

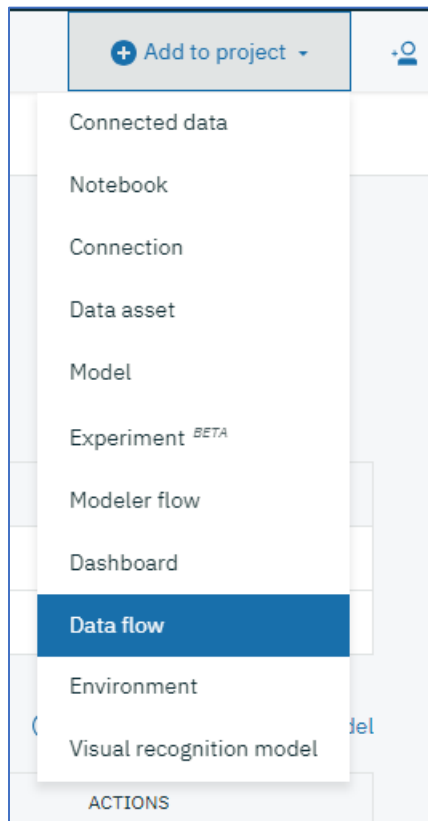
# Data Refinery Lab

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:

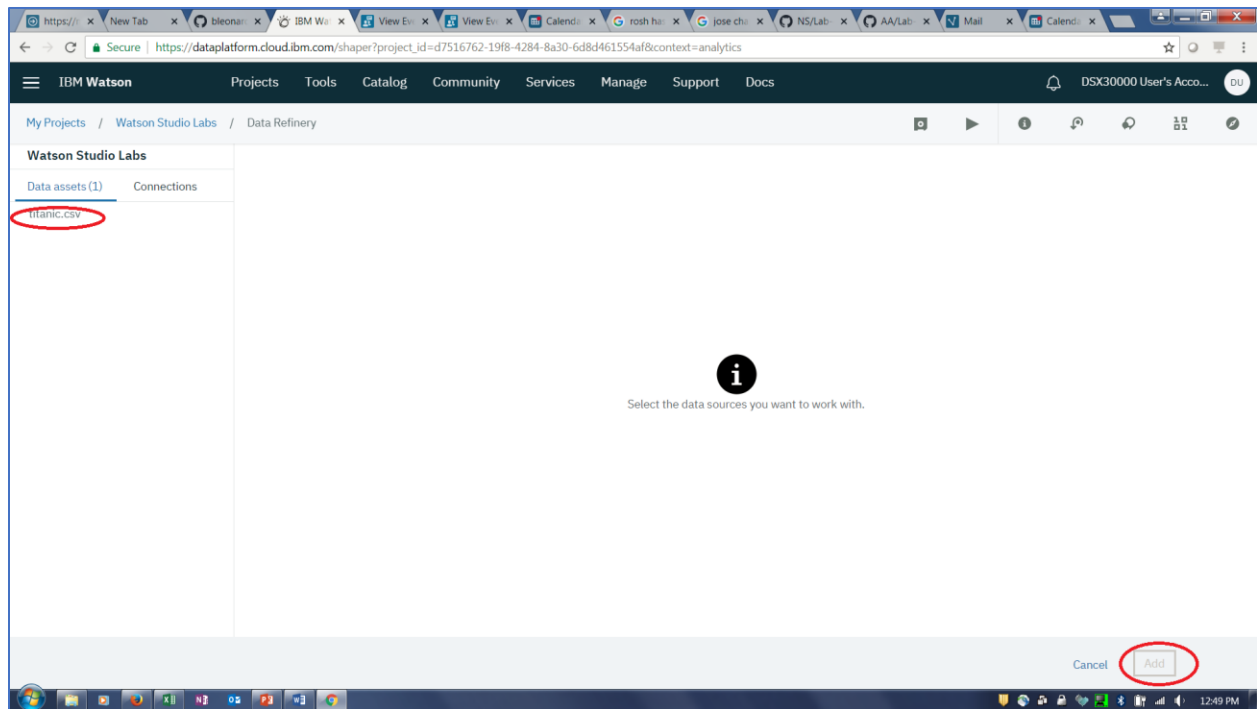
1. Use the Data Refinery Tool to:
  - a. Profile the data to help determine missing values
  - b. Visualize the data to gain a better understanding
  - c. Prepare the data for modeling
  - d. Run the sequence of data preparation operations on the entire data set.

Step 1: Profile the data to help determine missing values.

