Lab-2 [Manage Data]

Out date: Jun 20, 2022
Due date: Jun 23, 2022 at 11:59PM

Submission

1. Prepare your solutions in Orange and save the workspace (e.g., Lab-2.ows) **[20 points]**
2. Complete the tables given below and save the file (e.g., Lab-2.docx). **[80 points]**
3. Upload the files to the Canvas.

Objective: To review and understand the dataset attributes, attribute types, dimensionality and distribution of the attributes.

Problem 1/4. [20 points]
Data: For this lab, please download *EIA_appendixC_2019.xlsx* from Canvas to your folder.

(**Reference:** The data is from the report titled U.S. Oil and Natural Gas Wells by Production Rate- https://www.eia.gov/petroleum/wells/.)

Lab Instructions

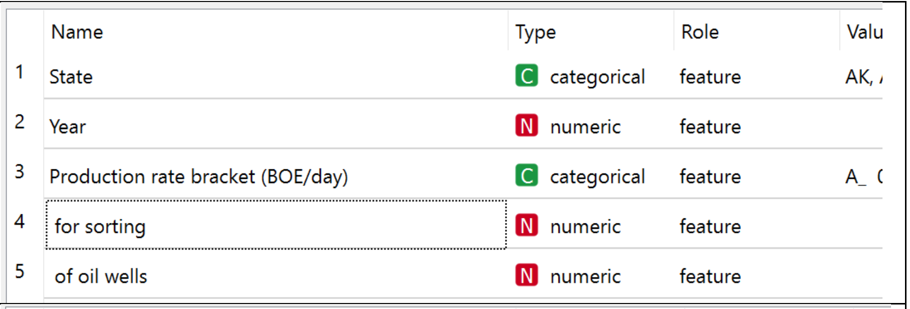
1. Launch Orange.
2. Click on the **File** Widget under **Data** to add the widget to your blank Orange canvas. → Load the *EIA_appendixC_2019.xlsx* using the File widget.
3. Open File window by double clicking on **File**. → Answer the following questions for this data:

How many objects are there in this dataset?	16796
What is the dimensionality (attribute) of this data?	2
What are the unique attribute types of this data?	Categorical, Numerical

4. If necessary, rename the attribute names after inspecting the header of the Excel data file. For instance, compare the attribute name of column D of the Excel data file with the 4th

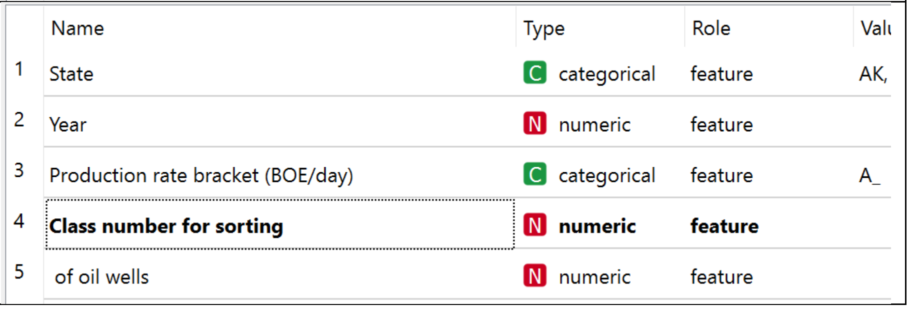
attribute name in Orange. There is a mismatch. Let's fix this by double clicking on it and change its name to the correct name.

