

## Watson Studio SPSS Modeler Overview

### Introduction

In this lab you will learn how to implement analytics in **SPSS Modeler**, a well-known visual data mining workbench which is part of **Watson Studio**. The lab will introduce the SPSS Modeler capability using the trafficking datasets. The lab will guide the development of an SPSS Modeler stream that will prepare the input data to train and evaluate a machine learning model for predicting the trafficking risk based on the travel itinerary.

### End-to-End Data Science

The general flow of the End to End Data Science PoT will be guided by the activities shown in Figure 1- End to End Flow. The SPSS capability spans the Prepare Data, Build Model, and Save and Deploy activities.

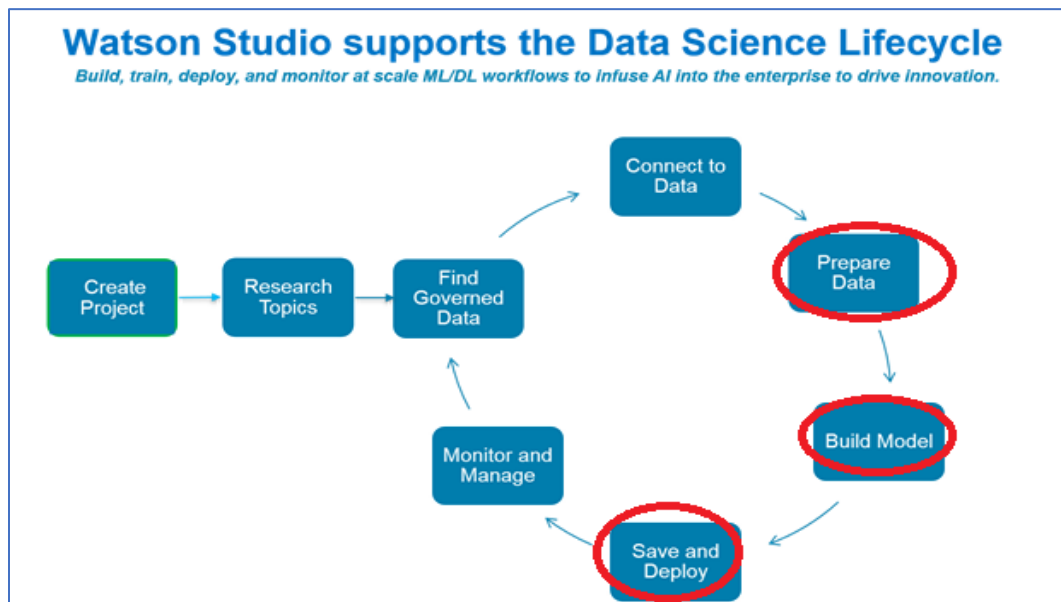


Figure 1- End to End Flow

### Objectives

1. Become familiar with the Watson Studio SPSS Modeler capability
2. Load the trafficking data into SPSS Modeler
3. Join the datasets
4. Profile the trafficking data
5. Prepare the trafficking data
6. Train/Evaluate a machine learning model.
7. Save the model.

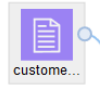
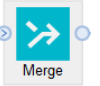
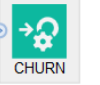

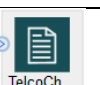

## Background

**SPSS Modeler** is a visual data mining workbench. Modeler can be used to complete all tasks in analytic application development

- Data understanding
- Data preparation
- Model building
- Model evaluation

Assets developed in Modeler are called “flows”. Another frequently used term in Modeler documentation is “streams” (used in Modeler desktop documentation). A flow starts with one or several data sources. Using visual nodes, a user can apply different operations to data. Data “flows” from one node to another in the direction of the arrows.

Visual nodes in modeler are color-coded and organized by type of operation: **Import, Record Operations, Field Operations, Graphs, Modeling, Output, and Export** (data sources). Most operations are well-known functions in data preparation and analytics, such as sampling, filtering, binning, etc.

The data sources are purple	
Data preparation operations are blue	
Algorithms are green	
The models that are created based on algorithms are orange	
Different types of output (graphs, tables, external files) are black	
The nodes with a star icon are called “supernodes” because they contain several nodes. Supernodes are used for visual organization of the flow.	

If a user needs more information about a particular node, it can be looked up in Modeler documentation. SPSS also publishes the **Algorithms Guide** that explains how machine learning algorithms are implemented in Modeler.

## Female Human Trafficking Data

The data sets used for this lab consist of **simulated** travel itinerary data. The use case corresponds to an analyst reviewing the travel data to assign a risk of trafficking. The risk is recorded as the VETTING \_LEVEL column in the dataset. Some of the records have already

been analyzed and have a VETTING\_LEVEL of low (value is 30), medium (value is 20), or high risk (value is 10). Others have not yet been vetted (value is 100). We will use the data that has been vetted to train a model to predict the risk for the unvetted records. This can be used to automate the process and augment the analyst. For example, one option would be to send the predicted high-risk persons to the analyst for further investigation.

The OCCUPATION data included in the travel data is very granular. For modeling purposes, it was decided to categorize the OCCUPATION data. Two additional datasets are used for this purpose. The occupation.csv dataset maps the granular occupation data to a category code. The categories dataset maps a category code to a category description. These datasets will be joined to the main dataset to prepare the data for modeling.

Other columns in the dataset are similarly very granular and could also be categorized for modeling purposes. This lab does not include steps to accomplish this, but it would be similar to what was done for the occupation column.

## Lab Steps

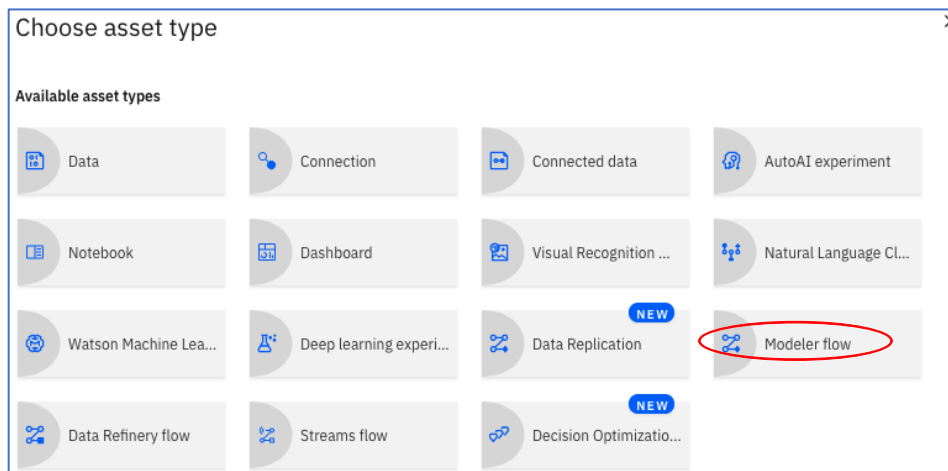
In this section, we will create a Machine Learning flow using SPSS nodes.

### Step 1 - Create a New Flow

1. In the Watson Studio project, click on **Add to project**.



2. Select **Modeler Flow**.



3. Enter a **Name** for the flow, optionally enter a **Description**, and click on **Create**.

## New modeler flow

**New** From File From Example

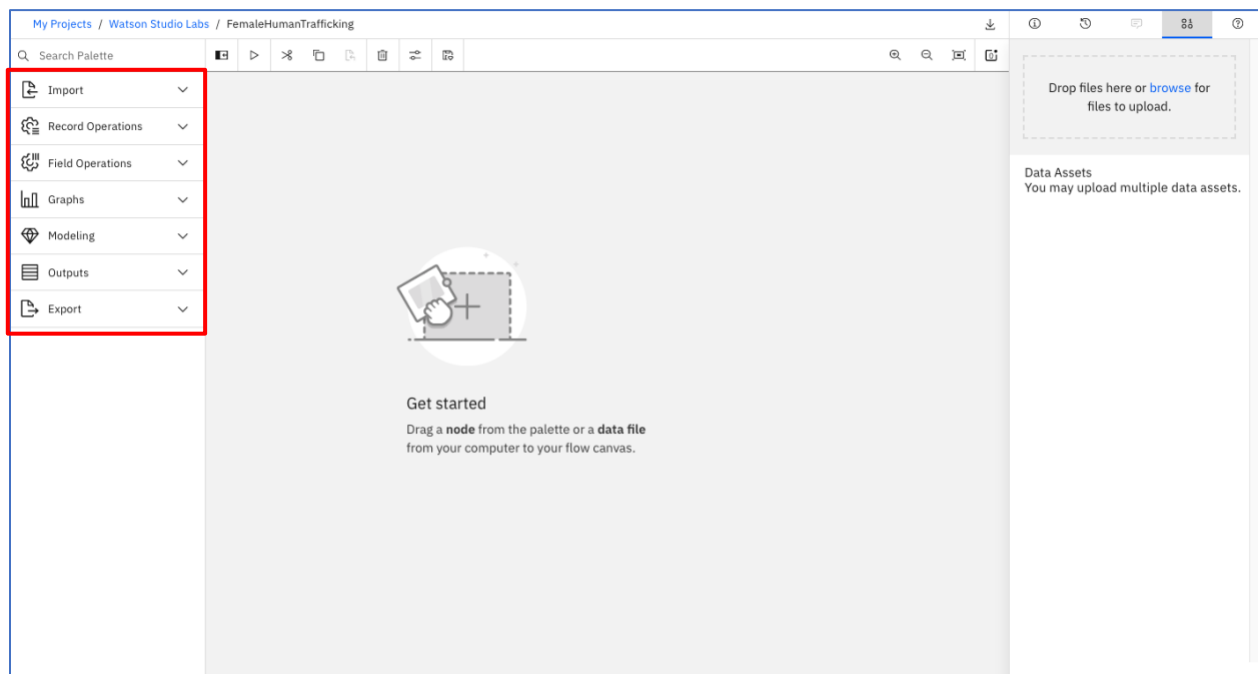
Name  
**FemaleHumanTrafficking**

Description (optional)  
Type description here.