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



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

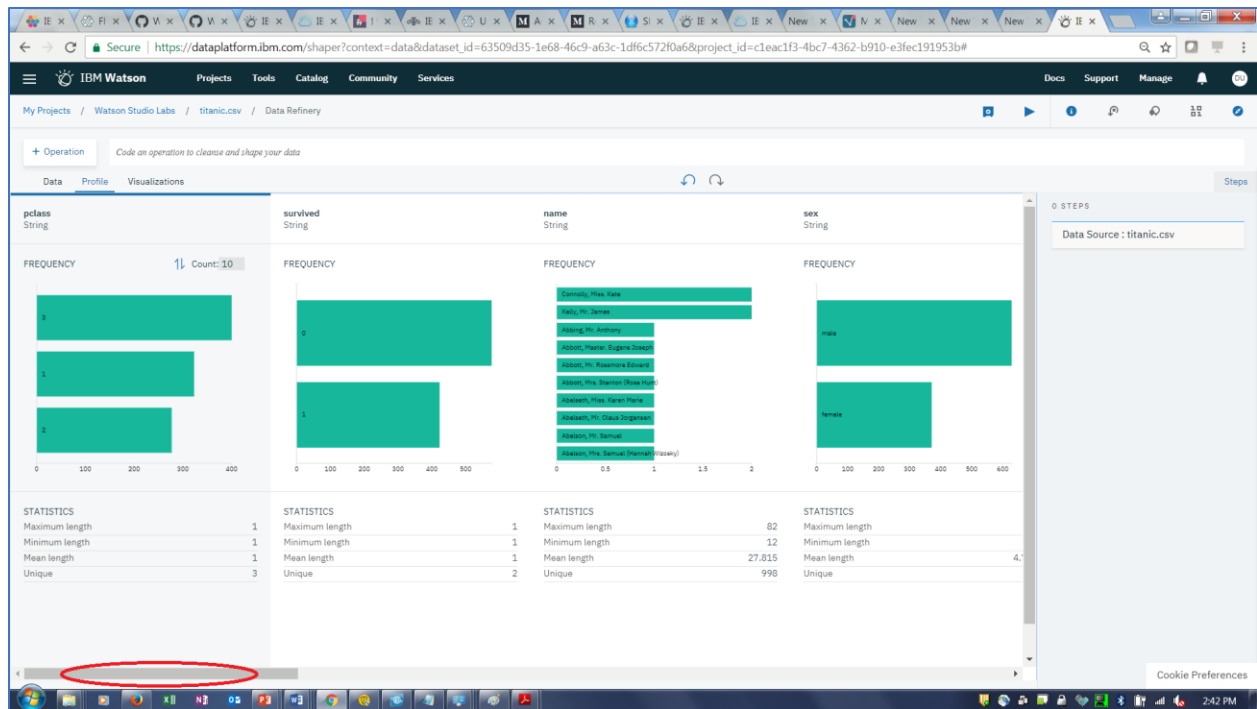


3. The Data Refinery panel will display the Titanic data set. Click on the **Profile** tab.

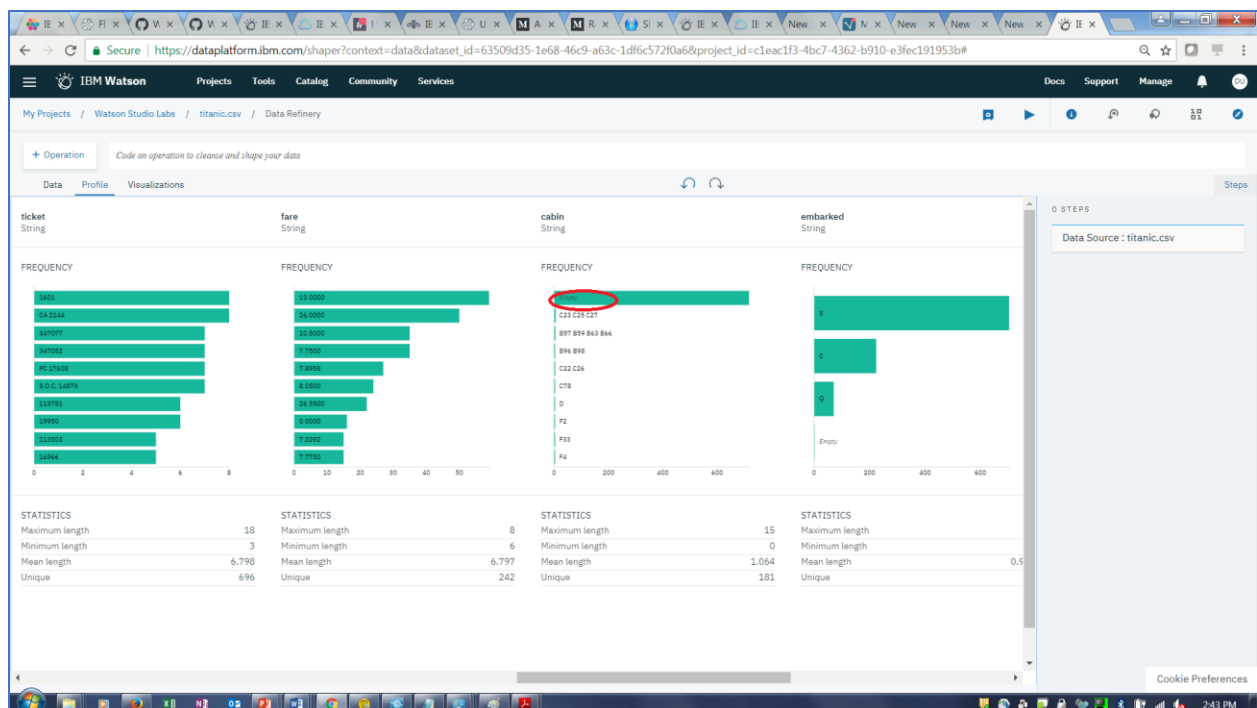
The screenshot shows the IBM Watson Data Refinery interface with the 'Profile' tab selected. The table displays the top 10 count values for each column. The 'cabin' column is highlighted, showing the top 10 count values for each cabin number.

	pclass	survived	name	sex	age	sibsp	parch	ticket	fare	cabin
1	1	1	Allen, Miss. Elisabeth...	female	29	0	0	24160	211.3375	B1...
2	1	1	Allison, Master. Hud...	male	0.9167	1	2	113781	151.5500	C...
3	1	0	Allison, Miss. Helen ...	female	2	1	2	113781	151.5500	C...
4	1	0	Allison, Mr. Hudson ...	male	30	1	2	113781	151.5500	C...
5	1	0	Allison, Mrs. Hudson...	female	25	1	2	113781	151.5500	C...
6	1	1	Anderson, Mr. Harry	male	48	0	0	19952	26.5500	E1...
7	1	1	Andrews, Miss. Korn...	female	63	1	0	113502	77.9583	D...
8	1	0	Andrews, Mr. Thom...	male	39	0	0	112050	0.0000	A...
9	1	1	Appleton, Mrs. Edw...	female	53	2	0	11769	51.4792	C1...
10	1	0	Artagaveytia, Mr. Ra...	male	71	0	0	PC 17609	49.5042	C...
11	1	0	Astor, Col. John Jacob	male	47	1	0	PC 17767	227.5250	C...
12	1	1	Astor, Mrs. John Jac...	female	18	1	0	PC 17767	227.5250	C...
13	1	1	Aubart, Mme. LeontL...	female	24	0	0	PC 17477	69.3000	B...
14	1	1	Barber, Miss. Ellen ...	female	26	0	0	19877	78.8500	B...
15	1	1	Barkworth, Mr. Alge...	male	80	0	0	27042	30.0000	A...
16	1	0	Baumann, Mr. John D	male		0	0	PC 17318	25.9250	B...
17	1	0	Baxter, Mr. Quigg Ed...	male	24	0	1	PC 17558	247.5208	B...
18	1	1	Baxter, Mrs. James (...)	female	50	0	1	PC 17558	247.5208	B...
19	1	1	Bazzani, Miss. Albina	female	32	0	0	11813	76.2917	D...
20	1	0	Beattie, Mr. Thomson	male	36	0	0	13050	75.2417	C...

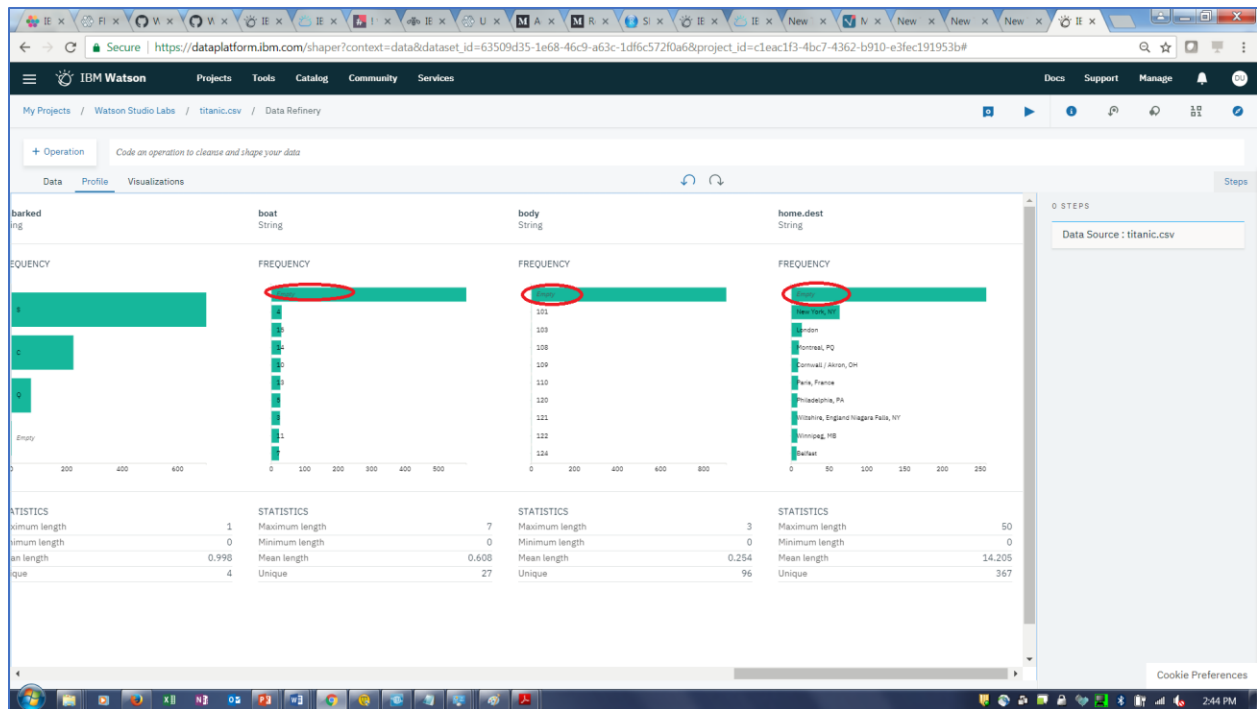
4. The Profile panel displays the counts of the top 10 count values for each column. Note that you can change 10 to another number if desired. You can also switch to the bottom 10 counts for a column. Scroll to the right to view the cabin column.