Before correction



	Name	Type	Role	Valu
1	State	🟩C categorical	feature	AK,
2	Year	🟥N numeric	feature	
3	Production rate bracket (BOE/day)	🟩C categorical	feature	A_ (
4	for sorting	🟥N numeric	feature	
5	of oil wells	🟥N numeric	feature	

After correction



	Name	Type	Role	Valu
1	State	🟩C categorical	feature	AK,
2	Year	🟥N numeric	feature	
3	Production rate bracket (BOE/day)	🟩C categorical	feature	A_
4	**Class number for sorting**	🟥N **numeric**	**feature**	
5	of oil wells	🟥N numeric	feature	

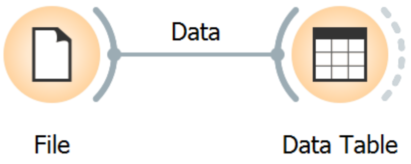
5. Change attribute header of at least two attributes whose names are not matching with the header of the Excel data file. → Enter the header names before correction and after correction in the following table.

Attribute	Before Correction	After Correction
12	of gas wells	Number of gas wells
5	of oil wells	Number of oil wells

6. Observe the time **year** attribute. Its attribute type is numeric. It is more appropriate to have it as datetime. Open the **File** Widget and change the attributes.

7. Click **Apply** button to save changes and close the **File** window.

8. Connect to a **Data Table** widget.



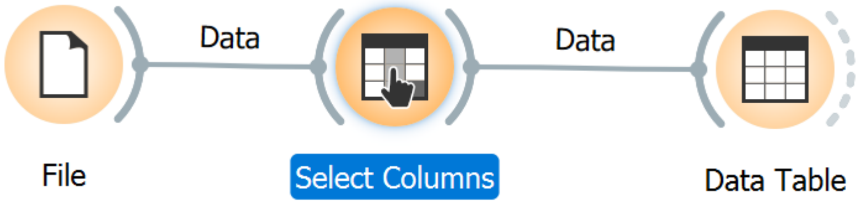
9. Open **Data Table** window by double clicking on **Data Table**. → Answer the following questions for this data:

Is this a structured dataset?	Yes
Are there any missing values?	No
What is the time resolution (frequency) of the dataset?	Annual resolution per State and per category

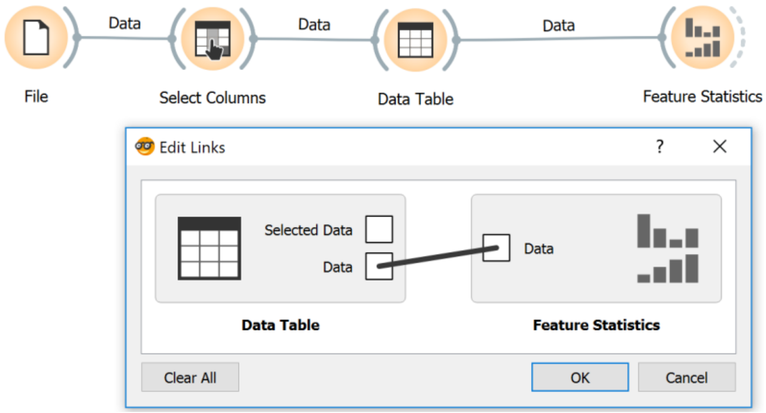
10. Three of the attributes are derived from other attributes.

- Total number of wells
- Total wells: Annual gas prod. (Bcf)
- Total wells: Annual oil prod. (MMbbl)

Most ML algorithms assumes that the attributes are independent. Dependent attributes may not be suitable for ML model building. → Remove dependent attributes by adding the **Select Columns** widget as shown below.



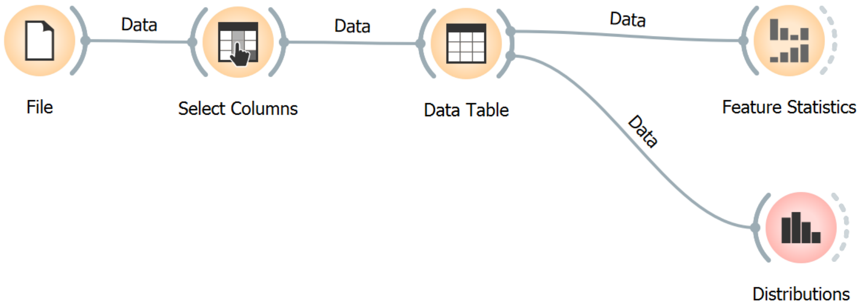
11. For further data exploration, add the **Feature Statistics** widget as shown below. Double click on the connection line between **Data Table** and **Feature Statistics** → connect **Data** boxes.