Runtime  
IBM SPSS Modeler

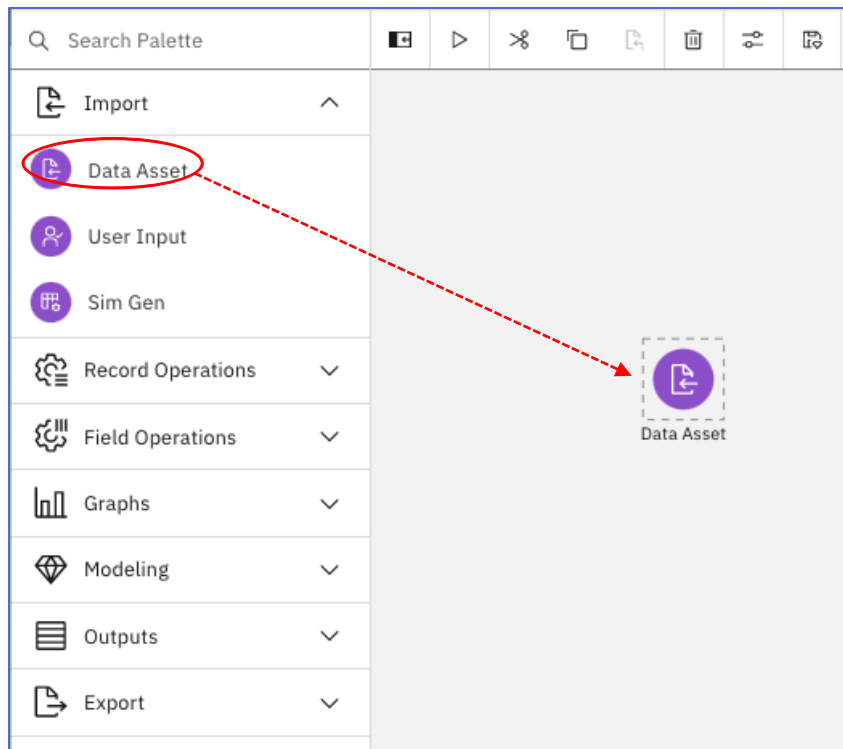
Cancel Create

4. This opens the Flow Editor. Note the palette of operations on the left-hand side.

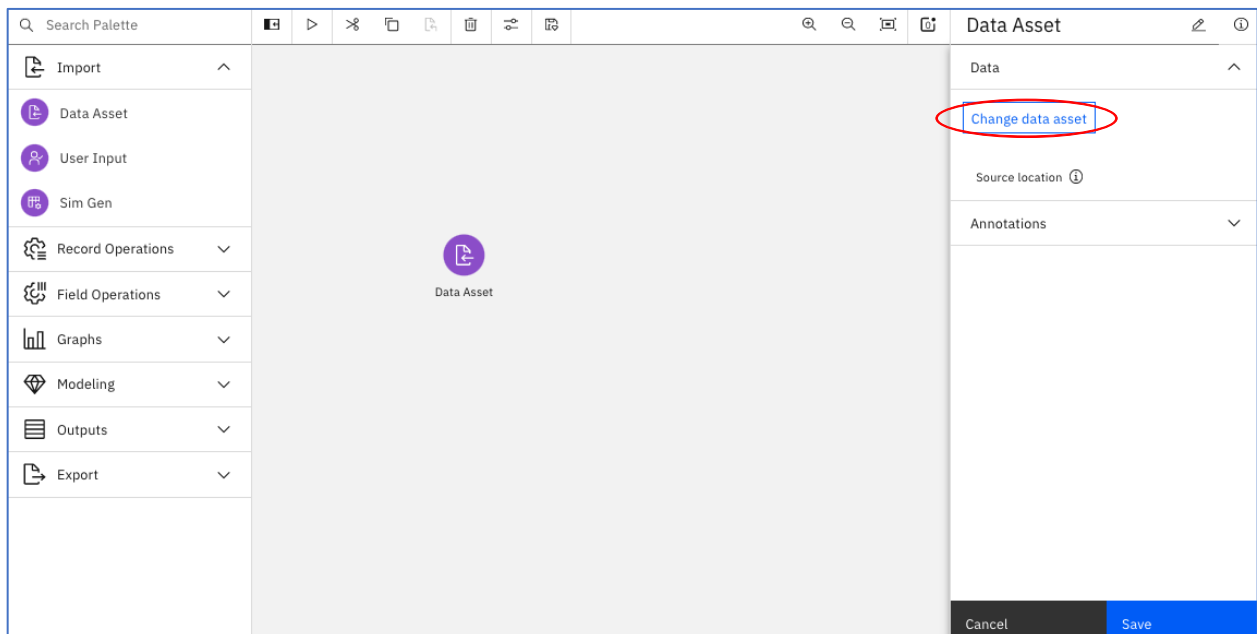


## Step 2 - Load the Trafficking Datasets

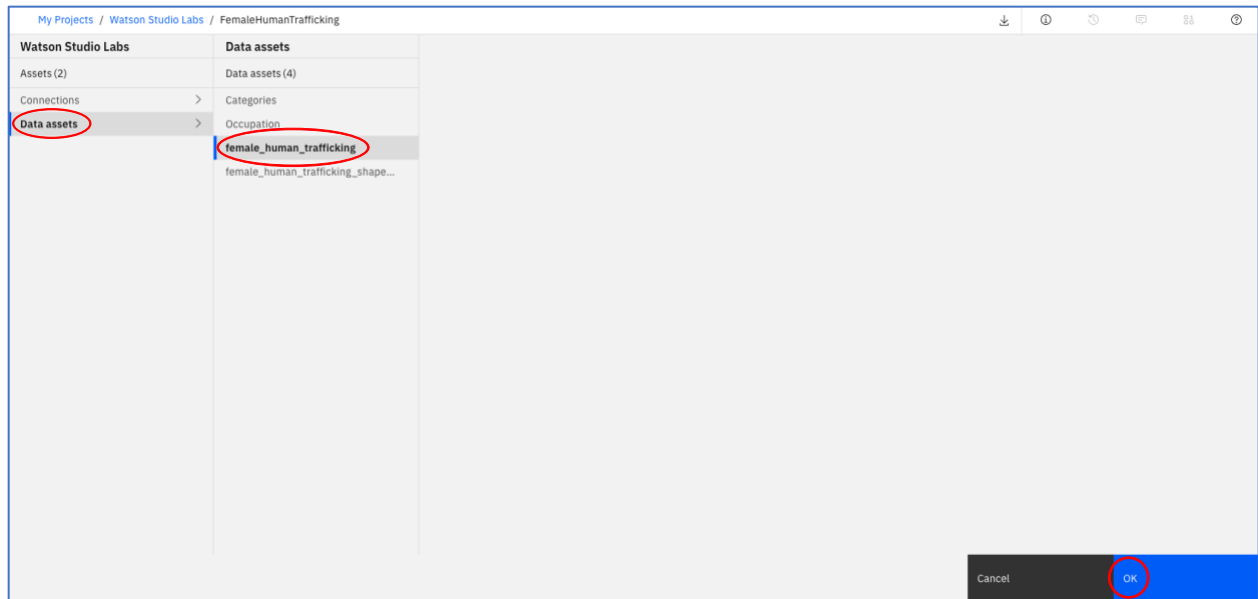
1. Click on **Import** and then **Data Asset** and hold the left mouse key on the Data Asset icon and **drag it onto the left side of the canvas**. Release the left mouse key.



2. Double click on the **Data Asset**. In the window pane on the right-hand-side click on **Change data asset**.



3. Click on **Data Assets**, click on **female\_human\_trafficking**, then click **OK**.



#### 4. Click on ANNOTATIONS.

Data Asset ✎ ℹ

Data ^

[Change data asset](#)

**Source location** ℹ  
female\_human\_trafficking

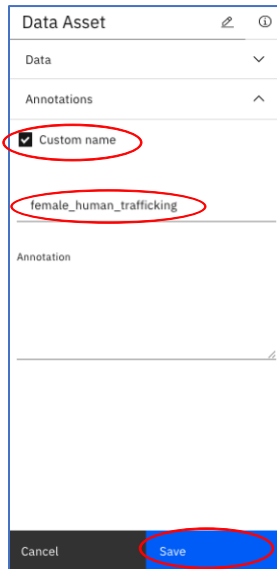
**Field delimiter**  
Comma (,) ▼

**Quote character**  
Double quotation mark (") ▼


**Decimal symbol**  
Period (.) ▼

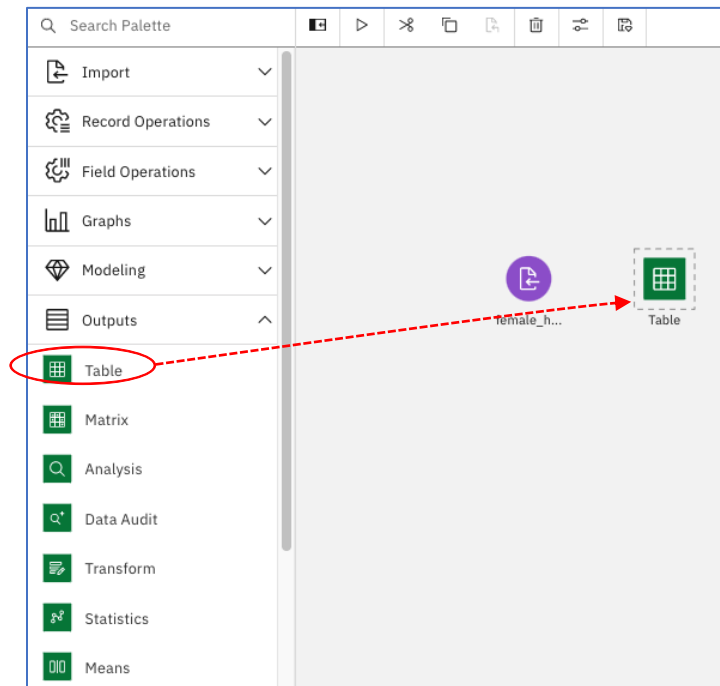
**Annotations** ▼

5. Click on **Custom name**, and type **female\_human\_trafficking**, and click on **Save**.

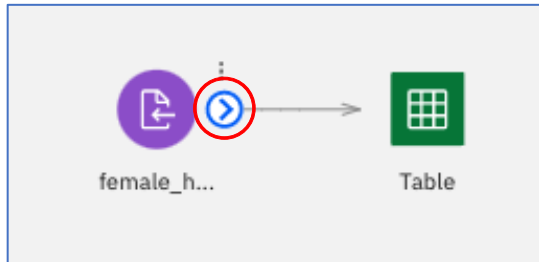


The screenshot shows the 'Data Asset' configuration window. The 'Data' dropdown is set to 'Data'. Under the 'Annotations' section, the 'Custom name' checkbox is checked and circled in red. Below it, the text 'female\_human\_trafficking' is entered and also circled in red. At the bottom, the 'Save' button is circled in red, while the 'Cancel' button is not.

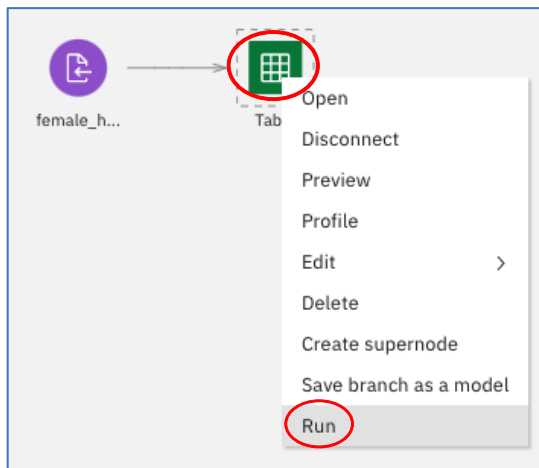
6. Click on the **Outputs** menu item in the Node Palette on the left and then click on the **Table** icon and drag the icon to the right of the female\_human\_trafficking to display its contents. If the Node Palette is not visible, click on the Node Palette icon .



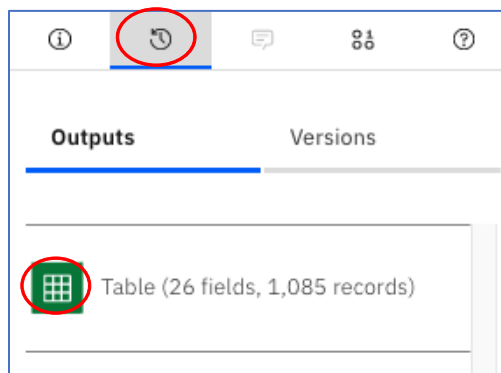
7. **Connect the right side of the female\_human\_trafficking icon to the left side of the Table icon.** This is accomplished by hovering over the data asset icon, clicking on the little blue arrow that appears on the right side of the icon, holding the left mouse key, and dragging the mouse to the Table icon, and then releasing the left mouse key.



8. Right click on the **Table** icon and select **Run**.



9. The “Running Flow” prompt will appear and then when completed a Table output selection will appear on the right side of the screen under the **Outputs** tab. If the Table output selection does not appear, select the clock icon. **Double click on the Table selection** and the contents of the female\_human\_trafficking is displayed.



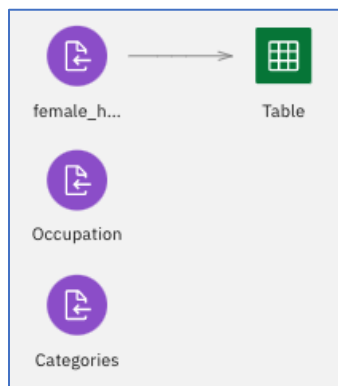


10. Each row contains travel information for a person. We will use this data to make predictions on trafficking risk. **Click on your flow name.**

My Projects / Watson Studio Labs / **FemaleHumanTrafficking** Table (26 fields, 1,085 records)


INTERNAL_ID	VETTING_LEVEL	DESCRIPTION	NAME	GENDER	BIRTH_DATE	BIRTH_COUNTRY	BIRTH_COUNTRY_CODE	OCCUPATION	ADDRESS
706	100	NA	Lee Anderson	F	1992-03-09	Ghana	GH	Sport and exercise psychologist	53943 David Causeway, Whitesburg, Kentucky 41858
707	20	NA	Gab Chapman	F	1999-06-07	Ghana	GH	Production designer, theatre/television/film	8369 Laura Burg Suite 494, Mount Airy, North Carolina 27003
708	30	NA	Leslie Terri Robinson	F	1974-08-27	Ghana	GH	International aid/development worker	51807 Kennedy Landing, Dexter, New Mexico 88320
709	100	NA	Jeney Errie Garcia	F	1977-03-03	Ghana	GH	Paramedic	304 Kelly Spur Ste 903, Zanesville, None 46799
710	100	NA	Katrina Allen	F	1974-09-26	Ghana	GH	Paediatric nurse	528 Deanna Shores, Fort Wayne, Indiana 46825

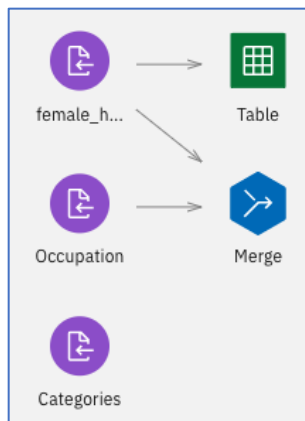
11. Repeat steps 1-5 for the occupation dataset and then repeat steps 1-5 for the Categories dataset. When complete, the canvas should appear as below.



### Step 3 - Join the Data Sources

In this step we will join the data sources using **Merge** Nodes.

1. Add a **Merge** node to the flow by clicking on the **Record Operations** menu in the Node Palette, and then dragging the **Merge** node to the right of the **Occupations** data source. If the Node Palette is not visible, click on the Node Palette icon . Connect the **female\_human\_trafficking** data source to the Merge node. Connect the **Occupations** data source to the **Merge** node. The canvas should appear as below.



2. Double-click on the **Merge** Node. Click on **MERGE**, then click on **Keys** for the Merge method, and click on **Add Columns**.

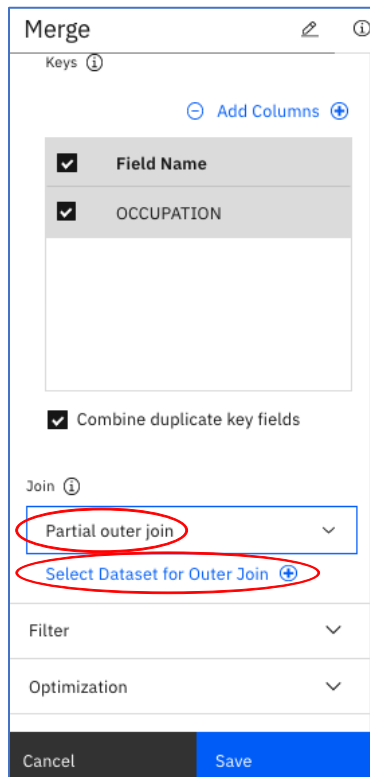
The screenshot shows the configuration panel for a 'Merge' node. The 'Merge' section is expanded, revealing the 'Merge method' dropdown menu, which is currently set to 'Keys'. Below this, there is a section for 'Keys' and an 'Add Columns' button with a plus icon, both of which are circled in red.

3. Click on **OCCUPATION** and then click on **Ok**. You may need to scroll down.

The screenshot displays the 'Select Fields for Merge' dialog box. It features a search bar at the top and a table of available fields. The 'OCCUPATION' field is selected, indicated by a checkmark in the first column. The 'OK' button at the bottom right is circled in red.