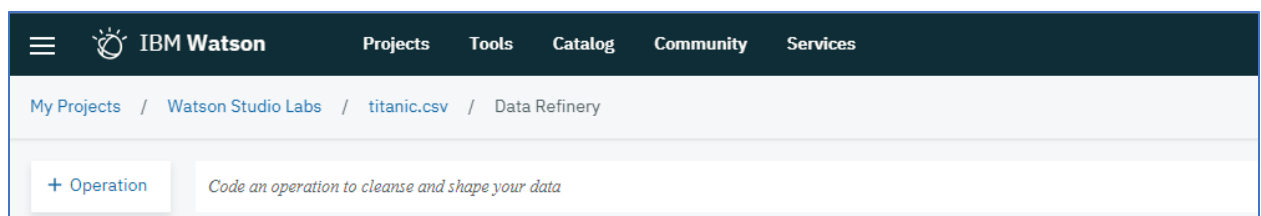
- Note that the cabin column has many missing values and should be removed as part of the data preparation step.



- 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.

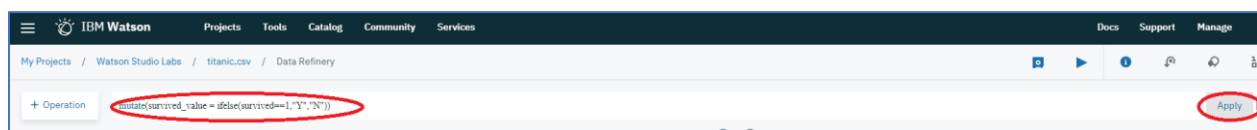


7. Age and Embarked also have missing values. Embarked has very few missing values. Age has over 100 missing values, but we will keep that column in the analysis. As part of data preparation, we will remove the rows that contain the missing age and embarked values.
8. Click on the **Data** tab. We will 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**.

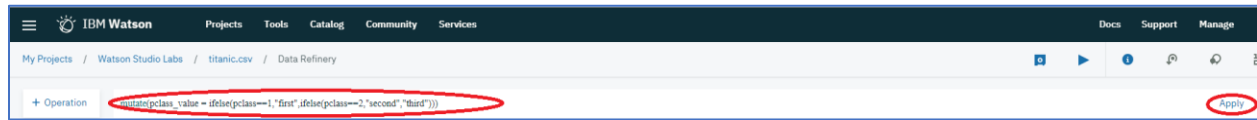


9. Copy and paste the following:  
`mutate(survived_value=ifelse(survived==1, "Y", "N"))`

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



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



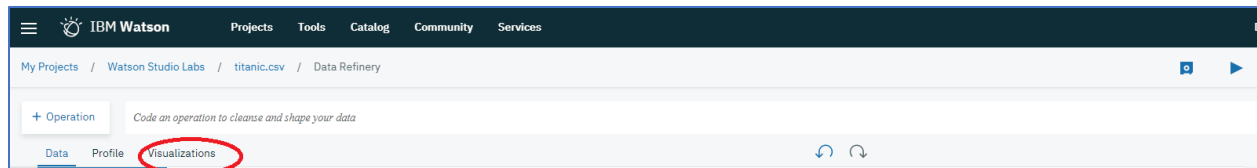
- The result is shown below. Notice that the right panel will contain a running list of the transformations.

The screenshot shows the IBM Watson Data Refinery interface with the 'Data' tab selected. The table displays the results of the transformation. The right panel shows the 'Custom code' section with the transformation code.

	ticket String	fare String	cabin String	embarked String	boat String	body String	home_dest String	survived_value String	pclass_value 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	D		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

- Click on the **Visualizations** tab.



- 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.

Visualizations

DETAILS CHART TYPES Scatter plot Line Multi-series Histogram Q-Q plot Pie **Bar** Parallel Relationship Box plot ACTIONS

Choose a chart above or select columns below, and then choose a chart. If you select columns, suggested charts will be indicated with a dot next to the chart name.