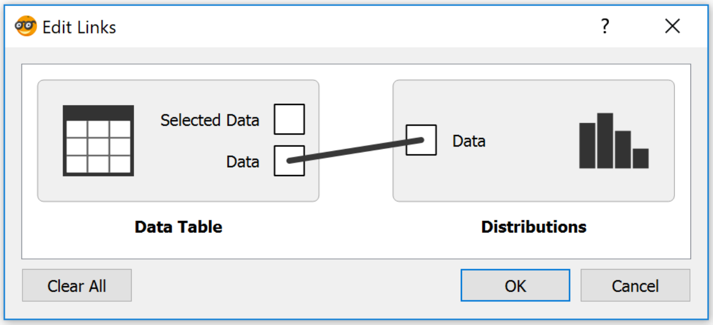


12. Open **Feature Statistics** window by double clicking on **Feature Statistics**. → Answer the following question:

#	List pieces of information this GUI convey.
1	Mean
2	Median
3	Dispersion
4	Min
5	Max

13. Let's dig deeper by adding the **Distribution** widget as shown below. Double click on the connection line between **Data Table** and **Distribution** → connect **Data** boxes.





14. Open **Distribution** window by double clicking on **Distribution**. → Answer the following questions:

#	What additional information that **Distribution** convey over **Future Statistics**.
1	Can adjust the width size of histogram
2	Can filter different distributions
3	Gives parameters upper right as means and standard deviation
4	Color variables by, say, state
5	Stack columns = stack bar graph (like by states…)
6	Normal, Gamma, Beta, Rayleigh, Exponential, Kernel Density, Pareto

Attribute Name	Comment on the type of the distributions for three attributes of your interest.
Number of Wells	Skewed
Number of Oil Wells	Skewed
Horizontal Wells Count	Exponential and Skewed

Problem 2/4. [20 points]

Data: For this lab, please download *Log Lithology classification example.xlsx* from Canvas to your folder. We used this dataset for Lab-1.

Lab Instructions

1. The same orange pipeline can be used to inspect various datasets. Let's bring-in *Log Lithology classification example.xlsx*.
2. Perform the similar inspection for this data and answer the following questions.

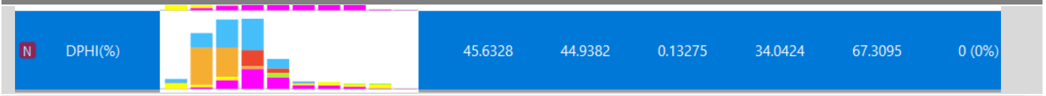
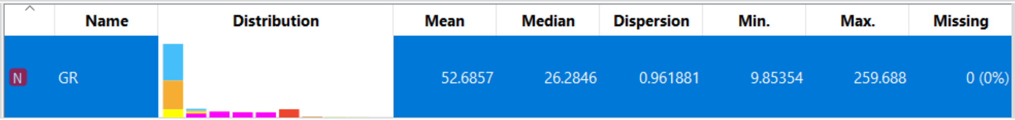
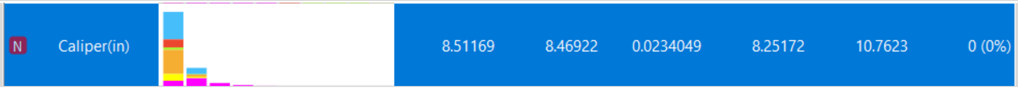
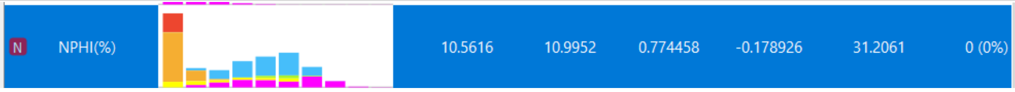
How many objects are there in this dataset?	1001
What is the dimensionality of this data?	6
What are the unique attribute types of this data?	Cate, Num

