data preparation, we will remove the rows that contain the missing age and embarked values.
8. Click on the **Data** tab. We will add columns that contain more readable values for the survived and pclass columns. The column survived_value will contain a “Y” or “N”. The pclass_value column will contain “first”, “second”, or “third”. We will use the mutate (R dplyr function) and ifelse functions to do the conversion. Click on the **Code an operation to cleanse and shape your data**.

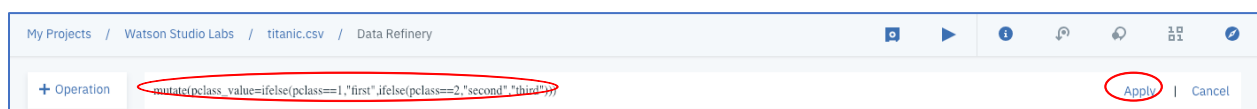


9. Copy and paste the following:
`mutate(survived_value=ifelse(survived==1, "Y", "N"))`

and then click Apply. If you scroll to the right you should see the new column “survived_value”.



10. Copy and paste the following to create pclass_value,
`mutate(pclass_value=ifelse(pclass==1,"first",ifelse(pclass==2,"second","third")))`

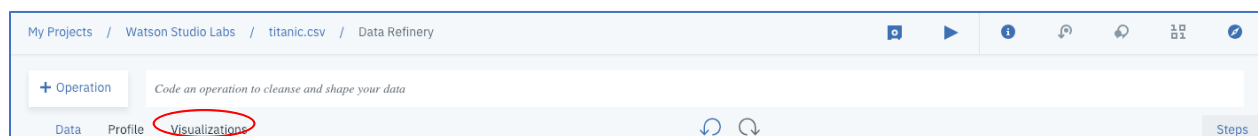


11. The result is shown below. Notice that the right panel will contain a running list of the transformations.

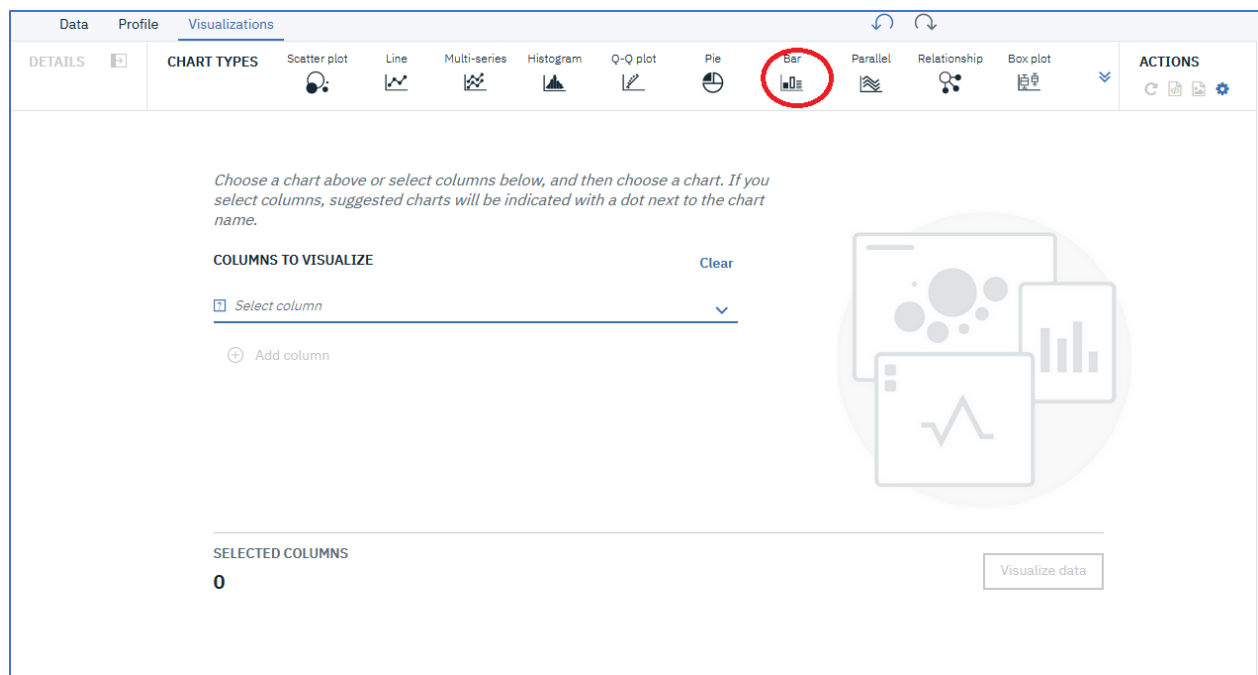
+ Operation Code an operation to cleanse and shape your data									
	ticket	fare	cabin	embarked	boat	body	home.dest	survived_value	pclass_value
	String	String	String	String	String	String	String	String	String
1	24160	211.3375	B5	S	2		St Louis, MO	Y	first
2	113781	151.5500	C22 C26	S	11		Montreal, PQ / Ches...	Y	first
3	113781	151.5500	C22 C26	S			Montreal, PQ / Ches...	N	first
4	113781	151.5500	C22 C26	S		135	Montreal, PQ / Ches...	N	first
5	113781	151.5500	C22 C26	S			Montreal, PQ / Ches...	N	first
6	19952	26.5500	E12	S	3		New York, NY	Y	first
7	13502	77.9583	D7	S	10		Hudson, NY	Y	first
8	112050	0.0000	A36	S			Belfast, NI	N	first
9	11769	51.4792	C101	S	0		Bayside, Queens, NY	Y	first
10	PC 17609	49.5042		C		22	Montevideo, Uruguay	N	first
11	PC 17757	227.5250	C62 C64	C		124	New York, NY	N	first
12	PC 17757	227.5250	C62 C64	C	4		New York, NY	Y	first