COLUMNS TO VISUALIZE Clear

Select column

Add column

SELECTED COLUMNS 0

Visualize data

3. In the **Category** required field, select **pclass\_value**.

Visualizations

DETAILS Bar chart

Category \*

embarked  
boat  
home.dest  
survived\_value  
**pclass\_value**

Ascending  
Descending

Summary

Count  
Sum  
Mean  
Maximum  
Minimum

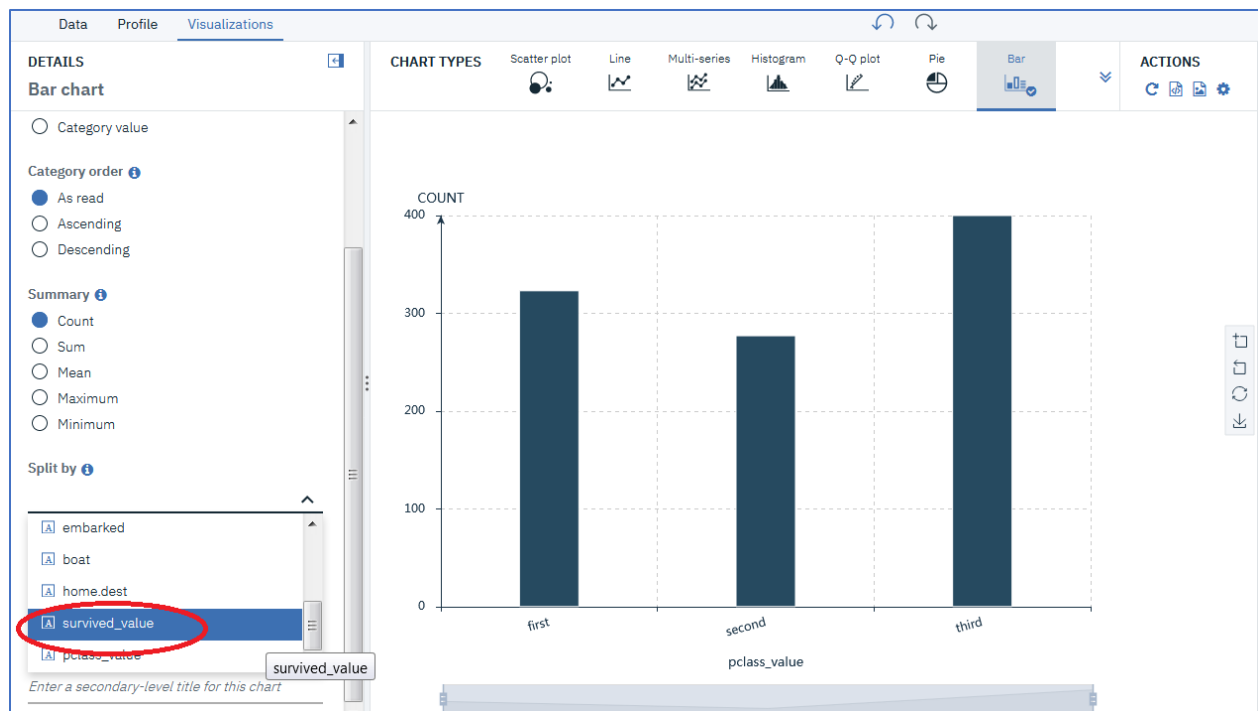
Split by

Transpose

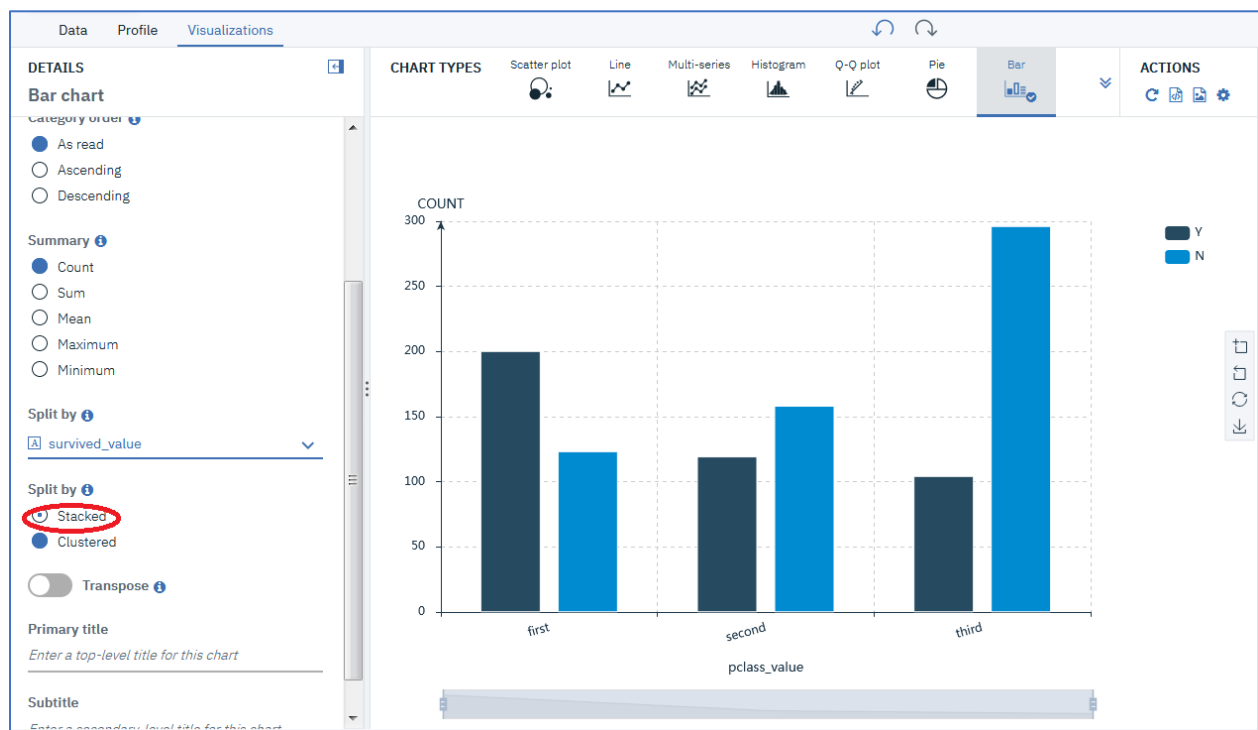
Start by adding columns

Add the columns you want to see in the visualization.

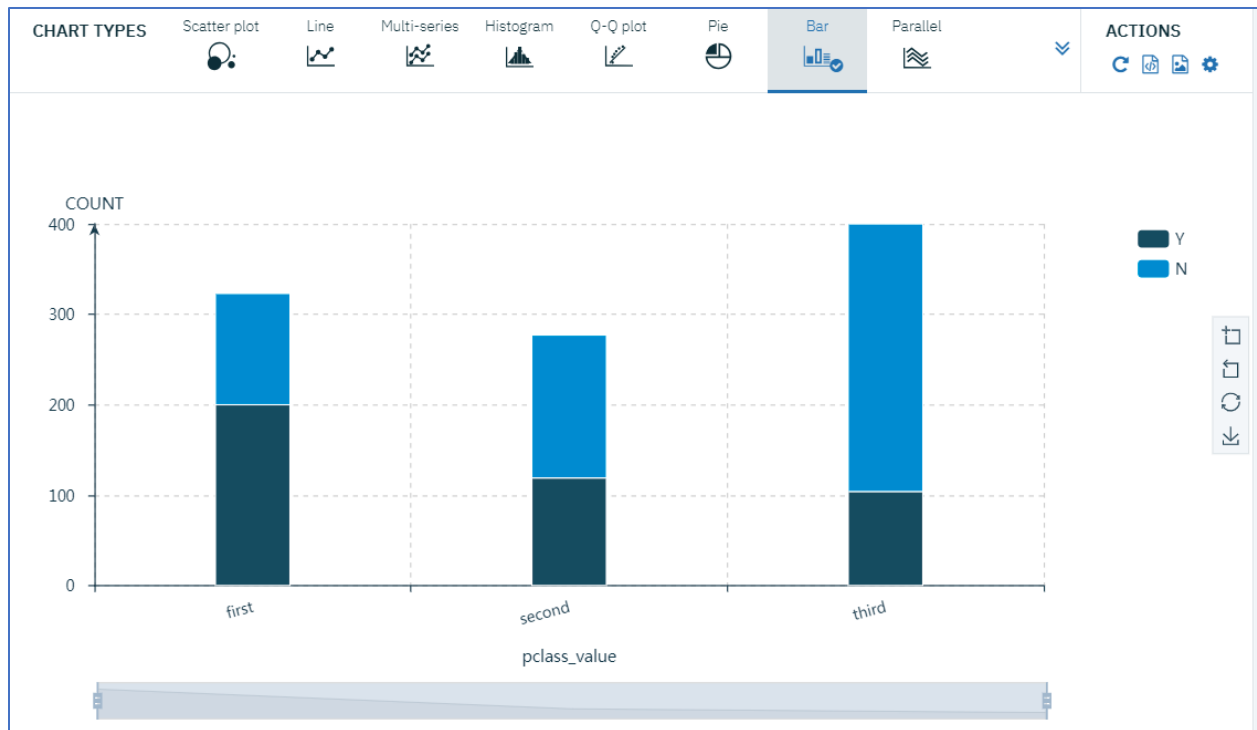
4. In the **Split by** field, select **survived\_value**.