Field Name	Schema Name	Data Type
<input type="checkbox"/> INTERNAL_ID	0	# integer
<input type="checkbox"/> VETTING_LEVEL	0	# integer
<input type="checkbox"/> DESCRIPTION	0	abc string
<input type="checkbox"/> NAME	0	abc string
<input type="checkbox"/> GENDER	0	abc string
<input type="checkbox"/> BIRTH_DATE	0	date
<input type="checkbox"/> BIRTH_COUNTRY	0	abc string
<input type="checkbox"/> BIRTH_COUNTRY_CODE	0	abc string
<input checked="" type="checkbox"/> OCCUPATION	0	abc string
<input type="checkbox"/> ADDRESS	0	abc string

4. Scroll down in the Merge side panel that you have been working in. Select **Partial outer join** and then click on **Select Dataset for Outer Join**.



Merge

Keys ⓘ

⊖ Add Columns ⊕

☒ Field Name

☒ OCCUPATION

☒ Combine duplicate key fields

Join ⓘ

Partial outer join ▼

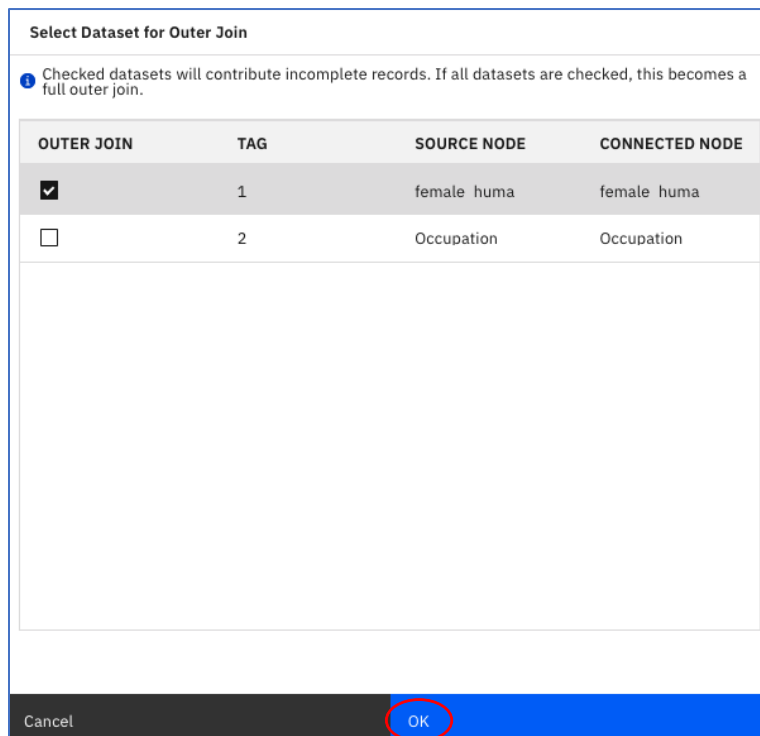
Select Dataset for Outer Join ⊕

Filter ▼

Optimization ▼

Cancel Save

5. Make sure the female\_human\_trafficking **SOURCE NODE** is checked and click **OK**.



Select Dataset for Outer Join


ⓘ Checked datasets will contribute incomplete records. If all datasets are checked, this becomes a full outer join.

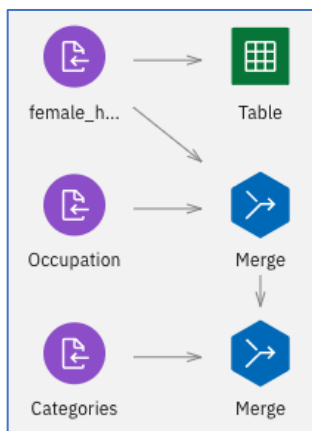
OUTER JOIN	TAG	SOURCE NODE	CONNECTED NODE
<input checked="" type="checkbox"/>	1	female huma	female huma
<input type="checkbox"/>	2	Occupation	Occupation

Cancel OK



6. Click on **Save**.


The screenshot shows the 'Merge' configuration window. At the top, there's a 'Keys' section with an 'Add Columns' button. Below it, a list of fields is shown with checkboxes: 'Field Name' and 'OCCUPATION'. The 'Combine duplicate key fields' checkbox is checked. The 'Join' section is set to 'Partial outer join' with a 'Select Dataset for Outer Join' button. There are also 'Filter' and 'Optimization' dropdown menus. At the bottom, there are 'Cancel' and 'Save' buttons, with the 'Save' button circled in red.


7. Add a **Merge** node to the flow by clicking on the **Record Operations** menu in the Node Palette, and then dragging the **Merge** node to the right of the **Categories** data source. If the Node Palette is not visible, click on the Node Palette icon . Connect the prior **Merge** node to this **Merge** node. Connect the **Categories** data source to the **Merge** node. The canvas should appear as below.





8. Double click on the second **Merge** node to set the merge options. Click on **MERGE**, click on **Keys** for the Merge method, and then click on **Add Columns** to add the key columns.


**Merge**  



Inputs 

**Merge** 

**Merge method** 



**Keys** 

**Keys** 

 **Add Columns** 

9. Scroll down and click on the **Code** checkbox where the Schema Name column is 0.  
Click on **OK**.


Select Fields for Merge

Search in column Field name Filter: # abc  Reset 

<input type="checkbox"/>	Field Name	Schema Name	Data Type
<input type="checkbox"/>	ARRIVAL_AIRPORT_REGION	0	abc string
<input type="checkbox"/>	DEPARTURE_AIRPORT_COUN	0	abc string
<input type="checkbox"/>	DEPARTURE_AIRPORT_IATA	0	abc string
<input type="checkbox"/>	DEPARTURE_AIRPORT_MUN	0	abc string
<input type="checkbox"/>	DEPARTURE_AIRPORT_REGI	0	abc string
<input type="checkbox"/>	UUID	0	abc string
<input type="checkbox"/>	AGE	0	# integer
<input checked="" type="checkbox"/>	Code	0	# integer
<input type="checkbox"/>	Code	1	# integer
<input type="checkbox"/>	Category	1	abc string

Cancel **OK**

10. Scroll down in the side panel and click on **Partial Outer Join** and click on Select Dataset.

**Join** 

**Partial outer join** 

**Select Dataset for Outer Join** 

11. Make sure the **Merge SOURCE NODE** is selected and click **Okay**.

Select Dataset for Outer Join

Checked datasets will contribute incomplete records. If all datasets are checked, this becomes a full outer join.

OUTER JOIN	TAG	SOURCE NODE	CONNECTED NODE
<input checked="" type="checkbox"/>	1	Merge	Merge
<input type="checkbox"/>	2	Categories	Categories

Cancel OK

12. Click **Save**.

Merge

⊖ Add Columns ⊕

☐ Field Name

☐ Code

☒ Combine duplicate key fields

Join ⓘ

Partial outer join ▼

Select Dataset for Outer Join ⊕

Filter ▼


Optimization ▼

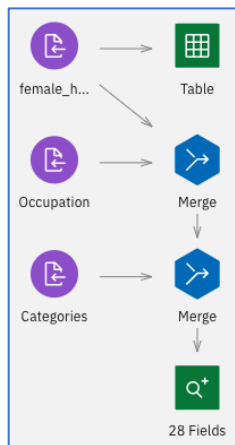
Annotations ▼

Cancel Save

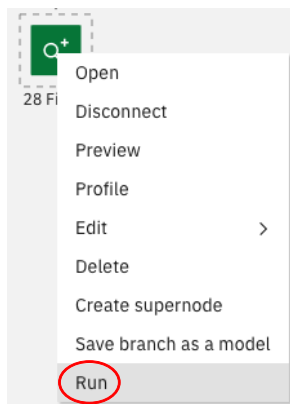
## Step 4 - Explore the Data using the Data Audit Node

The SPSS Modeler has a Data Audit node that provides profiling information on the input data that is useful for cleansing and preparing the data. It provides a comprehensive first look at the data, including summary statistics, as well as information about outliers, missing values, and extremes.

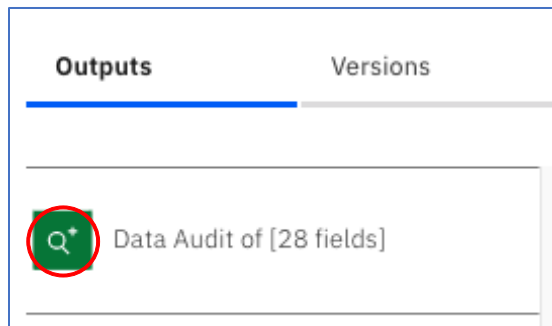
1. Add a **Data Audit** node to the flow clicking on the **Outputs** menu item in the Node Palette, and then dragging the **Data Audit** node to underneath the **Merge** node. If the Node Palette is not visible, click on the Node Palette icon . Connect the node to the Data Audit node. The canvas should appear as below.



2. Right click on the **Data Audit** node and click **Run**.



3. The “Running Flow” prompt will appear and then when completed a Data Audit output selection will appear on the right side of the screen under the **Outputs** tab. If the **Outputs** tab doesn’t display, click on the clock icon.





- Double click on the **Data Audit of [28 fields]** to view the Data Audit output. The top section of the Data Audit report displays profiling information. For modeling purposes, fields that have only 1 unique value, or have many unique values should be eliminated. In addition, certain fields are directly related such as PASSPORT\_COUNTRY, PASSPORT\_COUNTRY\_CODE, BIRTH\_COUNTRY, and BIRTH\_COUNTRY\_CODE. Only one of these fields need to be retained. The fields that we will keep for modeling purposes are VETTING\_LEVEL, Category, AGE, COUNTRIES\_VISITED\_COUNT, ARRIVAL\_AIRPORT\_REGION, DEPARTURE\_AIRPORT\_COUNTRY, PASSPORT\_COUNTRY. Later in the lab we will apply a filter operation to retain these fields.

My Projects / Watson Studio Labs / FemaleHumanTrafficking / Data Audit of [28 fields]

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- Scroll down** to view the bottom section. It displays data quality checks in the form of missing values or anomalous values. In our travel data simulator, we didn't simulate any of those type of values!



My Projects / Watson Studio Labs / FemaleHumanTrafficking / Data Audit of [28 fields]															
	Field	Measurement	Outliers	Extremes	Action	Impute Missing	Method	% Complete	Valid Records	Null Value	Empty String	White Space	Blank Value		
1	Code	Continuous	0	0	None	Never	Fixed	100.000	1085	0	0	0	0		
2	OCCUPATION	Categorical	--	--	--	Never	Fixed	100.000	1085	0	0	0	0		
3	INTERNAL_ID	Continuous	0	0	None	Never	Fixed	100.000	1085	0	0	0	0		
4	VETTING_LEVEL	Continuous	0	0	None	Never	Fixed	100.000	1085	0	0	0	0		
5	DESCRIPTION	Categorical	--	--	--	Never	Fixed	100.000	1085	0	0	0	0		
6	NAME	Categorical	--	--	--	Never	Fixed	100.000	1085	0	0	0	0		
7	GENDER	Categorical	--	--	--	Never	Fixed	100.000	1085	0	0	0	0		
8	BIRTH_DATE	Continuous	0	0	None	Never	Fixed	100.000	1085	0	0	0	0		
9	BIRTH_COUNTRY	Categorical	--	--	--	Never	Fixed	100.000	1085	0	0	0	0		
10	BIRTH_COUNTRY_CODE	Categorical	--	--	--	Never	Fixed	100.000	1085	0	0	0	0		
11	ADDRESS	Categorical	--	--	--	Never	Fixed	100.000	1085	0	0	0	0		
12	SSN	Categorical	--	--	--	Never	Fixed	100.000	1085	0	0	0	0		
13	PASSPORT_NUMBER	Continuous	0	0	None	Never	Fixed	100.000	1085	0	0	0	0		
14	PASSPORT_COUNTRY	Categorical	--	--	--	Never	Fixed	100.000	1085	0	0	0	0		
15	PASSPORT_COUNTRY_CODE	Categorical	--	--	--	Never	Fixed	100.000	1085	0	0	0	0		

6. Return to the flow by clicking on the **FemaleHumanTrafficking** breadcrumb at the top.

My Projects / Watson Studio Labs / FemaleHumanTrafficking / Data Audit of [28 fields]

①








🔄

💬

⚙️


②

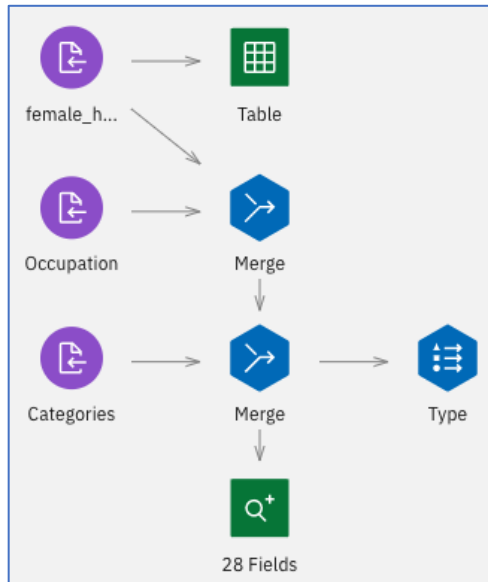
Data Audit of [28 fields]

	Field	Graph	Measurement	Min	Max	Mean	Std. Dev	Skewness	Unique	Valid
1	Code		Continuous	1	15	7.950	4.238	0.263	--	1085
2	OCCUPATION		Categorical	--	--	--	--	--	--	1085
3	INTERNAL_ID		Continuous	1	1085	543	313.357	0.000	--	1085
4	VETTING_LEVEL		Continuous	10	100	80.498	34.211	-1.216	--	1085
5	DESCRIPTION		Categorical	--	--	--	--	--	1	1085
6	NAME		Categorical	--	--	--	--	--	--	1085
7	GENDER		Categorical	--	--	--	--	--	1	1085

## Step 5 - Explore the Data using Graph Nodes.

Let's explore the data using Graph Nodes. The Distribution node, and the Histogram node will be used to explore some of the characteristics of the trafficking data. First, we will add a Type node to the canvas. The Type node specifies field metadata and properties. We will change the measurement property for the "Code" and "VETTING\_LEVEL" fields that were derived as "Continuous" (by scanning the data values) to "Nominal".