Step 3: Visualize the data to get a better understanding

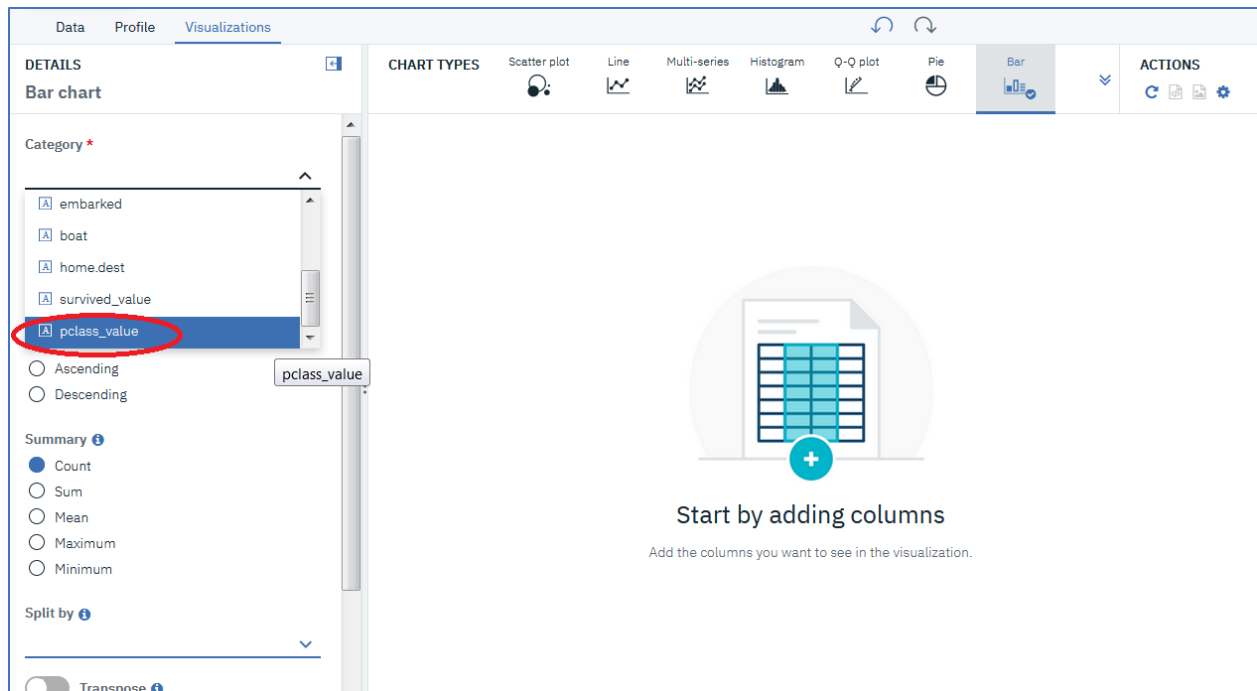
1. Click on the **Visualizations** tab.



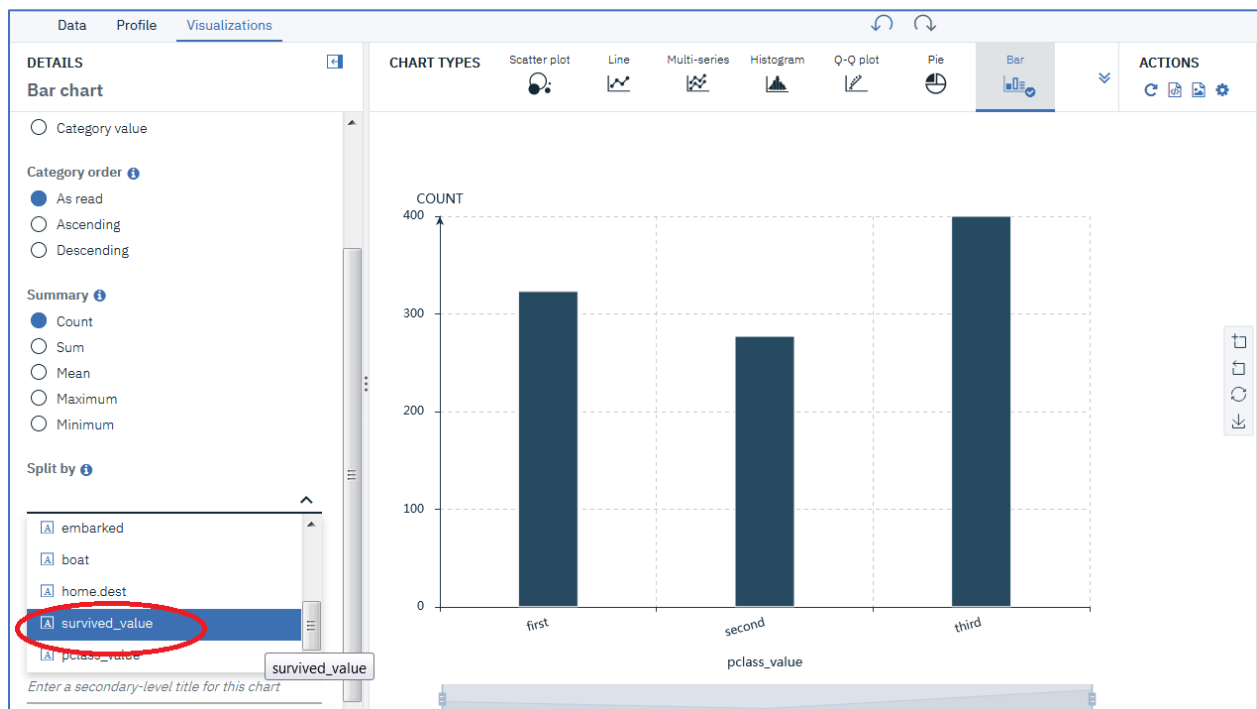
2. Let's take a look at the breakdown of passengers by passenger class. We will use our new `pclass_value` field. Select the **Bar Chart** Type.