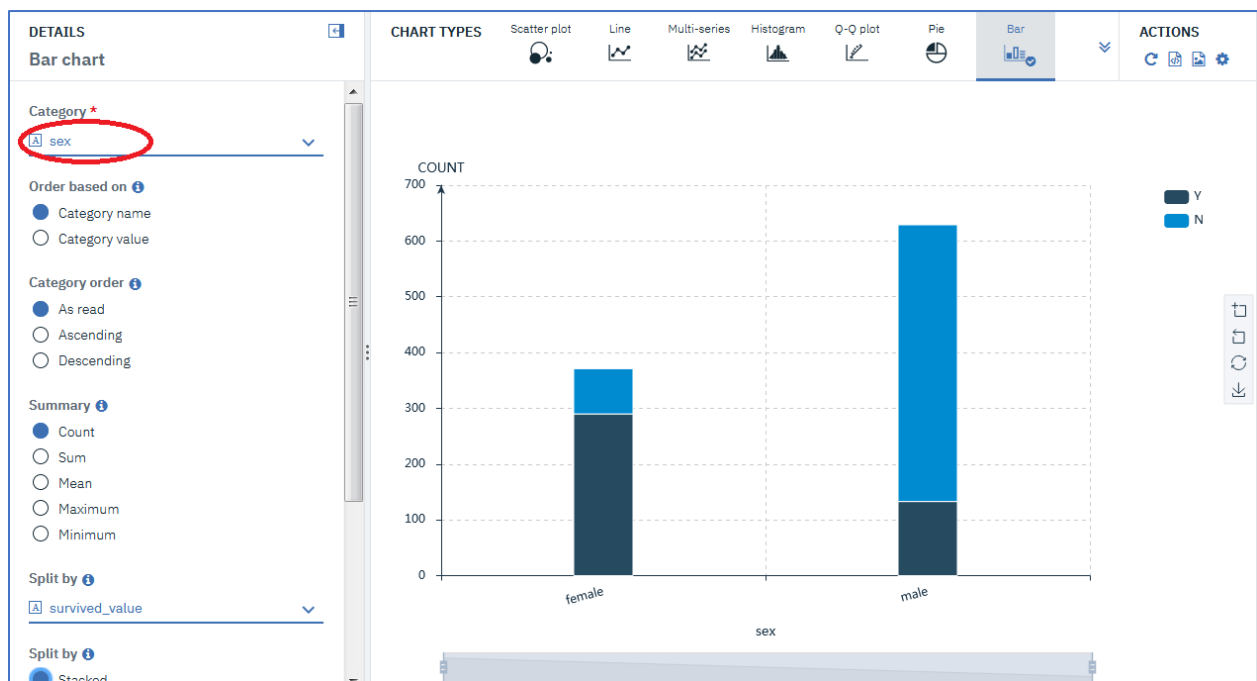
## 5. Select **Stacked**.



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.