1. Add a **Type** node to the flow by clicking on the **Field Operations** menu item in the Node Palette and then drag the **Type** node to the right of the second **Merge** node. If the Node Palette is not visible, click on the Node Palette icon . Connect the **Merge** node to the **Type** node. The canvas should appear as below.



2. Double click on the **Type** node. This will open a **Type** menu pallet on the right side of the screen. Select the dropdown in the **Measure** column next to **Code**. Change the **Measure** to **Nominal**.

### Type

Settings

Default Mode ⓘ  
☒ Read metadata ☐ Pass (do not scan)

Type Operations

Read Values

Clear All Values

Search in column Field

<input type="checkbox"/>	Field	Measure	Role	Value Mode	Values	Check
<input type="checkbox"/>	# Code	Continuous	Input	Read		None
<input type="checkbox"/>	abc OCCUPAT	Categorical	Input	Read		None
<input type="checkbox"/>	# INTERNAL	Continuous	Input	Read		None
<input type="checkbox"/>	# VETTING_	Continuous	Input	Read		None
<input type="checkbox"/>	abc DESCRIPT	Categorical	Input	Read		None

Type

Settings

Default Mode ⓘ  
☒ Read metadata ☐ Pass (do not scan)

Type Operations

Read Values Clear All Values

Search in column Field

<input type="checkbox"/>	Field	Measure	Role	Value Mode	Values	Check
<input type="checkbox"/>	# Code	<div> Default  ✓ Continuous  Categorical  Flag  Nominal  Ordinal  Typeless </div>	Input	Read		None
<input type="checkbox"/>	abc OCCUPAT:		Input	Read		None
<input type="checkbox"/>	# INTERNAL		Input	Read		None
<input type="checkbox"/>	# VETTING_	Continuous	Input	Read		None
<input type="checkbox"/>	abc DESCRIPT	Categorical	Input	Read		None

3. Following the same process, change the **Measure** of VETTING\_LEVEL to **Nominal**.

Type

Settings

Default Mode ⓘ  
☒ Read metadata ☐ Pass (do not scan)

Type Operations

Read Values Clear All Values

Search in column Field

<input type="checkbox"/>	Field	Measure	Role	Value Mode	Values	Check
<input type="checkbox"/>	# Code	Nominal	Input	Specify	1, 2, 3, 4, 5, 6, 7, ...	None
<input type="checkbox"/>	abc OCCUPAT:	Typeless	None	Specify		None
<input type="checkbox"/>	# INTERNAL	Continuous	Input	Specify	1, 1085	None
<input type="checkbox"/>	# VETTING_	Nominal	Input	Specify	10, 100	None
<input type="checkbox"/>	abc DESCRIPT	Flag	Input	Specify	NA	None

4. Click **Read Values** and **Save**.

Type

Settings

Default Mode ⓘ  
☒ Read metadata ☐ Pass (do not scan)

Type Operations

Read Values

Clear All Values


Search in column Field

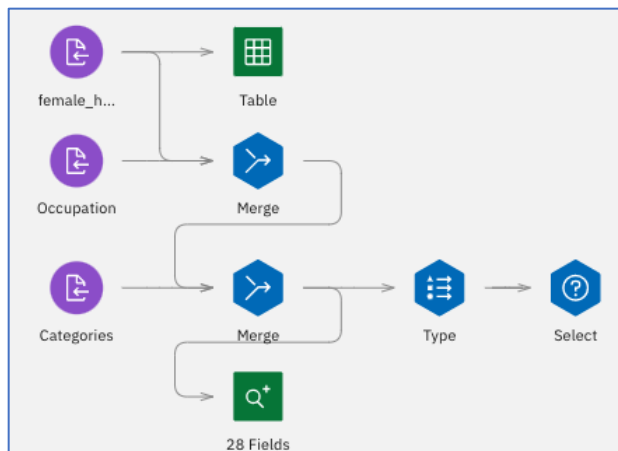
<input type="checkbox"/>	Field	Measure		Role		Value Mode		Values	Check	
<input type="checkbox"/>	# Code	Nominal	▼	Input	▼	Specify	▼	1, 2, 3, 4, 5, 6, 7, ...	None ▼	⚙
<input type="checkbox"/>	abc OCCUPAT	Typeless	▼	None	▼	Specify	▼		None ▼	⚙
<input type="checkbox"/>	# INTERNAL	Continuous	▼	Input	▼	Specify	▼	1, 1085	None ▼	⚙
<input type="checkbox"/>	# VETTING_	Nominal	▼	Input	▼	Specify	▼	10, 100	None ▼	⚙
<input type="checkbox"/>	abc DESCRIP1	Flag	▼	Input	▼	Specify	▼	NA	None ▼	⚙
<input type="checkbox"/>	abc NAME	Typeless	▼	None	▼	Specify	▼		None ▼	⚙
<input type="checkbox"/>	abc GENDER	Flag	▼	Input	▼	Specify	▼	F	None ▼	⚙
<input type="checkbox"/>	📅 BIRTH_D/	Continuous	▼	Input	▼	Specify	▼	1970-01-03, 200...	None ▼	⚙

Format

Cancel

Save

5. We will now discard the unvetted records. Add a **Select** node to the flow by clicking on the **Record Operations** menu item in the Node Palette and then dragging the **Select** node to the canvas to the right of the **Type** node. If the Node Palette is not visible, click on the Node Palette icon . The canvas should appear as below.



6. Double-click the **Select** node. Click on **Discard** for **Mode**. In the Condition, enter **VETTING\_LEVEL==100**, click **Save**.

Select

Settings

Mode

☐ Include


☒ Discard

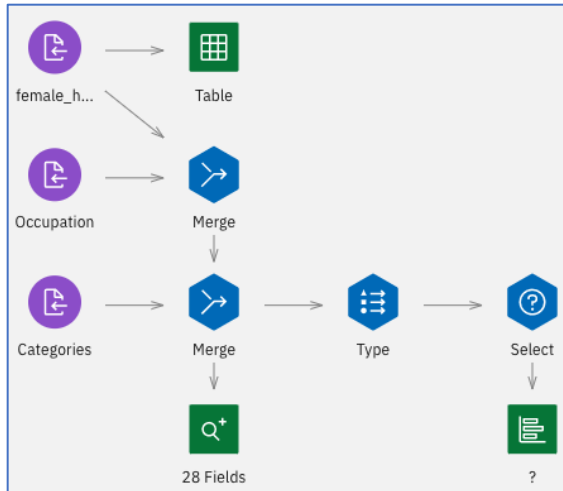
Condition

VETTING\_LEVEL==100

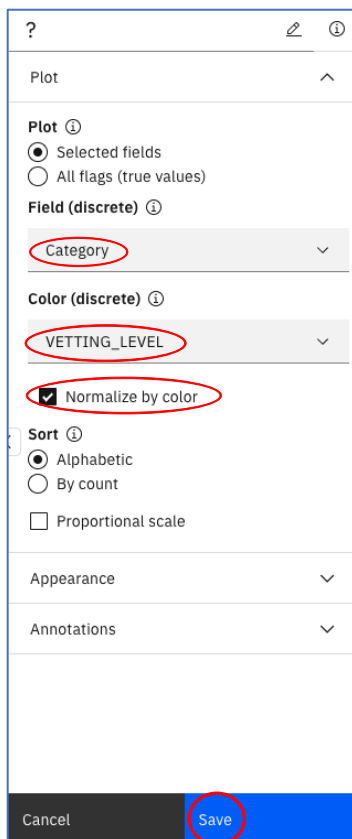
Annotations

Cancel Save

7. Add a **Distribution** node to the flow by clicking on the **Graph** menu item and then dragging the **Distribution** node to the canvas underneath the **Select** node. If the Node Palette is not visible, click on the Node Palette icon . Connect the **Select** node to the **Distribution** node. The canvas should appear as below. The ? indicates that the fields to be plotted have not been identified.



8. Double click on the Distribution Node. In the **Field (discrete)** dropdown, select **Category**. In the **Color (discrete)** dropdown, select **VETTING\_LEVEL**. Click on the **normalize by color** checkbox, and then click **Save**.



? Plot ^

**Plot** ⓘ

☒ Selected fields

☐ All flags (true values)

**Field (discrete)** ⓘ

Category

**Color (discrete)** ⓘ

VETTING\_LEVEL

☒ Normalize by color

**Sort** ⓘ

☒ Alphabetic

☐ By count

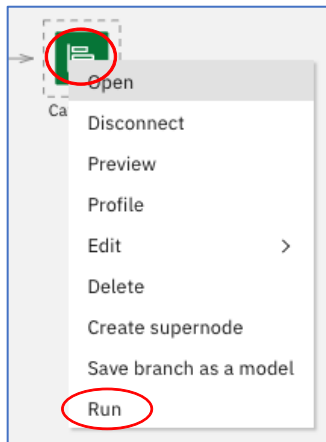
☐ Proportional scale

Appearance

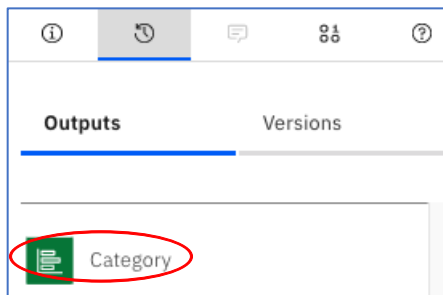
Annotations

Cancel Save

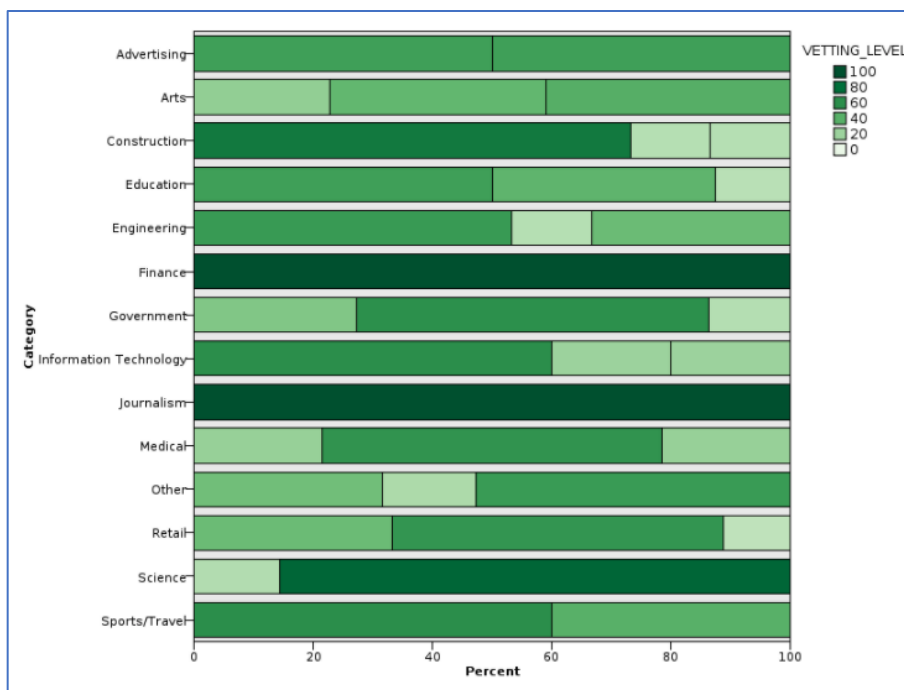
9. Right click on the Distribution node and select **Run**.



10. The Distribution output will appear under the **Outputs** tab. Double-click on Categories to view the graph. If you don't see the Outputs, click on the Outputs ("clock") icon.



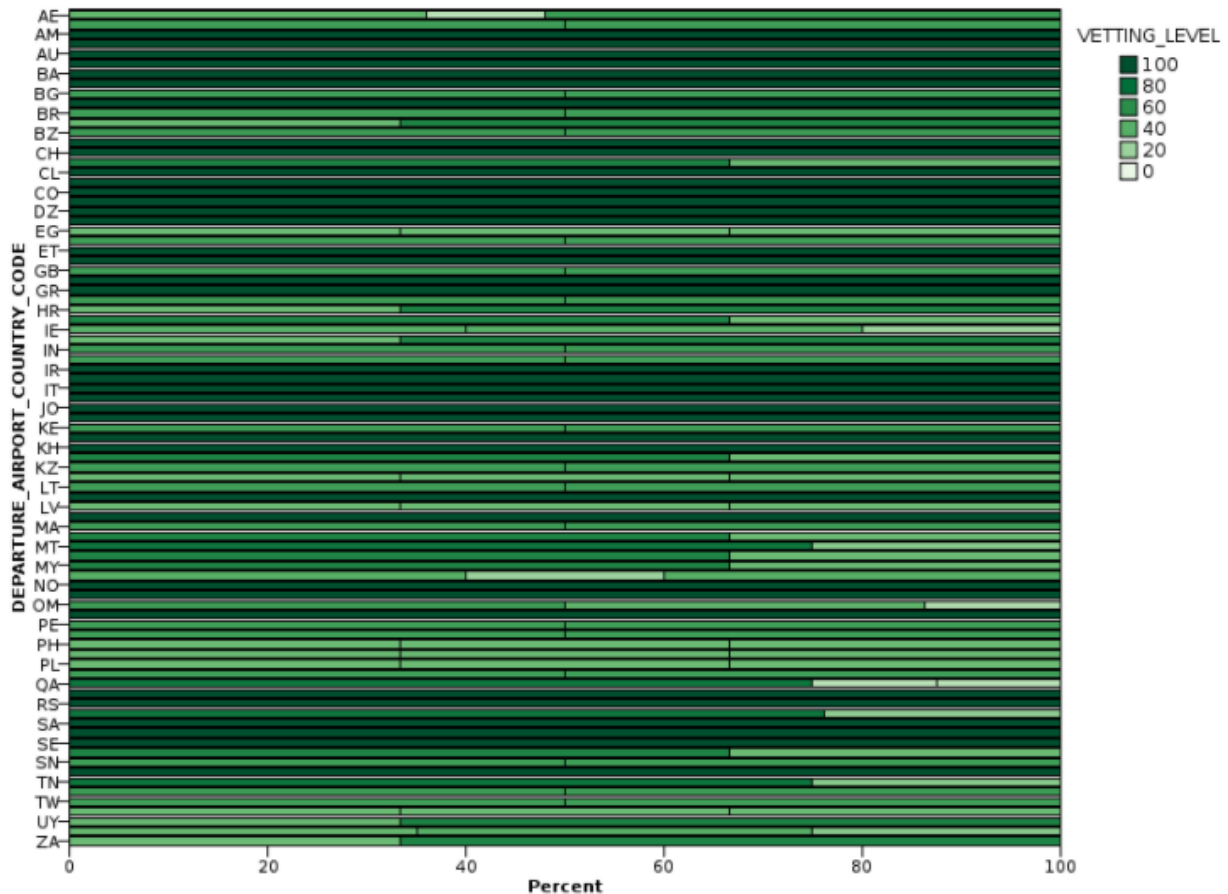
11. We can see from the graph that the VETTING\_LEVEL does differ based on Category.