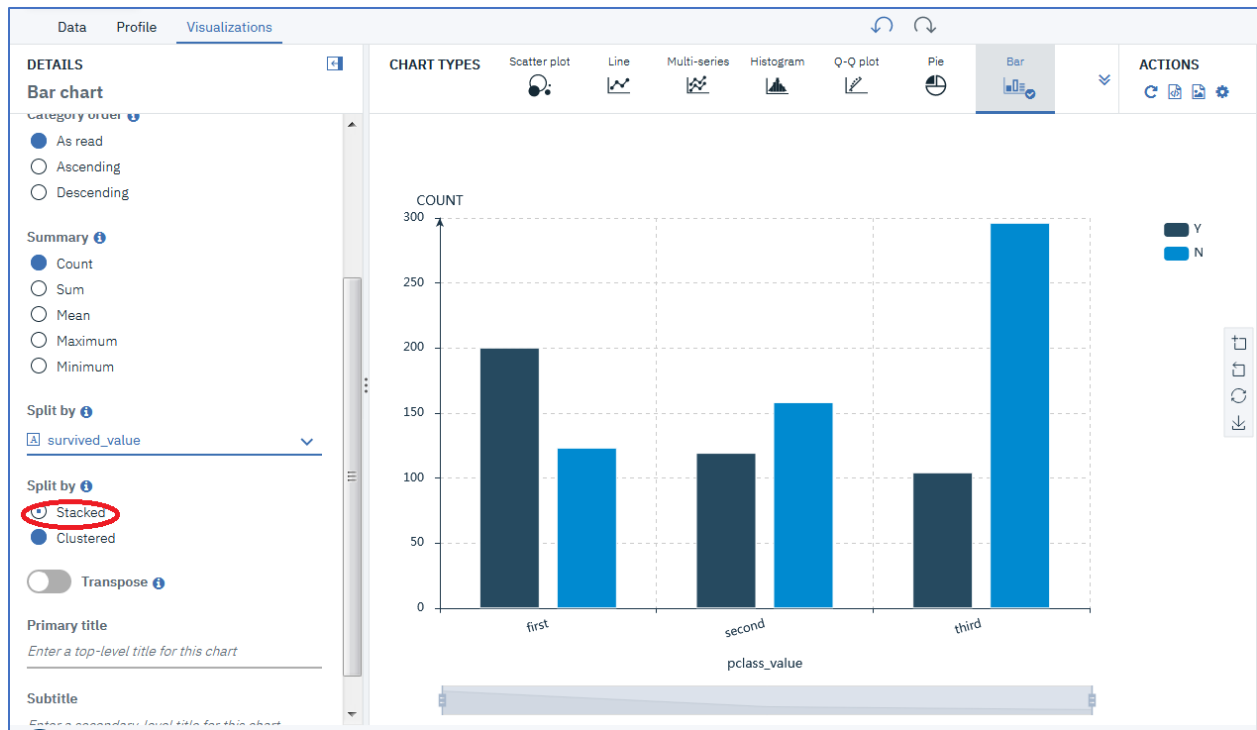
3. In the **Category** required field, select `pclass_value`.



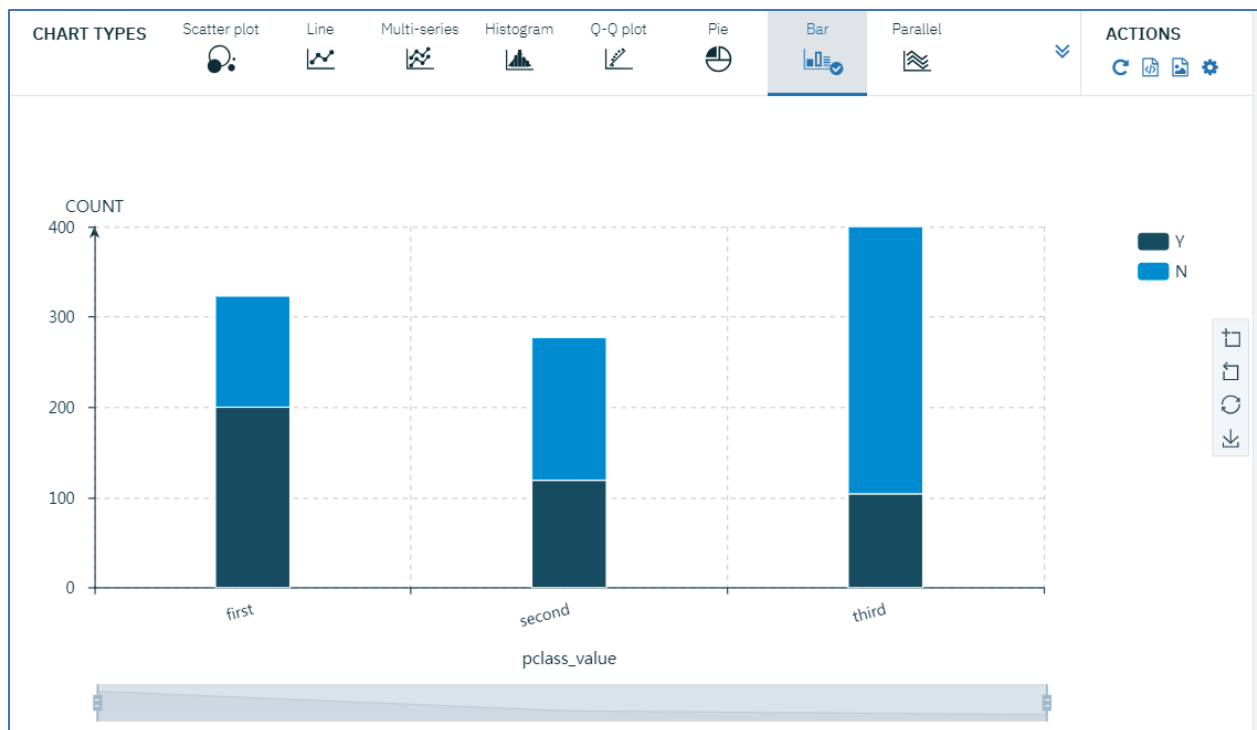
4. In the **Split by** field, select **survived_value**.