3. In the **File** widget, change Lithology attribute's Role to target.
4. Click **Apply** to save changes and close the **File** widget window. Use the **Data Table** widget to answer the following questions:

Is this a structured dataset?	Yes
Are there any missing values?	No
What is the depth resolution of the dataset?	0.5 ft per Lithology

5. If necessary, remove any dependent attributes

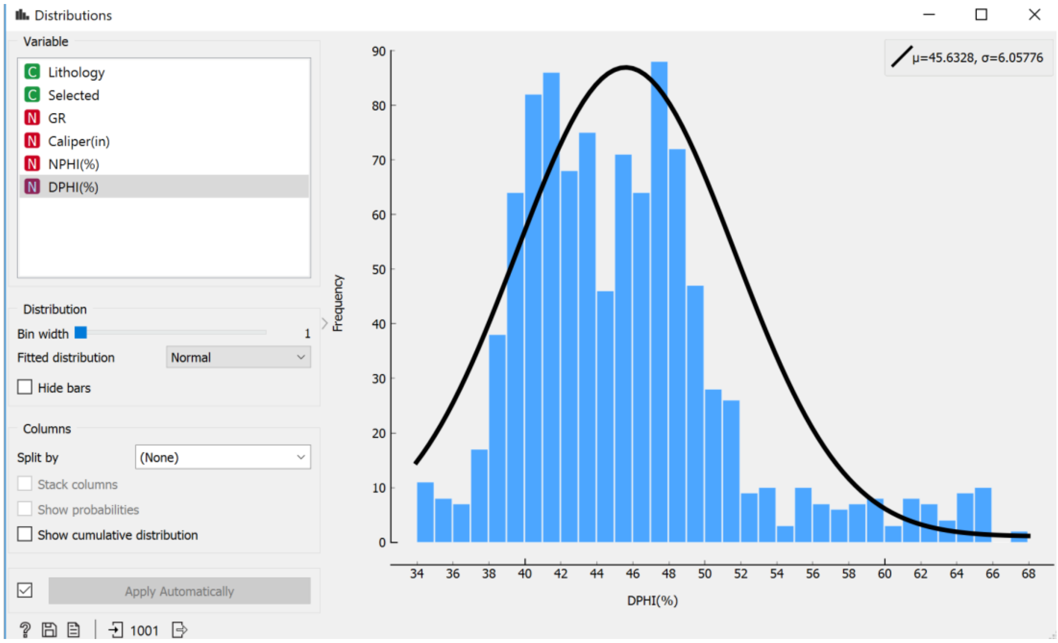
6. Open **Feature Statistics** window by double clicking on **Feature Statistics**. → Answer the following question:

Attribute Name	Write attribute range.
DPHI%	 N DPHI(%) 45.6328 44.9382 0.13275 34.0424 67.3095 0 (0%)
GR	 Name Distribution Mean Median Dispersion Min. Max. Missing N GR 52.6857 26.2846 0.961881 9.85354 259.688 0 (0%)
Caliper(in)	 N Caliper(in) 8.51169 8.46922 0.0234049 8.25172 10.7623 0 (0%)
NPHI(%)	 N NPHI(%) 10.5616 10.9952 0.774458 -0.178926 31.2061 0 (0%)

15. Open **Distribution** window by double clicking on **Distribution**. → Answer the following questions:

Attribute Name	Comment on the type of the distributions for three attributes of your interest.
DPHI(%)	Skewed Distribution
GR	Skewed Distribution
Caliper	Skewed

Sample visualizations of DPHI% distribution.