12. Return to the flow by clicking on the FemaleHumanTrafficking breadcrumb at the top.

My Projects / Watson Studio Labs / FemaleHumanTrafficking / Category


13. You can change the distribution graph to show the **VETTING\_LEVEL** by **DEPARTURE\_AIRPORT\_COUNTRY\_CODE** by double clicking on the Distribution node and replacing **Category** with **DEPARTURE\_AIRPORT\_COUNTRY\_CODE** and clicking Save. Re-run the graph by right clicking on the Distribution node and selecting Run. Double click on the **DEPARTURE\_AIRPORT\_COUNTRY\_CODE** in the **Outputs** pane to display the graph.

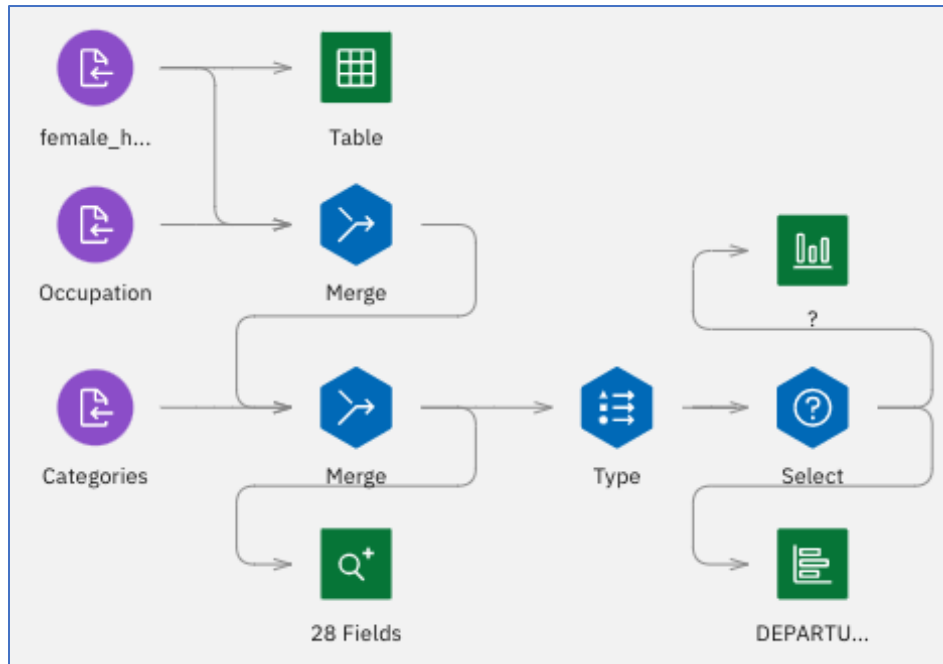


14. Return to the flow by clicking on the FemaleHumanTrafficking breadcrumb at the top.

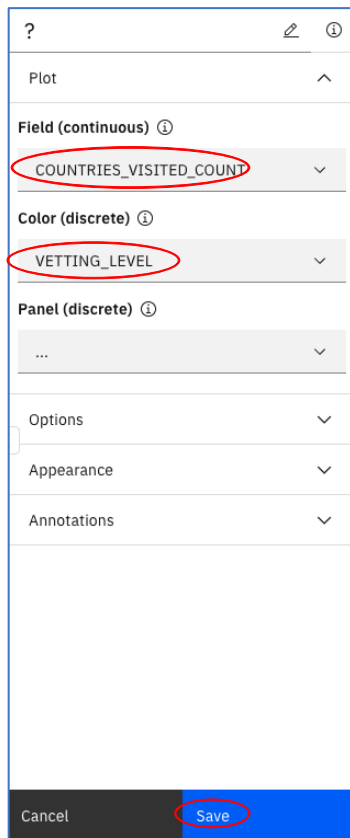
My Projects / Watson Studio Labs / FemaleHumanTrafficking / Category



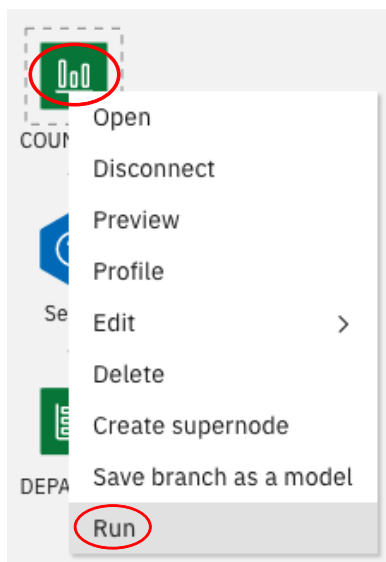
15. Add a **Histogram** node to the flow by clicking on the **Graphs** menu item and then dragging the **Histogram** node to the canvas above the **Select** node. If the Node Palette is not visible, click on the Node Palette icon . Connect the **Select** node to the **Histogram** node. The canvas should appear as below. The ? indicates that the fields to be plotted have not been identified.



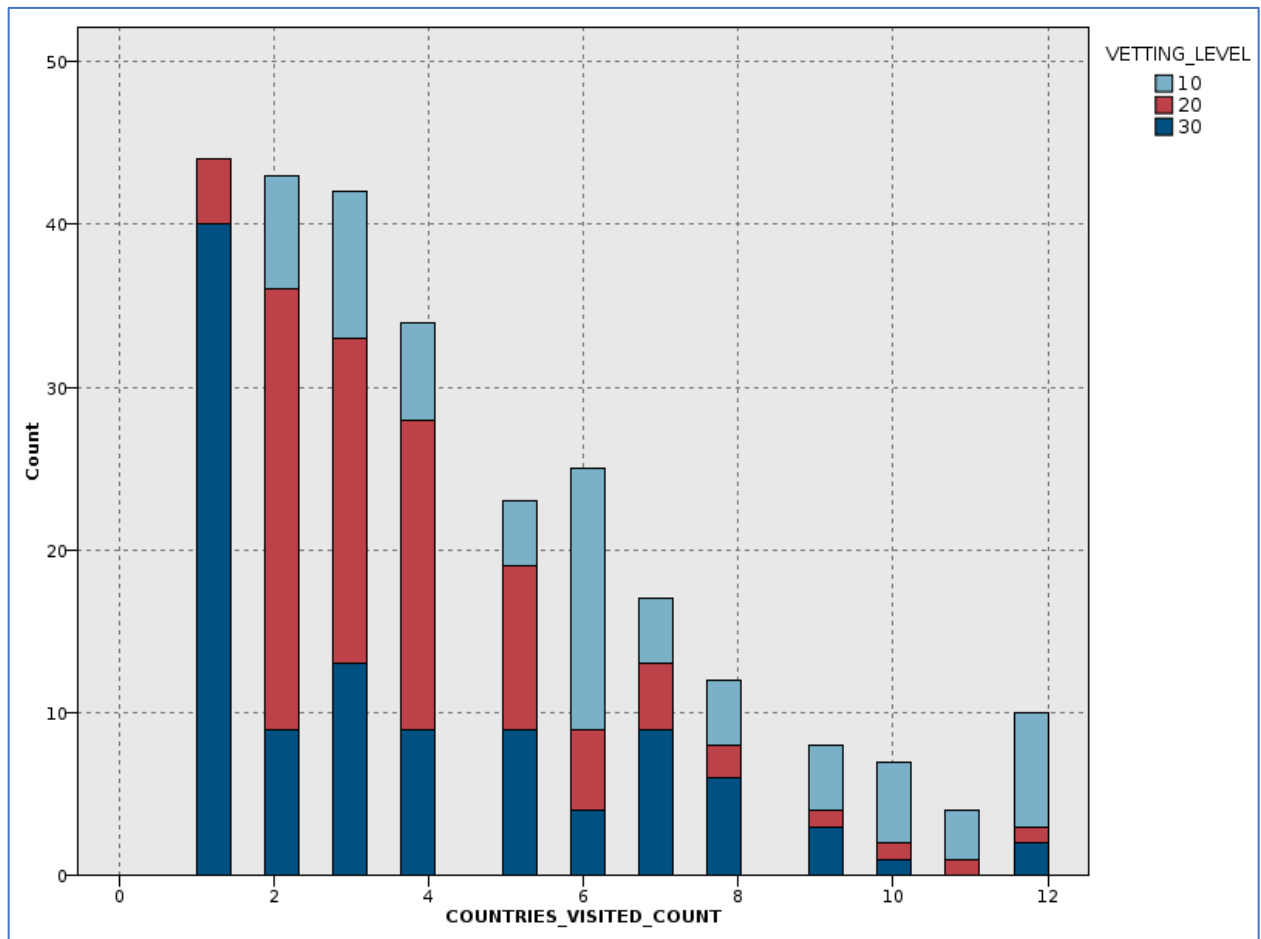
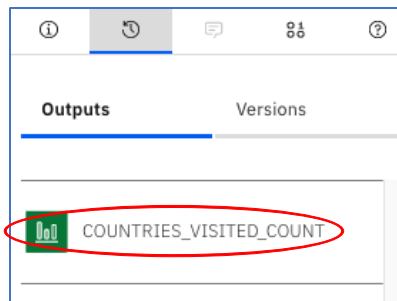
16. Double click on the **Histogram** node. Select **COUNTRIES\_VISITED\_COUNT** from the Field (continuous) dropdown. Select **VETTING\_LEVEL** from the Color (discrete) dropdown. Click on **Save**.



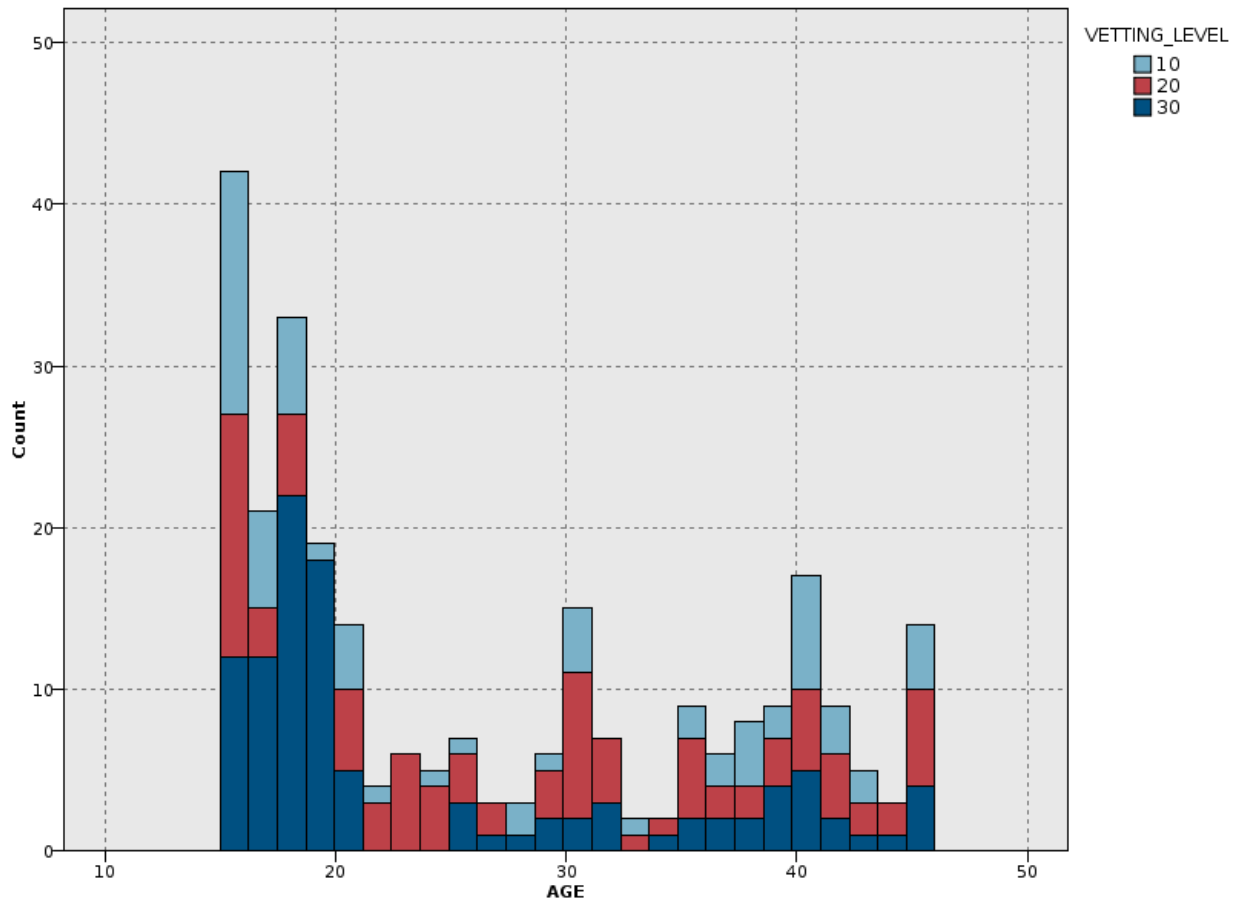
17. Right click on the **Histogram** node and select **Run**.