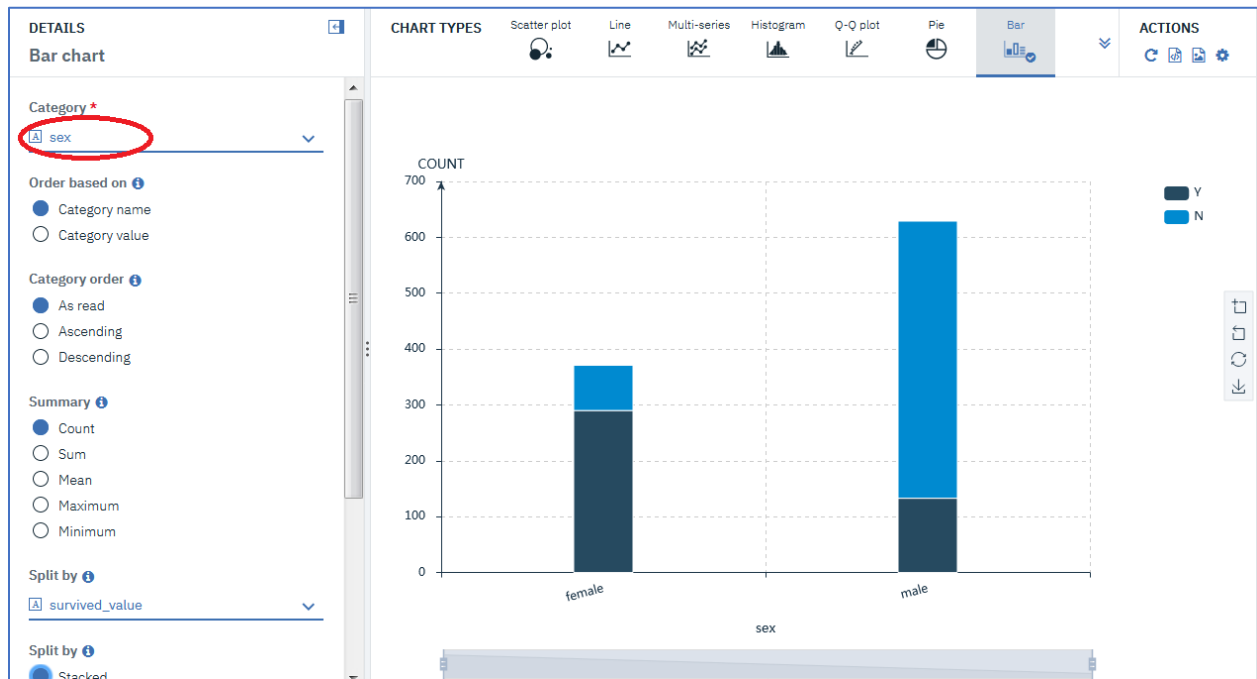
5. Select **Stacked**.



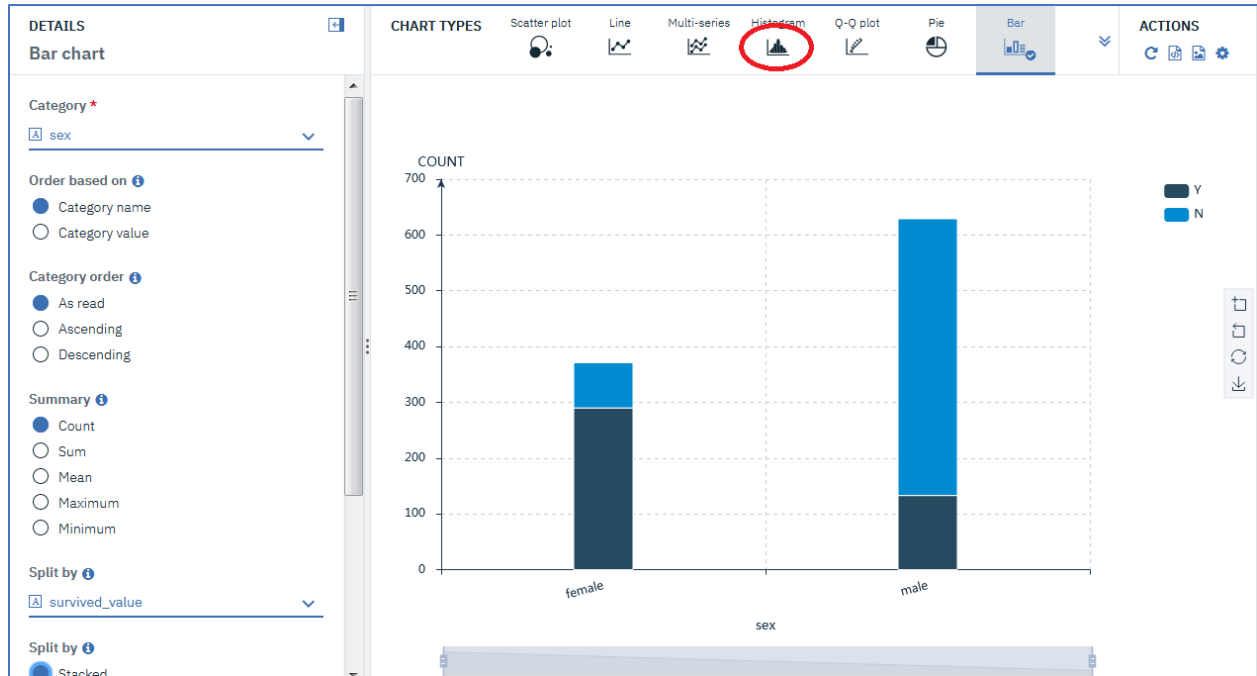
6. The result is shown below. The percentage of survivors is the greatest in first class, followed by second class, and then third-class passengers.