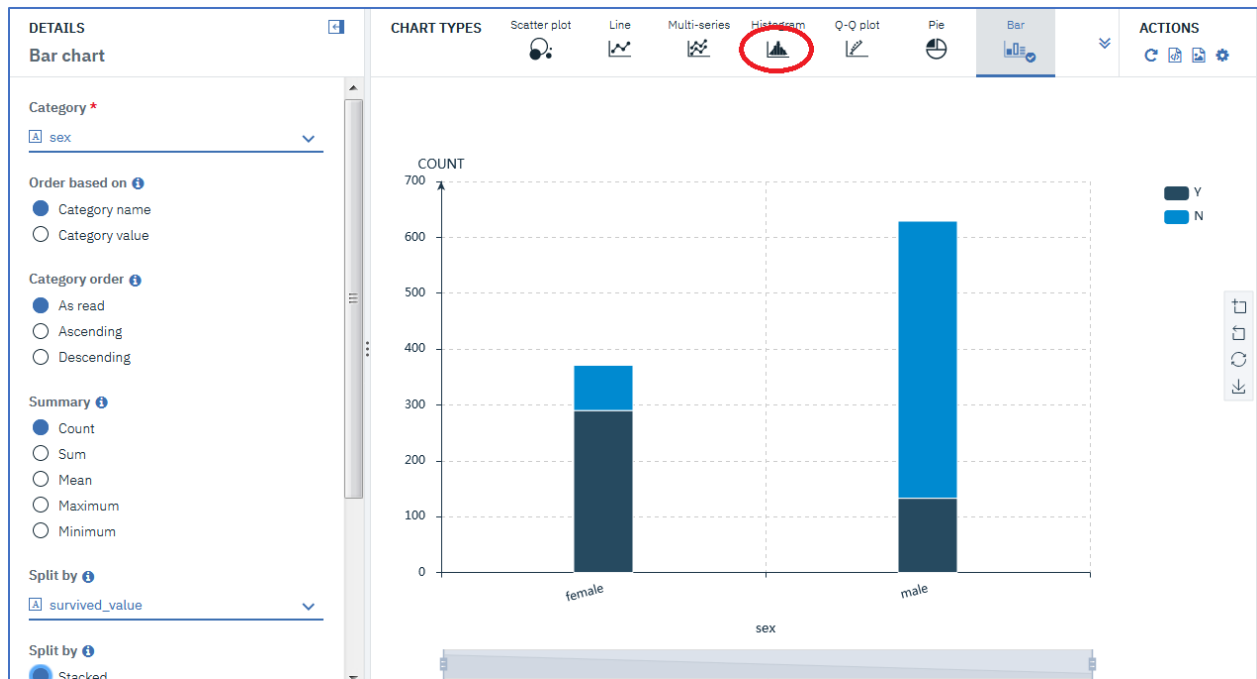


7. Change the **Category** to **sex**. We can see that survivorship for females is significantly greater than for males.

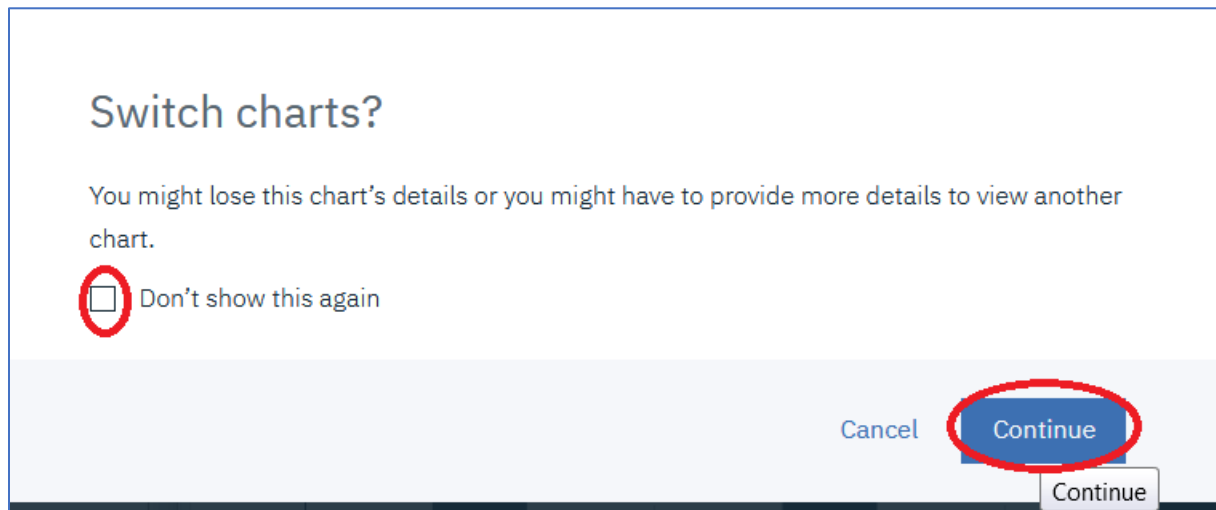


8. Click on the **Histogram** Chart Type.

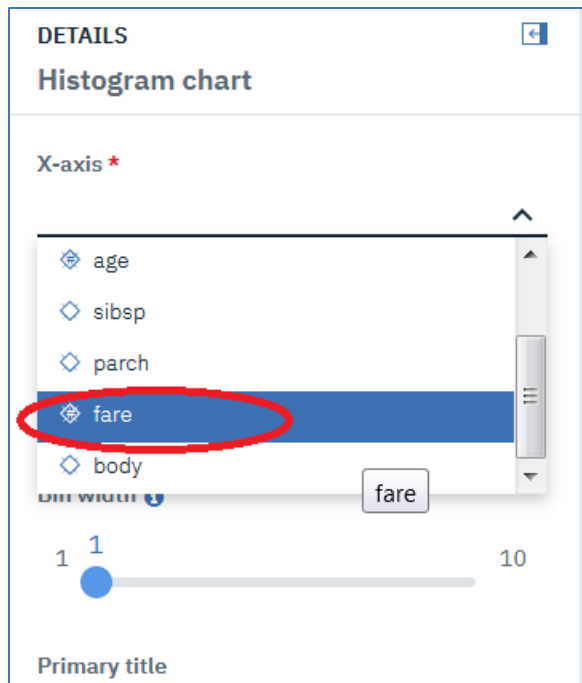




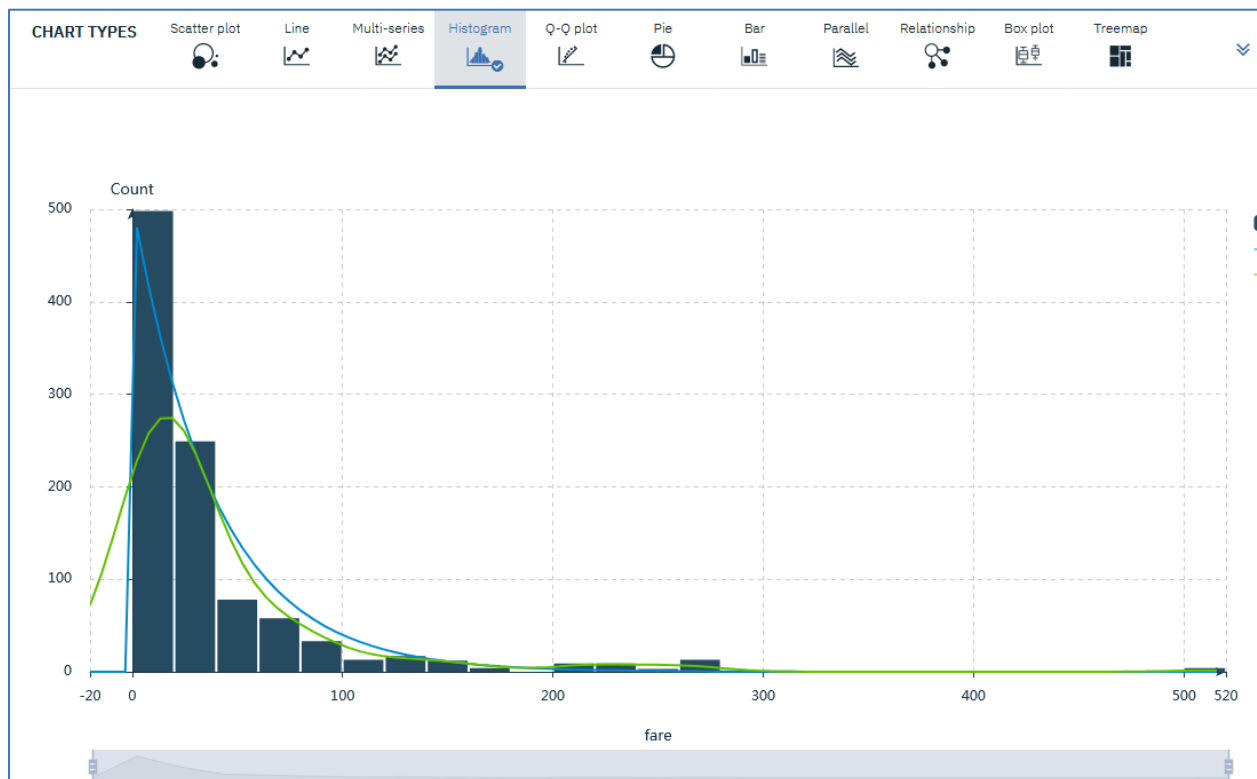
9. Click on the **Don't show this again** check box and click **Continue**.



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.



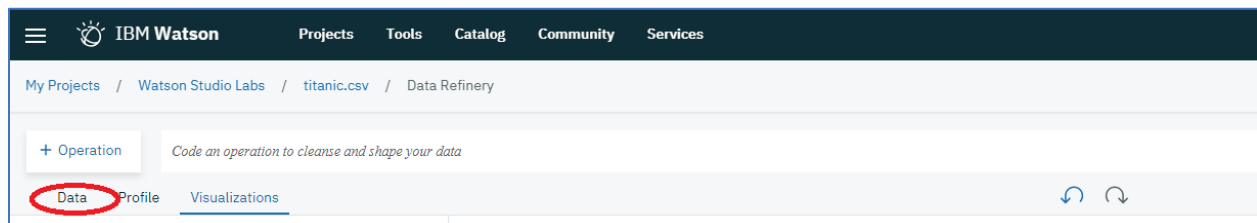
## Step 4: Prepare the data for modeling

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

```
mutate(survived_value =  
ifelse(survived==1,"Y","N"))
```

Custom code

```
mutate(pclass_value =  
ifelse(pclass==1,"first",ifelse(pclass==  
2,"second","third")))
```

Remove

Removed cabin

Remove

Removed boat

Remove

Removed body

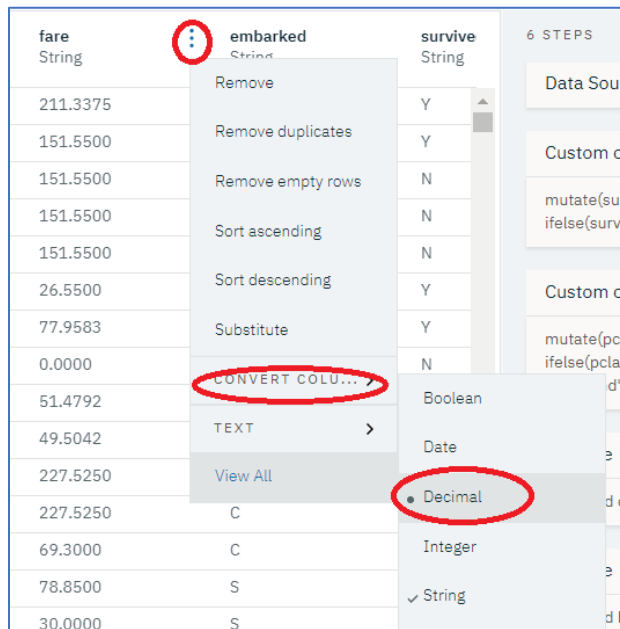
Remove JUST ADDED

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**.