18. Double click on the **COUNTRIES\_VISITED\_COUNT** under the **Outputs** tab at the right of the screen.



19. The general trend appears to be that the more countries visited, the higher likelihood to be a “High Risk”. You can change the histogram to show the **AGE** by **VETTING\_LEVEL** by double clicking on the Histogram node and replacing **COUNTRIES\_VISITED\_COUNT** with **AGE** and clicking **Save**. Re-run the graph by right clicking on the **Histogram** node and selecting **Run**. Double click on the **AGE** in the **Outputs** pane to display the graph.




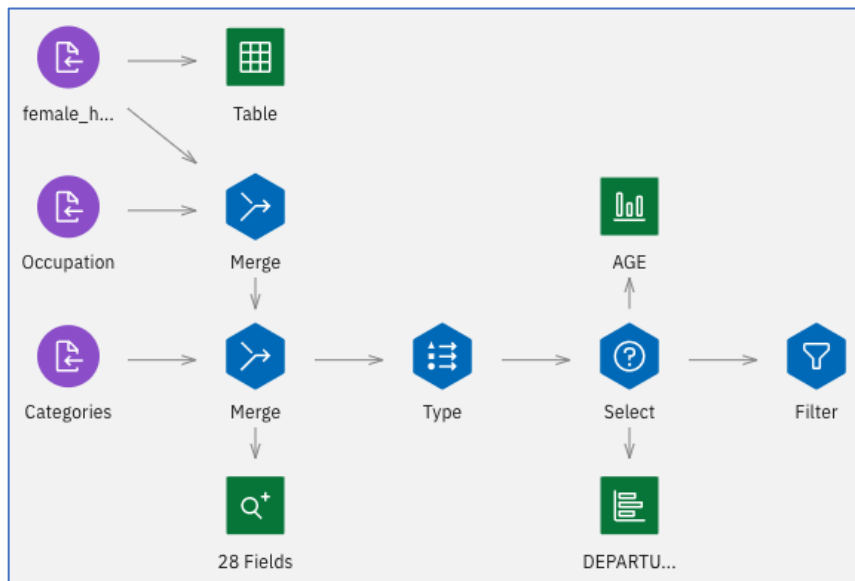
## Step 6 - Prepare the Data for Modeling

Based on our exploration of the data, there are several transformations that are needed to prepare the data for modeling. This section will introduce, the **Filter** node and the **Reclassify** node that will do the necessary transformations. The **Filter** and **Reclassify** nodes act on a field level.

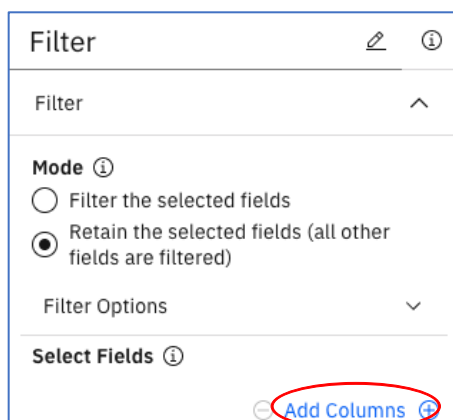
**Filter** node – The **Filter** node performs two functions. It specifies fields that can be dropped or the fields that should be retained. It also allows fields to be renamed. We will retain the following fields – VETTING\_LEVEL, COUNTRIES\_VISITED\_COUNT, ARRIVAL\_AIRPORT\_REGION, DEPARTURE\_AIRPORT\_COUNTRY\_CODE, AGE, and Category.

**Reclassify** node – The **Reclassify** node allows us to map input values to output values. We will use this node to map the VETTING\_LEVEL values of 10, 20, 30, and 100 to “High Risk”, “Medium Risk”, “Low Risk”, and “Unvetted” respectively.

1. Add a **Filter** node to the flow by clicking on the **Field Operations** menu in the Node Palette and then dragging the **Filter** node to the canvas to the right of the **Select** node. Connect the **Select** node to the **Filter** node. If the Node Palette is not visible, click on the Node Palette icon . The canvas should appear as below.



2. Double-click on the **Filter** node. Click **Retain the selected ...**, and click **Add Column**.



3. Scroll down and click on VETTING\_LEVEL, PASSPORT\_COUNTRY, COUNTRIES\_VISITED\_COUNT, ARRIVAL\_AIRPORT\_REGION, DEPARTURE\_AIRPORT\_COUNTRY\_CODE, AGE, and CATEGORY, then click OK. Scroll as required to check all of the above fields.

**Select Fields for Filter**

Filter: # abc [Reset](#)

<input type="checkbox"/>	Field Name	Data Type
<input type="checkbox"/>	ARRIVAL_AIRPORT_IATA	abc string
<input type="checkbox"/>	ARRIVAL_AIRPORT_MUNICIPALITY	abc string
<input checked="" type="checkbox"/>	ARRIVAL_AIRPORT_REGION	abc string
<input checked="" type="checkbox"/>	DEPARTURE_AIRPORT_COUNTRY_CODE	abc string
<input type="checkbox"/>	DEPARTURE_AIRPORT_IATA	abc string
<input type="checkbox"/>	DEPARTURE_AIRPORT_MUNICIPALITY	abc string
<input type="checkbox"/>	DEPARTURE_AIRPORT_REGION	abc string
<input type="checkbox"/>	UUID	abc string
<input checked="" type="checkbox"/>	AGE	# integer
<input checked="" type="checkbox"/>	Category	abc string

Cancel

OK

4. Click **Save**.

Filter

Filter

**Mode**

☐ Filter the selected fields

☒ Retain the selected fields (all other fields are filtered)

Filter Options

**Select Fields**

⊖ Add Columns ⊕

☒ Field Name

☒ ARRIVAL\_AIRPORT\_REGI...

☒ DEPARTURE\_AIRPORT\_C...

☒ AGE


☒ Category

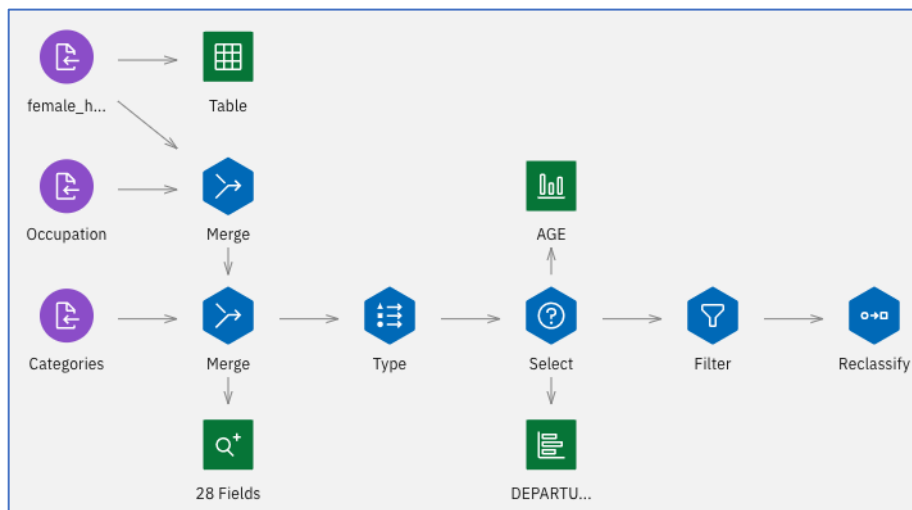
Fields: 28 in, 21 filtered, 7 out

Rename

Annotations

Cancel Save

5. Add a **Reclassify** node to the canvas by clicking on the **Field Operations** menu item in the Node palette, and then dragging the **Reclassify** node onto the canvas to the right of the **Filter** node. If the Node Palette is not visible, click on the Node Palette icon  first. Connect the **Filter** node to the **Reclassify** node. The canvas should appear as below.



6. Double-click on the **Reclassify** node. Configure the **Reclassify** node as follows. Select **VETTING\_LEVEL** for the **Reclassify** field. Enter **VETTING\_LEVEL\_DESC** for the **New Field Name**. Click **Get values**.

Reclassify

Settings

Mode ⓘ

☒ Single

☐ Multiple

Reclassify Into ⓘ

☒ New field

☐ Existing field

Reclassify Field ⓘ

VETTING\_LEVEL

New Field Name ⓘ

VETTING\_LEVEL\_DESC

Get values

Copy

Clear new

7. Scroll down. Enter in “High Risk” as the new value for “10”, “Medium Risk” as the new value for “20”, “Low Risk” as the new value for “30”, and “Unvetted” as the new value for “100”. Click on **Save**.

Values ⓘ

⊖ Add Value ⊕

<input type="checkbox"/>	ORIGINAL VALUE	NEW VALUE
<input type="checkbox"/>	10	High Risk
<input type="checkbox"/>	20	Medium Risk
<input type="checkbox"/>	30	Low Risk
<input type="checkbox"/>		

For Unspecified Values Use ⓘ

☒ Original value ☐ Default value

undef

Annotations

▼


Cancel

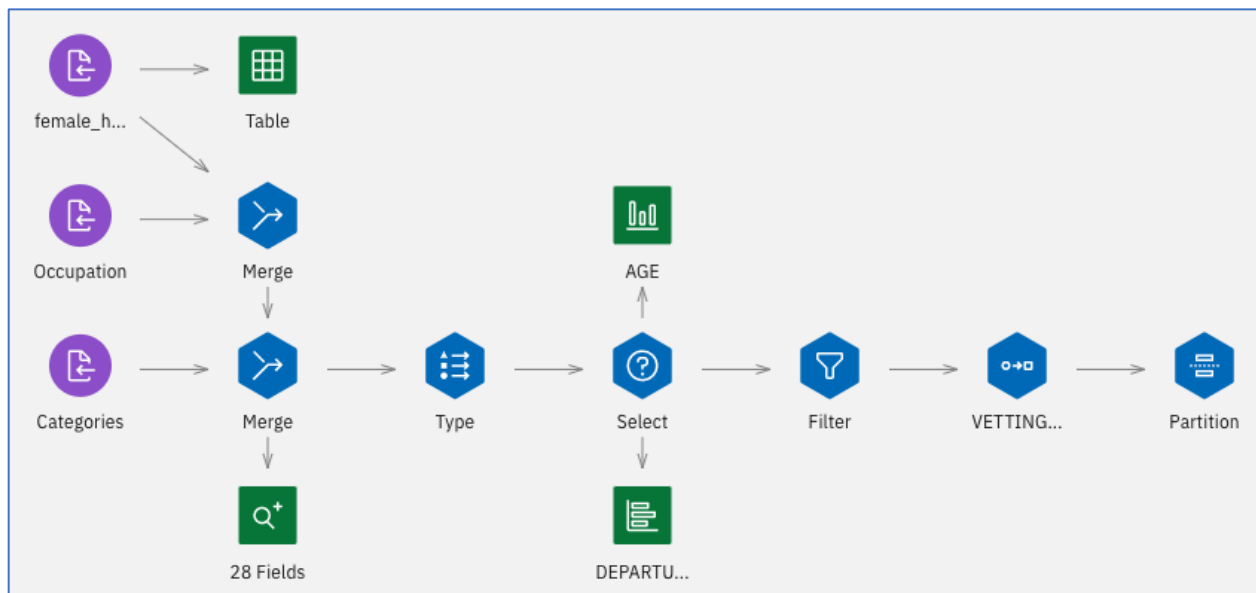
Save



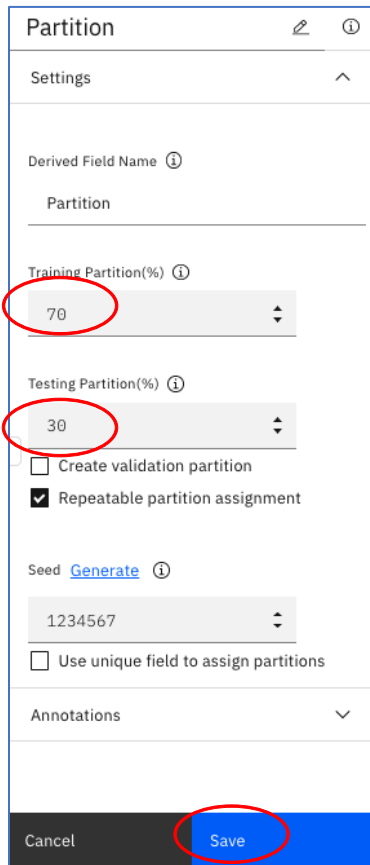
## Step 7 - Modeling and Evaluation

Now that the data is prepared, we can start the modeling effort. First, we will add a **Partition** node to divide the data set into Training and Testing sets. In addition, a **Type** node is needed prior to modeling to set the roles of the data fields. Then we will add several modeling nodes and use the Training set to train the model. Finally, we will add **Analysis** nodes to evaluate the results.

1. Add a **Partition** node to the canvas by clicking on the **Field Operations** menu item in the Node Palette, and then dragging the **Partition** node onto the canvas to the right of the **Reclassify** node. If the Node Palette is not visible, click on the Node Palette icon . Connect the **Reclassify** node to the **Partition** node. The canvas should appear as below.



2. Double-click on the **Partition** node. Use a 70-30 breakdown between training and testing. Leave the other defaults and click **Save**.