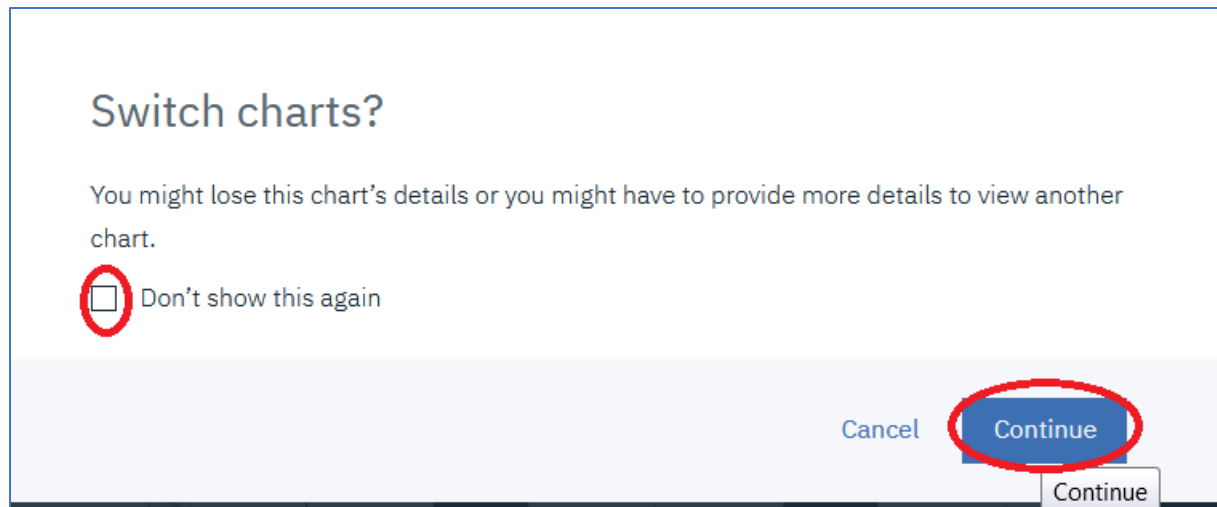
7. Change the **Category** to **sex**. We can see that survivorship for females is significantly greater than for males.



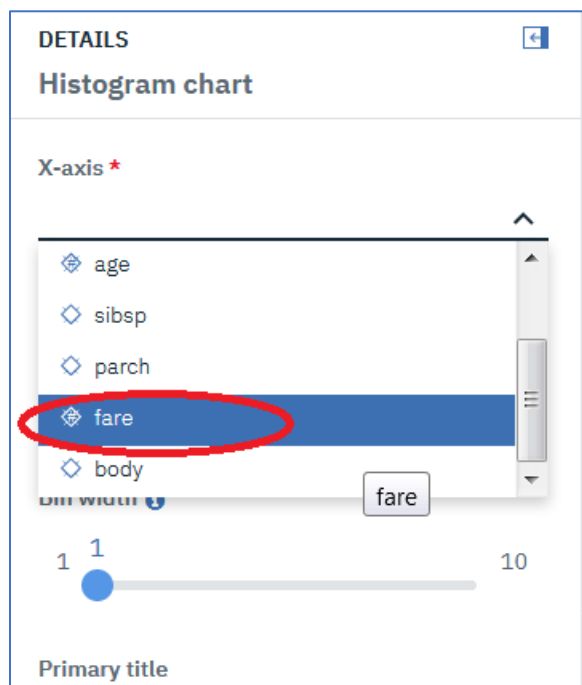
8. Click on the **Histogram** Chart Type.



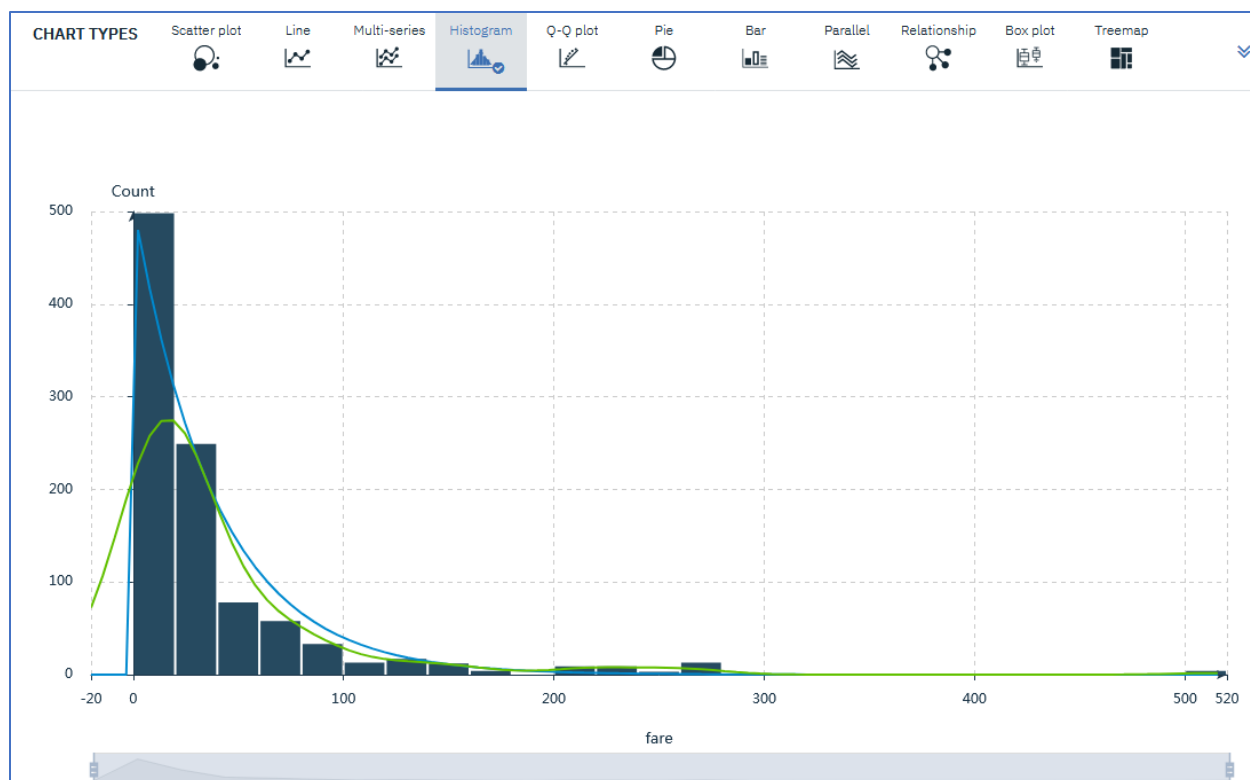
9. Click on the **Don't show this again** check box and click **Continue**.