Distributions

Variable

- C Lithology
- C Selected
- N GR
- N Caliper(in)
- N NPHI(%)
- N DPHI(%)

Distribution

Bin width 1

Fitted distribution: Normal

☐ Hide bars

Columns

Split by: (None)

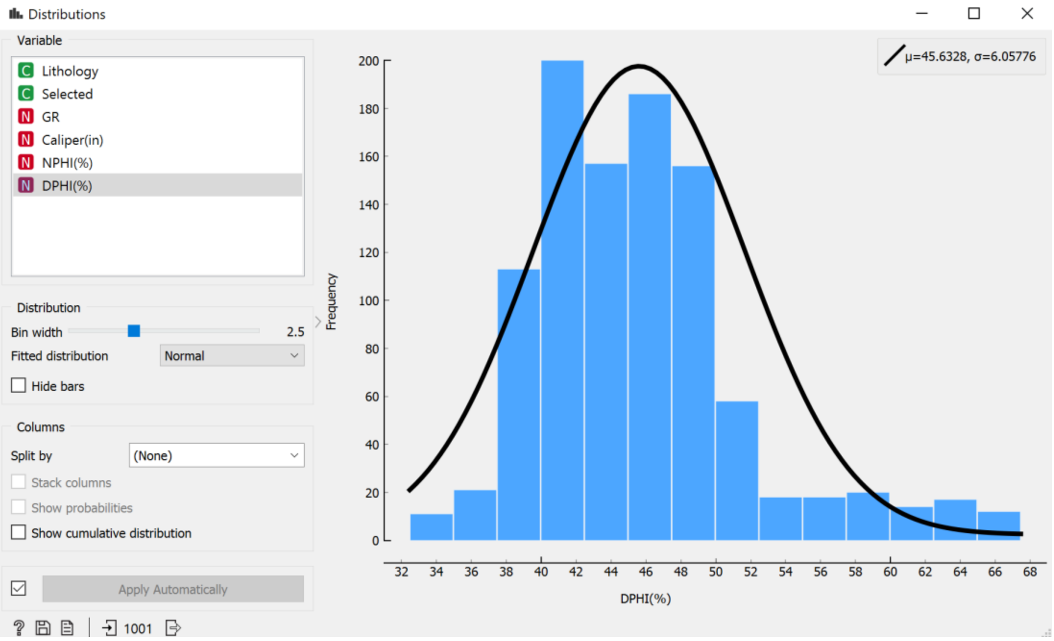
☐ Stack columns

☐ Show probabilities

☐ Show cumulative distribution

☑ Apply Automatically

1001



Distributions

Variable

- C Lithology
- C Selected
- N GR
- N Caliper(in)
- N NPHI(%)
- N DPHI(%)

Distribution

Bin width 2.5

Fitted distribution: Normal

☐ Hide bars

Columns

Split by: (None)

☐ Stack columns

☐ Show probabilities

☐ Show cumulative distribution

☑ Apply Automatically

1001

Problem 3/4. [20 points]

Data: For this lab, please download *58-32_xray_diffraction_data.csv* from Canvas to your folder.

(**Reference**: Utah FORGE Well Data, https://gdr.openei.org/submissions/1111)

Lab Instructions

1. Load the *58-32_xray_diffraction_data.csv*.
2. Perform the similar inspection for this data and answer the following questions.