Partition

Settings

Derived Field Name ⓘ

Partition

Training Partition(%) ⓘ

70

Testing Partition(%) ⓘ

30

☐ Create validation partition

☒ Repeatable partition assignment


Seed [Generate](#) ⓘ

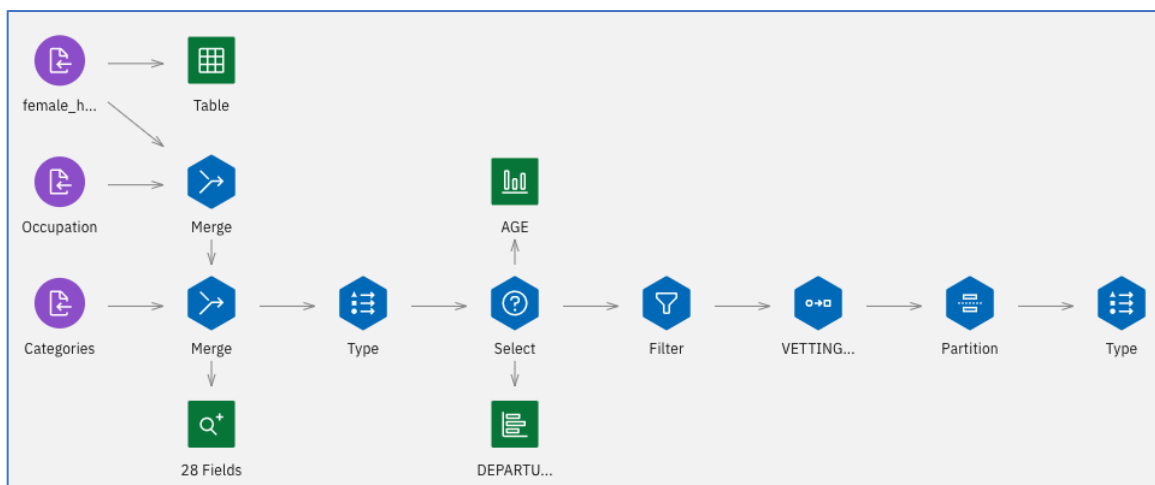
1234567

☐ Use unique field to assign partitions

Annotations

Cancel Save

3. Add a **Type** node to the canvas by clicking on the **Field Operations** menu item in the Node palette, and then dragging the **Type** node onto the canvas to the right of the **Partition** node. If the Node Palette is not visible, click on the Node Palette icon  first. Connect the **Partition** node to the **Type** node. The canvas should appear as below.



4. Double-click on the **Type** Node. Click on **Read Values**.

**Type**

Settings

**Default Mode** ⓘ  
☒ Read metadata ☐ Pass (do not scan)

Type Operations

Read Values

Clear All Values

5. Hover over the Field name to see the full name. Change the role of **VETTING\_LEVEL** to None. Change role of **VETTING\_LEVEL\_DESC** to **Target**. Click **Save**.

**Type** ⓘ

Settings ^

**Default Mode** ⓘ  
☒ Read metadata ☐ Pass (do not scan)

Type Operations v

Read Values

Clear All Values

Search in column Field

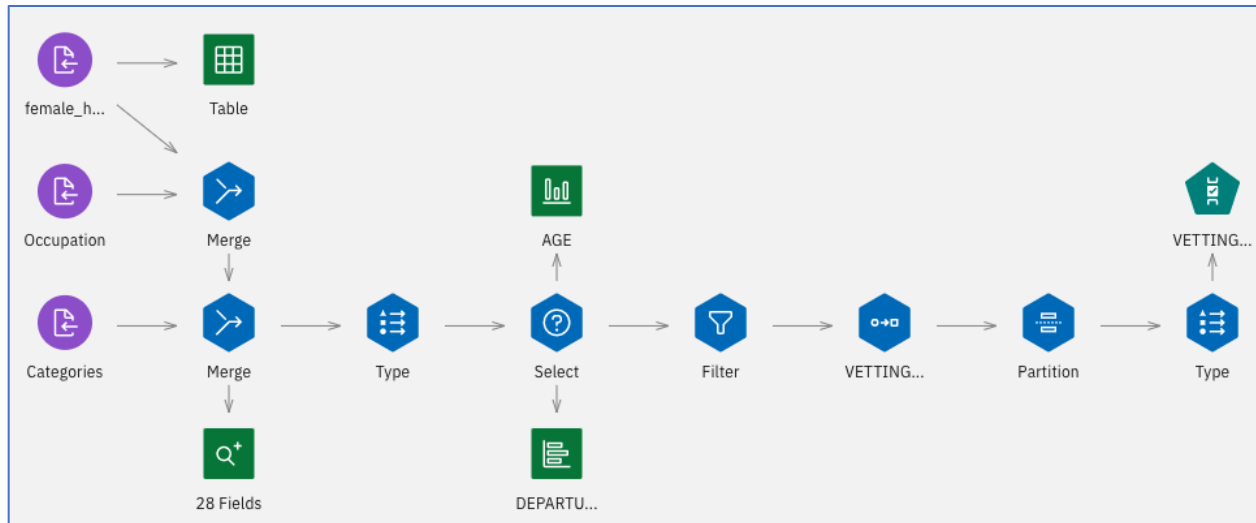
<input type="checkbox"/>	Field	Measure		Role		Value Mode		Values		Check
<input type="checkbox"/>	# VETTING_	Nominal	v	None	v	Specify	v	10, 100		None v ⚙
<input type="checkbox"/>	abc PASSPOR	Nominal	v	Input	v	Specify	v	Bangladesh, Brazi...		None v ⚙
<input type="checkbox"/>	# COUNTRII	Continuous	v	Input	v	Specify	v	1, 12		None v ⚙
<input type="checkbox"/>	abc ARRIVAL_	Nominal	v	Input	v	Specify	v	US-AK, US-AL, US...		None v ⚙
<input type="checkbox"/>	abc DEPARTUI	Nominal	v	Input	v	Specify	v	AE, AL, AM, AR, A...		None v ⚙
<input type="checkbox"/>	# AGE	Continuous	v	Input	v	Specify	v	15, 47		None v ⚙
<input type="checkbox"/>	VETTING_LEVEL_DESC	Nominal	v	Input	v	Specify	v	Advertising, Arts, ...		None v ⚙
<input type="checkbox"/>	abc VETTING_	Nominal	v	Target	v	Specify	v	High Risk, Low Ris...		None v ⚙

Format

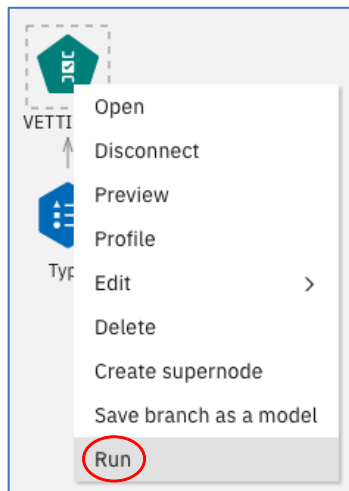
Cancel

Save

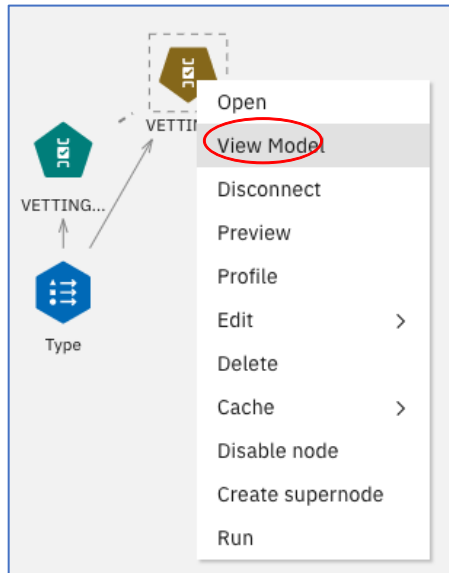
6. Add a **Feature Selection** node by clicking on the **Modeling** menu item in the Node palette and dragging the **Feature Selection** node onto the canvas to the right of the **Type** node. Connect the **Type** node to the **Feature Selection** node. The canvas should appear as below. The Feature Selection node provides the correlation of each of the input features to the target field. It gives an indication of the Importance of each feature.



7. Right-click on **Feature Selection** and click **Run**.



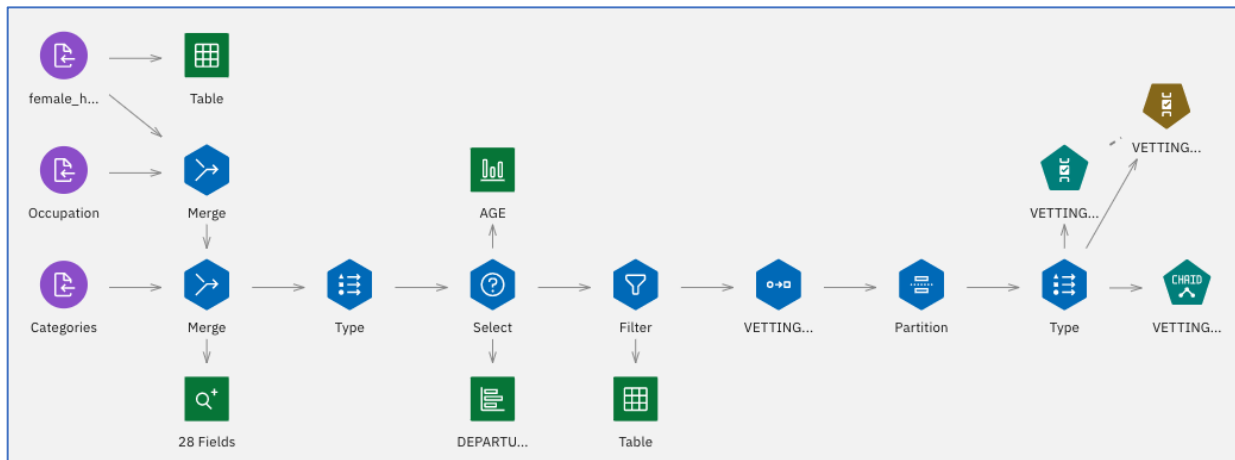
8. A **Model** node is created. Drag the **Model** node to the right of the **Feature Selection** node. Right-click on the **Model** node and click **View Model**.



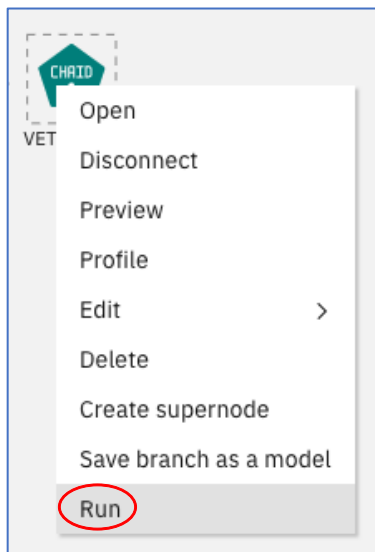
9. The Feature Selection output is displayed. Note that the ranges for what is Important can be changed in the modeling options. According to the default criteria, the **COUNTRIES\_VISITED\_COUNT**, **Category**, and **AGE** are the most important features.

VETTING_LEVEL_DESC						
	Rank		Field	Measurement	Importance	Value
1	true	1	COUNTRIES_VISITED_COUNT	range	Important	1.0
2	true	2	Category	set	Important	1.0
3	true	3	AGE	range	Important	0.951
4	false	4	DEPARTURE_AIRPORT_COUNTRY_CODE	set	Unimportant	0.873
5	false	5	PASSPORT_COUNTRY	set	Unimportant	0.469
6	false	6	ARRIVAL_AIRPORT_REGION	set	Unimportant	0.26

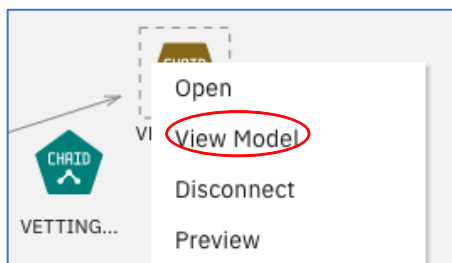
7. Add a **CHAID** node by clicking on the **Modeling** menu item in the Node palette and dragging the **CHAID** node onto the canvas to the right of the **Type** node. Connect the **Type** node to the **CHAID** node. The canvas should appear as below.



8. Right-click on the CHAID node and click Run.



9. A **Model** node is created. Drag the **Model** node to the right of the **CHAID** node. Right-click on the **Model** node and click **View Model**.