10. Select **fare** for the X-axis.



11. The result is shown below. Note that it is highly skewed which affects the performance of some machine learning algorithms. One way to deal with this is to apply a logarithmic transformation. We will do that as part of data preparation.



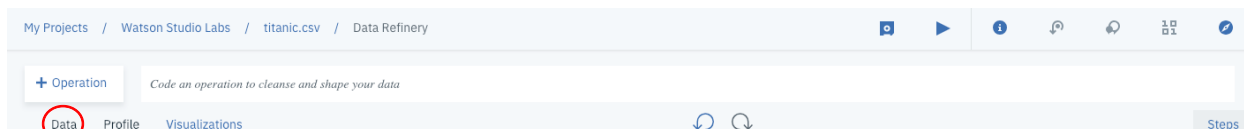
Step 4: Prepare the data for modeling

Based on the data analysis, we need to do the following to prepare the data for modeling.

1. Remove columns cabin, boat, body, home.dest
2. Remove rows with missing values of age, and embarked.
3. Create a new column(log_fare) that is the logarithm of the fare column

We will also bin the age, and log_fare fields.

1. Return to the Data panel by clicking on the **Data** tab



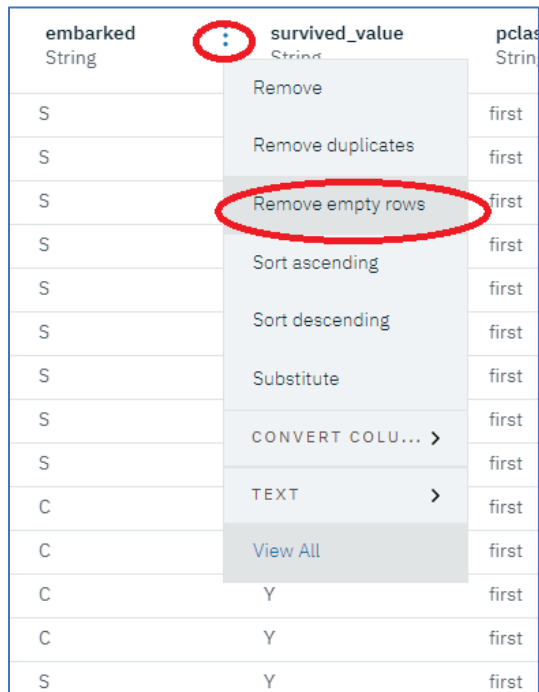
2. Remove the **cabin** column by selecting on the vertical ellipse and then clicking on **Remove**.

cabin String	embarked String	boat String
B5		2
C22 C26		11
C22 C26		
C22 C26		
C22 C26		
E12		3
D7		10
A36		
C101		D
C62 C64		
C62 C64	C	4
B35	C	9
	S	6

3. Remove the **boat**, **body**, and **home.dest** columns in a similar manner by selecting on the vertical ellipse adjacent to the column and clicking on **Remove**. Notice the STEPS panel on the right-hand side that provides a running list of the data operations.

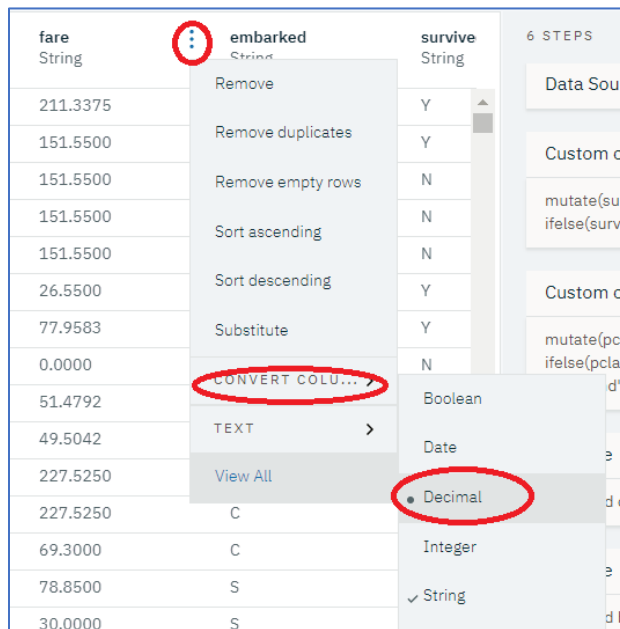
6 STEPS
Data Source : titanic.csv
Custom code
<code>mutate(survived_value = ifelse(survived==1,"Y","N"))</code>
Custom code
<code>mutate(pclass_value = ifelse(pclass==1,"first",ifelse(pclass== 2,"second","third"))</code>
Remove
Removed cabin
Remove
Removed boat
Remove
Removed body
Remove JUST ADDED
Removed home.dest

4. For the **age** and **embarked** columns, click on the vertical ellipse adjacent to the columns, and click on **Remove empty rows**.



embarked	survived_value	pclass
S		first
S		first
S		first
S		first
S		first
S		first
S		first
S		first
S		first
C		first
C		first
C	Y	first
C	Y	first
S	Y	first

5. Convert the **fare** column from a String to a Decimal by clicking on the vertical ellipse adjacent to the column, click on **Convert Column**, and then click on **Decimal**.

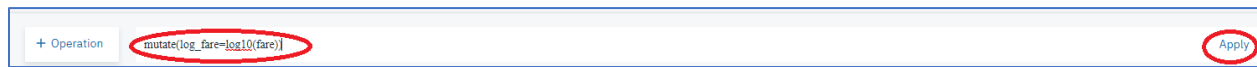


fare	embarked	survived
211.3375		Y
151.5500		Y
151.5500		N
151.5500		N
151.5500		N
26.5500		Y
77.9583		Y
0.0000		N
51.4792		
49.5042		
227.5250		
227.5250	C	
69.3000	C	
78.8500	S	
30.0000	S	

6. Create a new column that is the log to the base 10 of the fare by clicking into the **Code** an operation to cleanse and shape your data, and entering

```
mutate(log_fare=log10(fare))
```

then click **Apply**.