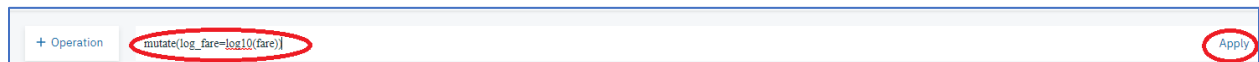
embarked	survived_value	pclass
String	String	String
S		first
S		first
S		first
S		first
S		first
S		first
S		first
S		first
S		first
C		first
C		first
C	Y	first
C	Y	first
S	Y	first

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**.



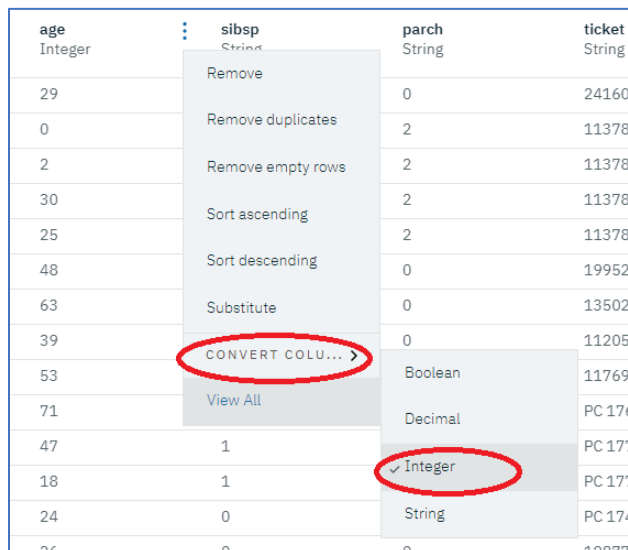
fare	embarked	survive
String	String	String
211.3375		Y
151.5500		Y
151.5500		N
151.5500		N
151.5500		N
26.5500		Y
77.9583		Y
0.0000		N
51.4792		
49.5042		
227.5250		
227.5250		
69.3000		
78.8500		
30.0000		

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**.



| + Operation | mutate(log_fare=log10(fare)) | 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**.



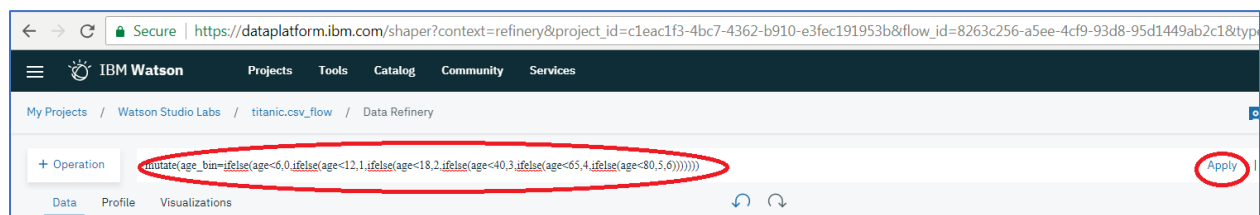
| age     | sibsp  | parch  | ticket |
|---------|--------|--------|--------|
| Integer | String | String | String |
| 29      |        | 0      | 24160  |
| 0       |        | 2      | 11378  |
| 2       |        | 2      | 11378  |
| 30      |        | 2      | 11378  |
| 25      |        | 2      | 11378  |
| 48      |        | 0      | 19952  |
| 63      |        | 0      | 13502  |
| 39      |        | 0      | 11205  |
| 53      |        |        | 11769  |
| 71      |        |        | PC 174 |
| 47      | 1      |        | PC 177 |
| 18      | 1      |        | PC 177 |
| 24      | 0      |        | PC 174 |
| 26      | 0      | 0      | 19877  |

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**.

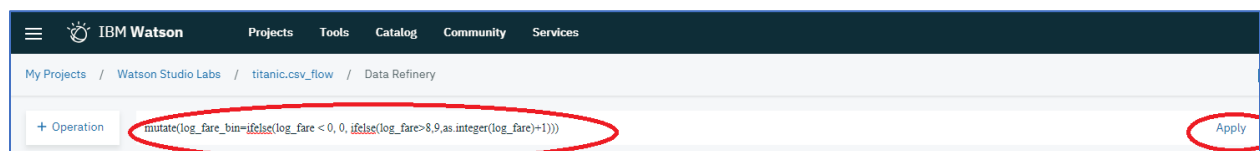
| Bin | Age Range |
|-----|-----------|
| 0   | 0-5       |
| 1   | 6-11      |
| 2   | 12-17     |
| 3   | 18-39     |
| 4   | 40-64     |
| 5   | 65-79     |
| 6   | Over 79   |
|     |           |



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**




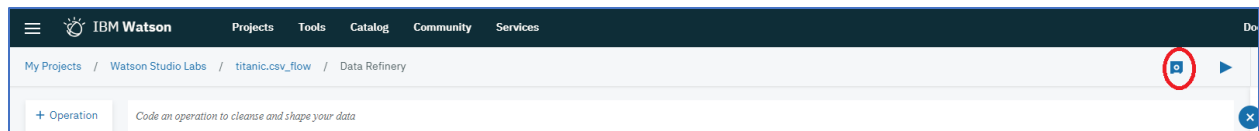
10. Now we will drop the age, fare, and log\_fare columns as they are no longer needed for modeling purposes. Select the vertical ellipse adjacent to the column and click on **Remove** as shown below.

| age | Integer | sibsp             | String |
|-----|---------|-------------------|--------|
| 29  |         | Remove            |        |
| 0   |         | Remove duplicates |        |
| 2   |         | Remove empty rows |        |
| 30  |         | Sort ascending    |        |
| 25  |         | Sort descending   |        |
| 48  |         | Substitute        |        |
| 63  |         | CONVERT COLU... > |        |
| 39  |         | View All          |        |
| 53  |         |                   |        |

| fare     | Decimal | embarked          | String |
|----------|---------|-------------------|--------|
| 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 |         |
| 2.18055594070364 |         |
| 2.18055594070364 |         |
| 2.18055594070364 |         |
| 2.18055594070364 |         |
| 1.42406452541749 |         |
| 1.89186236009324 |         |
| -Inf             |         |
| 1.71163178923691 |         |
| 1.69464204659912 |         |
| 2.35702912303943 | 4       |
| 2.35702912303943 | 3       |
| 1.84073323461181 | 3       |

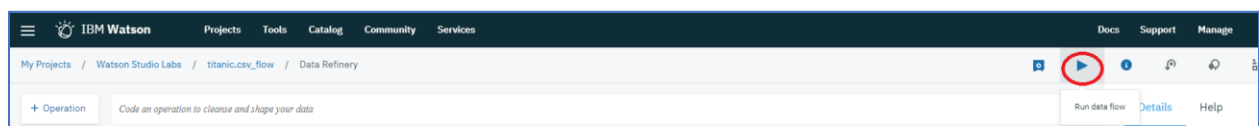
11. Save the Data Flow by clicking on the Save Data Flow icon .