10. The Model Information is displayed. Click on **Feature Importance**.

CHAID Tree Model ⓘ

MODEL VIEWER

Model Information

**Feature Importance**

Top Decision Rules

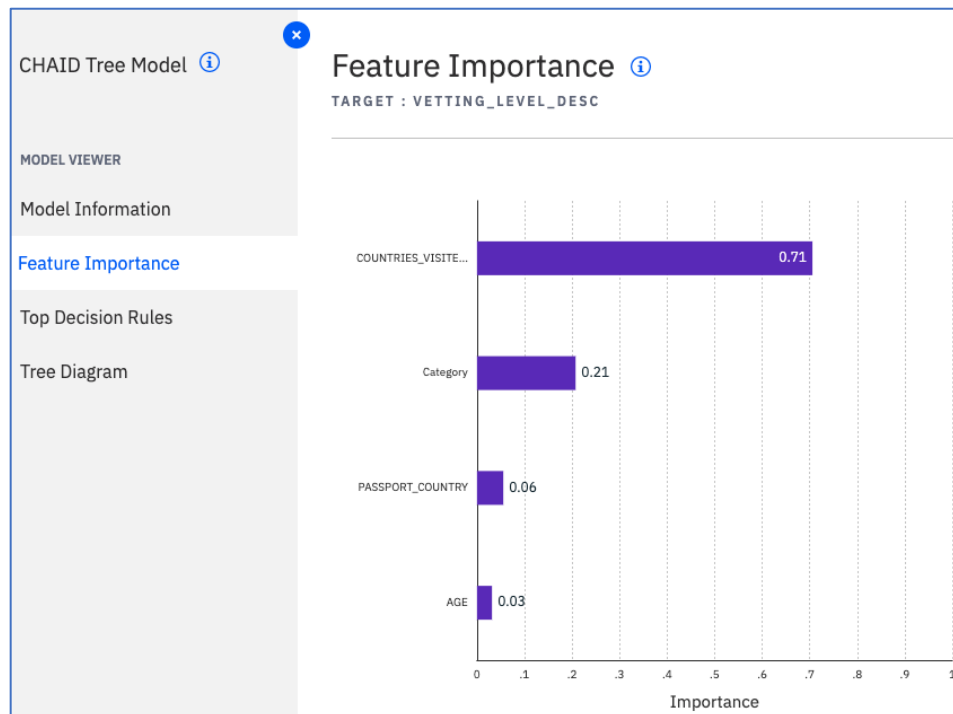
Tree Diagram

Model Information ⓘ

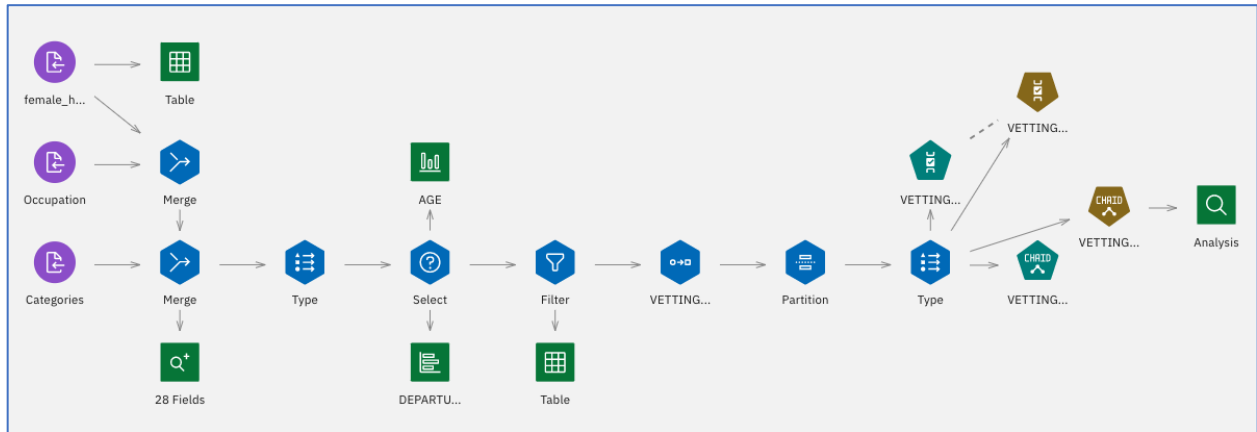
TARGET : VETTING\_LEVEL\_DESC

Target Field	VETTING_LEVEL_DESC
Model Type	Multi-Class Decision Tree
Algorithm Name	CHAID
Number of Features	4
Tree Depth	5
Number of Nodes	19

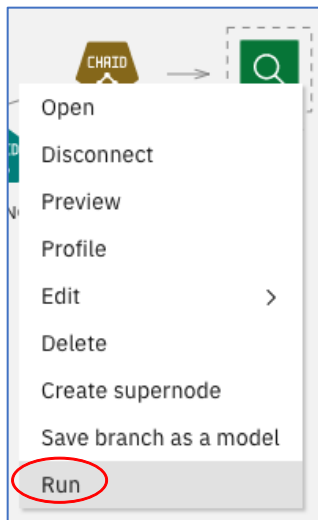
11. Feature Importance is displayed with similar results to the Feature Selection output. Click on **Tree Diagram** and/or **Top Decision Rules** to see the algorithm output.



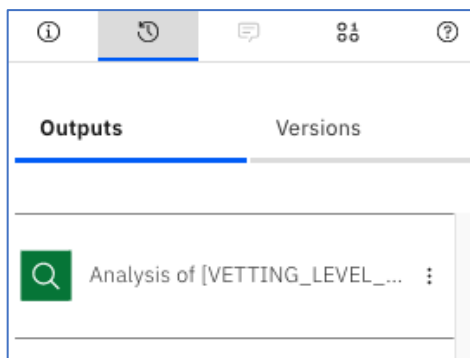
7. Add an Analysis node by clicking on the Output menu item in the Node palette and dragging the Analysis node onto the canvas to the right of the CHAID Model node. Connect the CHAID Model node to the Analysis node. The canvas should appear as below. The canvas should appear as below.



8. Right-click the **Analysis** node and click **Run**.



9. Double-click on the Analysis results in the Output area.

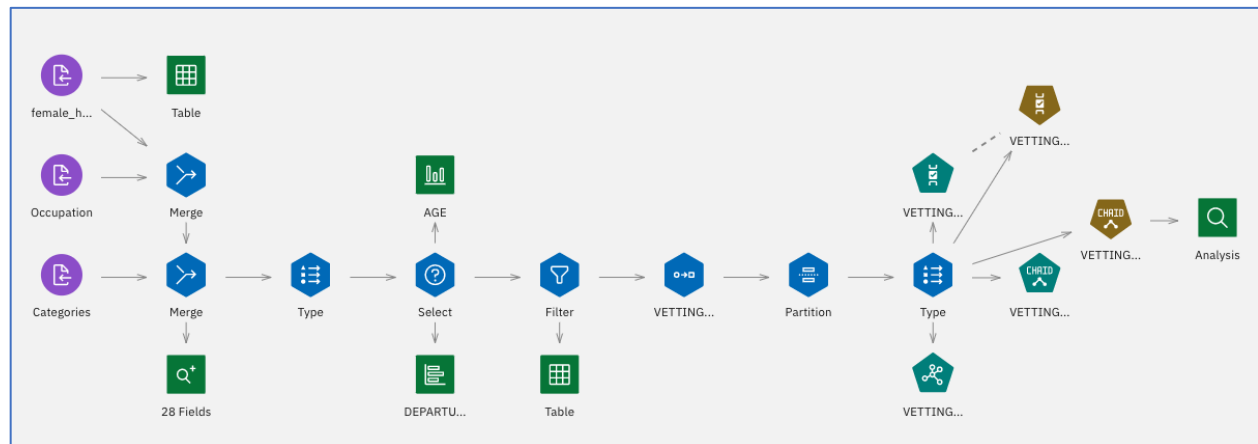




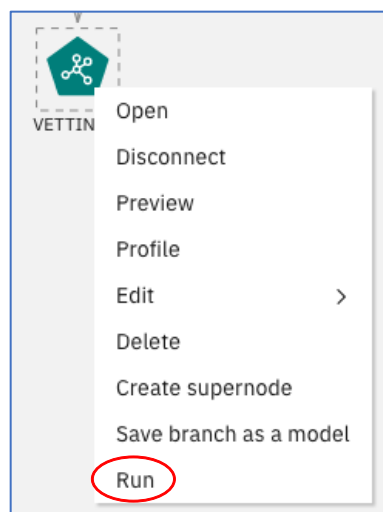
10. Accuracy results are displayed for the CHAID algorithm.

Results for output field VETTING_LEVEL_DESC				
Comparing \$R-VETTING_LEVEL_DESC with VETTING_LEVEL_DESC				
Partition'	1_Training		2_Testing	
Correct	142	77.6%	61	70.93%
Wrong	41	22.4%	25	29.07%
Total	183		86	

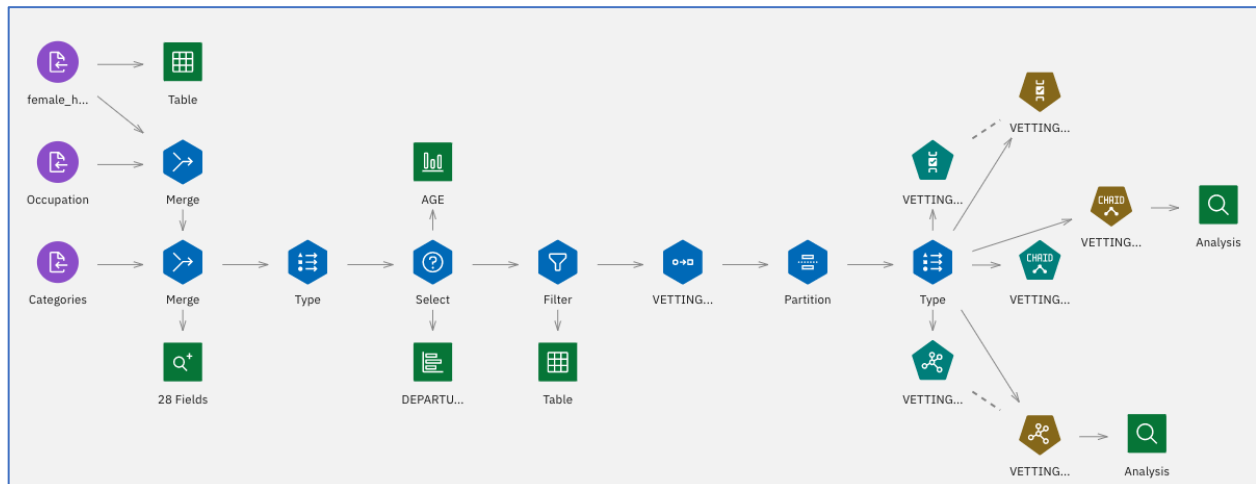
10. Add a **Random Forest** node by clicking on the **Modeling** menu item in the Node palette and dragging the **Random Forest** node onto the canvas underneath the **CHAID** node. Connect the **Type** node to the **Random Forest** node. The canvas should appear as below.



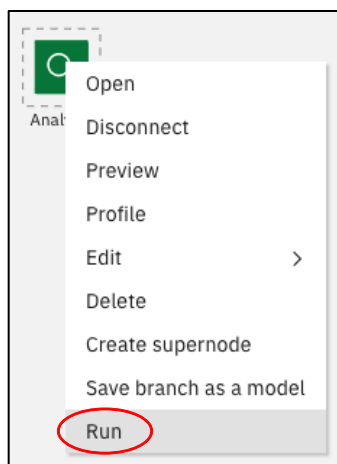
11. Right-click the **Random Forest** node and click **Run**.



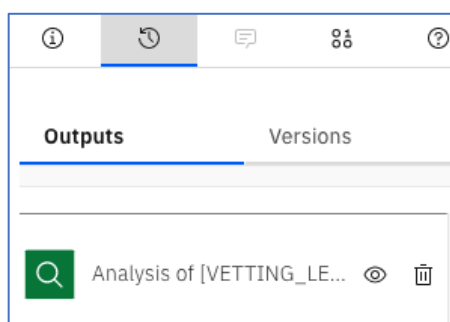
12. A **Random Forest Model** node is created. The **Random Forest Model** node does not have a **View Model** option. Add an **Analysis** node to the right of the **Random Forest Model** node by clicking on the **Outputs** menu of the Node Palette. Connect the **Analysis** node to the **Random Forest Model** node. The canvas should appear as shown below.



13. Right-click on the **Analysis** node and click **Run**.



14. The **Analysis** node output appears in the **Outputs** area. Double-click **Analysis of ...**



15. The results appear below. Based on the results, it appears the Random Forest model is overfitting given the disparity between training and testing results.

Results for output field VETTING\_LEVEL\_DESC

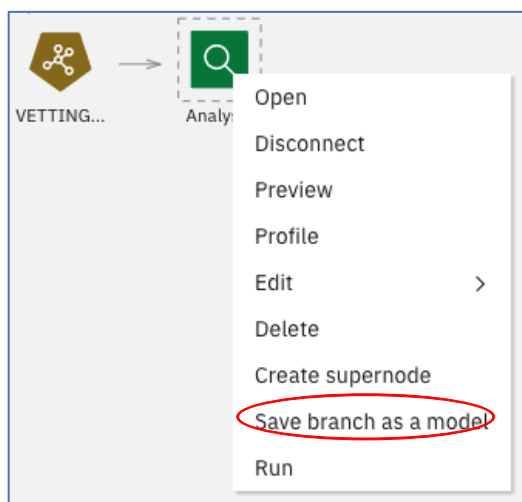
Comparing \$R-VETTING\_LEVEL\_DESC with VETTING\_LEVEL\_DESC

'Partition'	1_Training		2_Testing	
Correct	168	91.8%	66	76.74%
Wrong	15	8.2%	20	23.26%
Total	183		86	

## Step 8 - Saving a Model

Now that we have created and evaluated a model, we will save the model as an asset. This saved model can be deployed at a future date, removing the need to recreate the same model from scratch.

1. Right click on the Random Forest Analysis node and then click on **Save branch as a model**.



2. Type in “**FHT\_SPSS**” as the Model Name, optionally add a **Description**, and click **Save**.

**Save model**

Saving mode  
☒ Scoring branch ☐ Individual algorithm as PMML

Branch terminal node  
Analysis

Model name  
FHT\_SPSS

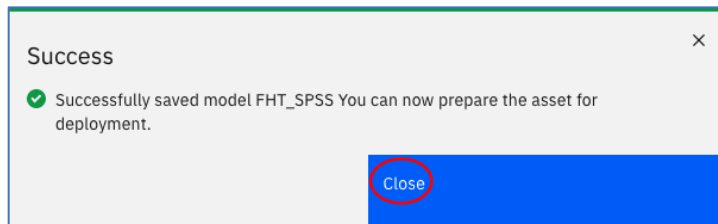
Model description (optional)  
Random Forest Model

Machine learning service  
WatsonMachineLearning

The model is saved to your project. Promote the model to a deployment space to deploy it.

Cancel Save

3. Click **Close**.



4. Navigate to your project “assets” page. Click on **Watson Studio Labs**.



5. Note that the model you built is now saved as an asset and the work you have completed can be easily reused in the future.

Models				
Watson Machine Learning model				
Import model +				
Name	Type	Runtime	Last modified	↓
FHT_SPSS	spss-modeler-18.1	spss-modeler-18.1	Aug 03, 2020	

## You have completed Lab-4!

- ✓ Became familiar with the Watson Studio SPSS Modeler capability
- ✓ Loaded the trafficking data into SPSS Modeler
- ✓ Joined the datasets
- ✓ Profiled the trafficking data
- ✓ Prepared the trafficking data
- ✓ Trained/Evaluated a machine learning model.
- ✓ Saved the model.