7. Convert the **age** from String to Integer by clicking on the vertical ellipse adjacent to the age column, clicking on **Convert Column**, and clicking on **Integer**.

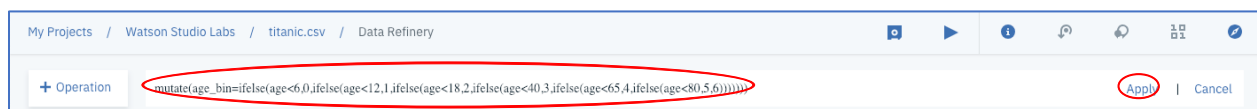
The screenshot shows a table with columns: age (Integer), sibsp (String), parch (String), and ticket (String). A vertical menu is open for the 'age' column, showing options: Remove, Remove duplicates, Remove empty rows, Sort ascending, Sort descending, Substitute, CONVERT COLUMN..., View All, and a list of data types: Boolean, Decimal, Integer (checked), and String. The 'CONVERT COLUMN...' option and the 'Integer' data type are circled in red.

8. Bin the **age** column into the following bins by clicking into the **Code an operation to cleanse and shape your data**, and copying and pasting the following

```
mutate(age_bin=ifelse(age<6,0,ifelse(age<12,1,ifelse(age<18,2,ifelse(age<40,3,ifelse(age<65,4,ifelse(age<80,5,6)))))))
```

and then click **Apply**.

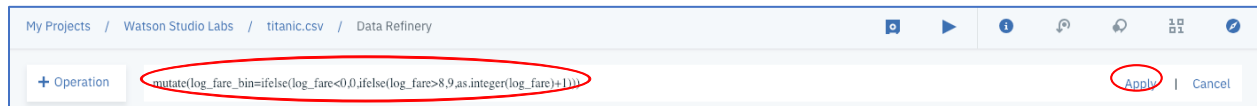
Bin	Age Range
0	0-5
1	6-11
2	12-17
3	18-39
4	40-64
5	65-79
6	Over 79



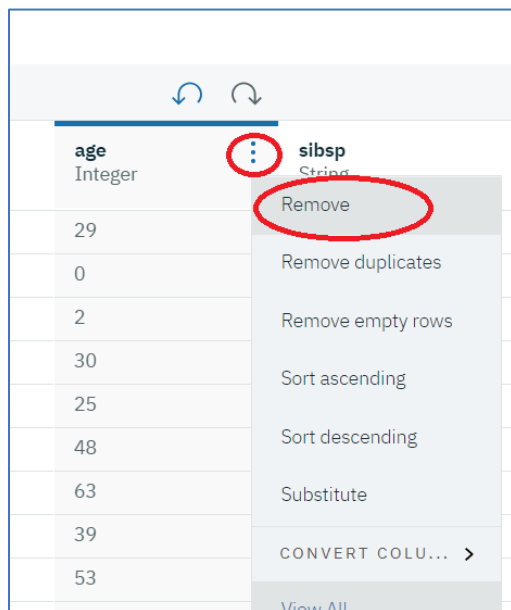
9. Bin the **log_fare** column, by clicking into the **Code an operation to cleanse and shape your data**, and copying and pasting the following

```
mutate(log_fare_bin=ifelse(log_fare<0,0,ifelse(log_fare>8,9,as.integer(log_fare)+1)))
```

and then clicking **Apply**




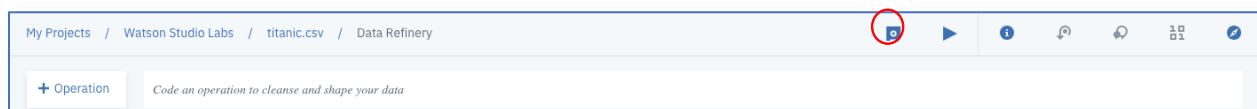
10. Now we will drop the **age**, **fare**, and **log_fare** columns as they are no longer needed for modeling purposes. Select the vertical ellipse adjacent to the column and click on **Remove** as shown below.



fare	embarked
Decimal	Categorical
211.3375	Remove
151.55	Remove duplicates
151.55	Remove empty rows
151.55	Sort ascending
151.55	Sort descending
26.55	Substitute
77.9583	CONVERT COLU... >
0	View All
51.4792	
49.5042	
227.525	C
227.525	C


log_fare	age_bin
Decimal	Decimal
2.32497656566603	Remove
2.18055594070364	Remove duplicates
2.18055594070364	Remove empty rows
2.18055594070364	Sort ascending
2.18055594070364	Sort descending
1.42406452541749	Substitute
1.89186236009324	CONVERT COLU... >
-Inf	View All
1.71163178923691	
1.69464204659912	
2.35702912303943	4
2.35702912303943	3
1.84073323461181	3

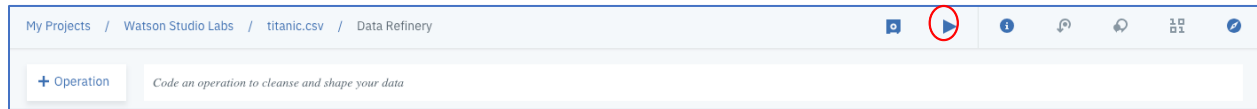
11. Save the Data Flow by clicking on the Save Data Flow icon .