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

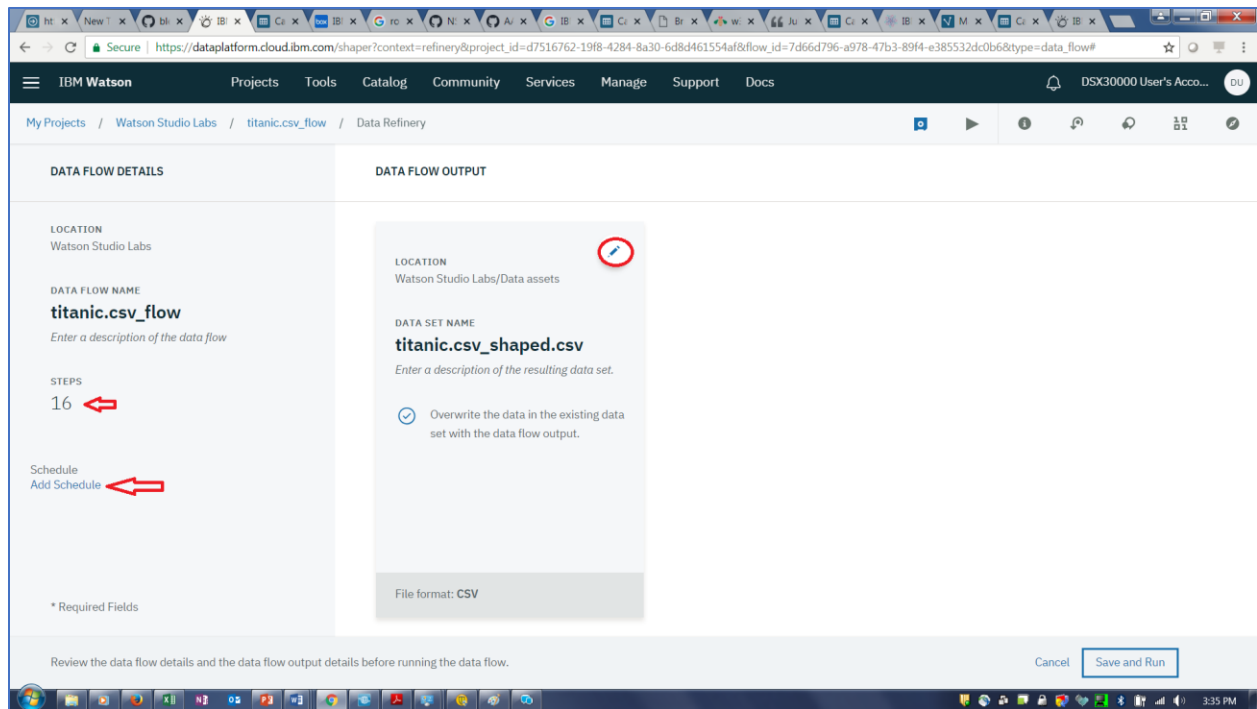
When users are interacting with the Data Refinery tool, the operations are applied to a subset of the data set to facilitate faster response times. To run the data operations on the entire data set, the user selects the run option.

1. Click on run icon 

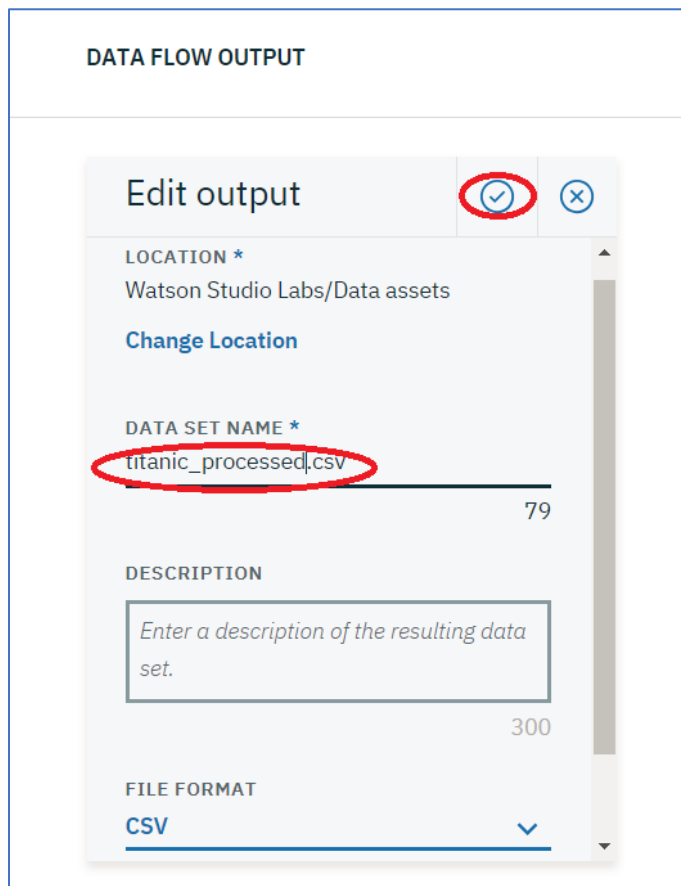


2. Note the number of steps used to transform the data. It should be 16. Also, a schedule can be set up if the transformation process needs to run on a scheduled basis. We are just going to do a one-time run. Change the name of the output file by clicking on the edit option (pencil icon).





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



4. Click **Save and Run**.

**DATA FLOW DETAILS**

LOCATION  
Watson Studio Labs

DATA FLOW NAME  
**titanic.csv\_flow**  
*Enter a description of the data flow*

STEPS  
16

Schedule  
Add Schedule

\* Required Fields

**DATA FLOW OUTPUT**

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**

6. 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

Refine ▶ ⓘ 🔊 🔍

**Summary**

Source 🔍 ↻

|                    | Data flow | Output                       |
|--------------------|-----------|------------------------------|
| <b>titanic.csv</b> | 16 Steps  | <b>titanic_processed.csv</b> |

**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 |

7. 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 + Add to project 👤

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

🔍 What assets are you looking for?

▼ **Data assets**

0 asset selected.

| <input type="checkbox"/> | 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 | ⋮       |

8. 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<br><small>Type: String</small> | SURVIVED<br><small>Type: String</small> | NAME<br><small>Type: String</small> | SEX<br><small>Type: String</small> | SIBSP<br><small>Type: String</small> | PARCH<br><small>Type: String</small> | TICKET<br><small>Type: String</small> | EMBARKED<br><small>Type: String</small> | SURVIVED_VALUE<br><small>Type: String</small> | PCLASS_VALUE<br><small>Type: String</small> | AGE_BIN<br><small>Type: Decimal</small> | LOG_FARE_BIN<br><small>Type: Decimal</small> |
|---------------------------------------|-----------------------------------------|-------------------------------------|------------------------------------|--------------------------------------|--------------------------------------|---------------------------------------|-----------------------------------------|-----------------------------------------------|---------------------------------------------|-----------------------------------------|----------------------------------------------|
| 1                                     | 1                                       | Allen, Miss. Elisab                 | 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. Heli                 | female                             | 1                                    | 2                                    | 113781                                | S                                       | N                                             | first                                       | 0.0                                     | 3.0                                          |
| 1                                     | 0                                       | Allison, Mr. Hudso                  | male                               | 1                                    | 2                                    | 113781                                | S                                       | N                                             | first                                       | 3.0                                     | 3.0                                          |
| 1                                     | 0                                       | Allison, Mrs. Hudso                 | 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. Ki                   | 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                                          |