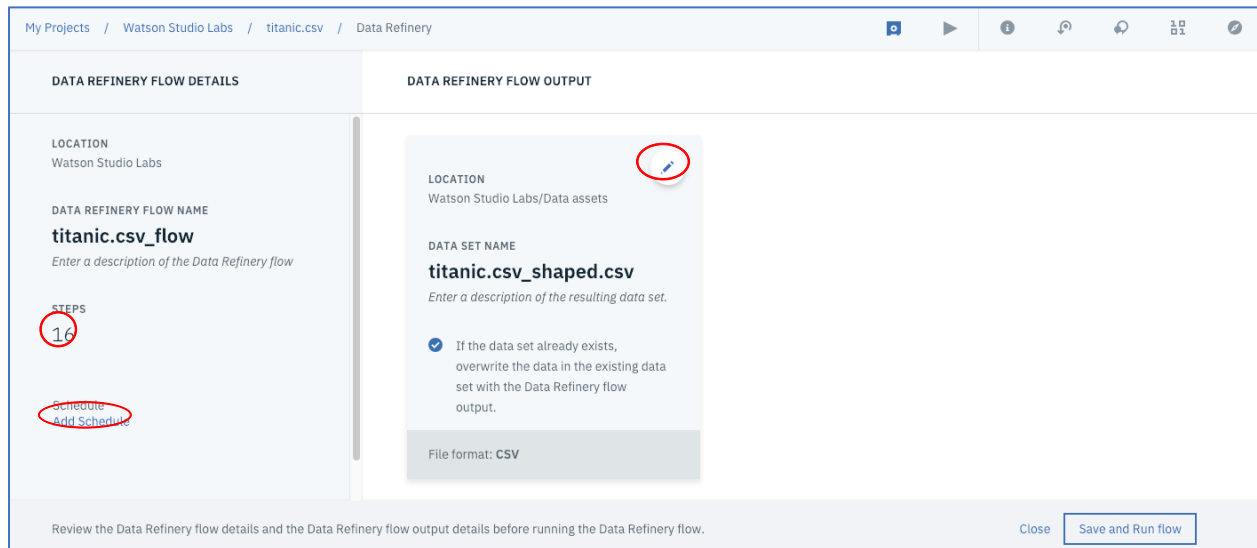
Step 5: Run the sequence of Data Flow operations on the entire data set.

When users are interacting with the Data Refinery tool, the operations are applied to a subset of the data set to facilitate faster response times. To run the data operations on the entire data set, the user selects the run option.

1. Click on run icon 



2. Note the number of steps used to transform the data. It should be 16. Also, a schedule can be set up if the transformation process needs to run on a scheduled basis. We are just going to do a one-time run. Change the name of the output file by clicking on the edit option (pencil icon).



3. Type in **titanic_processed.csv** as the new file name, and click on the check mark.

DATA FLOW OUTPUT

Edit output

✓

✕

LOCATION *

Watson Studio Labs/Data assets

Change Location

DATA SET NAME *

titanic_processed.csv

79

DESCRIPTION

Enter a description of the resulting data set.

300

FILE FORMAT

CSV

▼

4. Click **Save and Run**.

DATA FLOW DETAILS

DATA FLOW OUTPUT

LOCATION

Watson Studio Labs

DATA FLOW NAME

titanic.csv_flow

Enter a description of the data flow

STEPS

16

Schedule

Add Schedule

* Required Fields

LOCATION

Watson Studio Labs/Data assets

DATA SET NAME

titanic_processed.csv

Enter a description of the resulting data set.

✓

Overwrite the data in the existing data set with the data flow output.

File format: CSV

Review the data flow details and the data flow output details before running the data flow.

Cancel

Save and Run

5. You can continue to work on other items or monitor the Data Flow run status. Click on **View Flow**.

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](#)

- The completed flow is shown below. Note that 1044 records were written to the output file. Click on Watson Studio Labs to go back to the project Assets page.

My Projects / [Watson Studio Labs](#) titanic.csv_flow

Summary

Source	Data flow	Output
titanic.csv	16 Steps	titanic_processed.csv

Runs

History Schedule

TIMESTAMP	STATUS	DURATION	ROWS READ / WRITTEN	SIZE	INITIATED BY
23 Jul 2018 - 11:36 pm	Completed	10 sec	1309 / 1044	0.116 MB	DSX30000 User

- The output of the Data Refinery process should be listed in the Data Assets. Click on the asset to view the contents.

My Projects / Watson Studio Labs

Overview **Assets** Environments Bookmarks Deployments Access Control Settings

What assets are you looking for?

▼ Data assets

0 asset selected.

NAME	TYPE	SERVICE	CREATED BY	LAST MODIFIED	ACTIONS
titanic_processed.csv	Data Asset	Project	DSX30000 User	23 Jul 2018, 11:37:03 pm	
titanic_cleansed.csv	Data Asset	Project	DSX30000 User	22 Jul 2018, 11:17:09 am	
titanic.csv	Data Asset	Project	DSX30000 User	19 Jul 2018, 12:47:01 pm	

- The asset contents are displayed below. Review to confirm that the data transformations specified have been applied to all the data.

My Projects / Watson Studio Labs / titanic_processed.csv

Refine

Preview

Profile

Schema: 12 Columns

Preview (1000 rows)

PCLASS	SURVIVED	NAME	SEX	SIBSP	PARCH	TICKET	EMBARKED	SURVIVED_VALUE	PCLASS_VALUE	AGE_BIN	LOG_FARE_BIN
Type: String	Type: String	Type: String	Type: String	Type: String	Type: String	Type: String	Type: String	Type: String	Type: String	Type: Decimal	Type: Decimal
1	1	Allen, Miss. Elisat	female	0	0	24160	S	Y	first	3.0	3.0
1	1	Allison, Master. H	male	1	2	113781	S	Y	first	0.0	3.0
1	0	Allison, Miss. Hel	female	1	2	113781	S	N	first	0.0	3.0
1	0	Allison, Mr. Hudsr	male	1	2	113781	S	N	first	3.0	3.0
1	0	Allison, Mrs. Hudr	female	1	2	113781	S	N	first	3.0	3.0
1	1	Anderson, Mr. Ha	male	0	0	19952	S	Y	first	4.0	2.0
1	1	Andrews, Miss. Ku	female	1	0	13502	S	Y	first	4.0	2.0
1	0	Andrews, Mr. Tho	male	0	0	112050	S	N	first	3.0	
1	1	Appleton, Mrs. Ed	female	2	0	11769	S	Y	first	4.0	2.0
1	0	Artagaveytia, Mr.	male	0	0	PC 17609	C	N	first	5.0	2.0