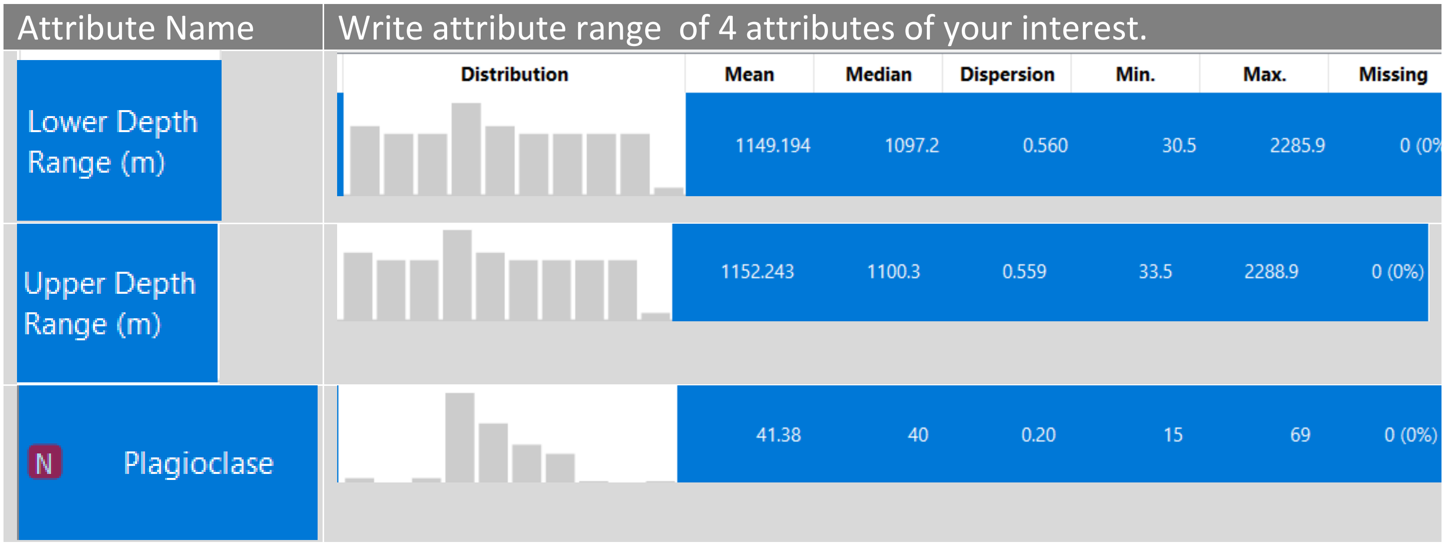
How many objects are there in this dataset?	79
What is the dimensionality of this data?	15
What are the unique attribute types of this data?	Cate, Num, Text

7. Click **Apply** to save changes and close the **File** widget window. Use the **Data Table** widget to answer the following questions:

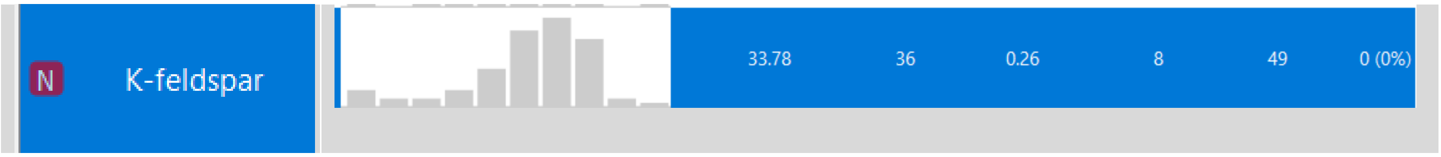
Is this a structured dataset?	Yes
Are there any missing values?	Yes
What is the depth resolution of the dataset?	30.5M

8. If necessary, remove any dependent attributes

9. Open **Feature Statistics** window by double clicking on **Feature Statistics**. → Answer the following question:



Attribute Name	Write attribute range of 4 attributes of your interest.						
	Distribution	Mean	Median	Dispersion	Min.	Max.	Missing
Lower Depth Range (m)		1149.194	1097.2	0.560	30.5	2285.9	0 (0%
Upper Depth Range (m)		1152.243	1100.3	0.559	33.5	2288.9	0 (0%)
N Plagioclase		41.38	40	0.20	15	69	0 (0%)



N K-feldspar 33.78 36 0.26 8 49 0 (0%)

16. Open **Distribution** window by double clicking on **Distribution**. → Answer the following questions:

Attribute Name	Comment on the type of the distributions for three attributes of your interest.
Quartz	Normal Distribution
Plagioclase	Normal Distribution
K-feldspar	Normal Distribution

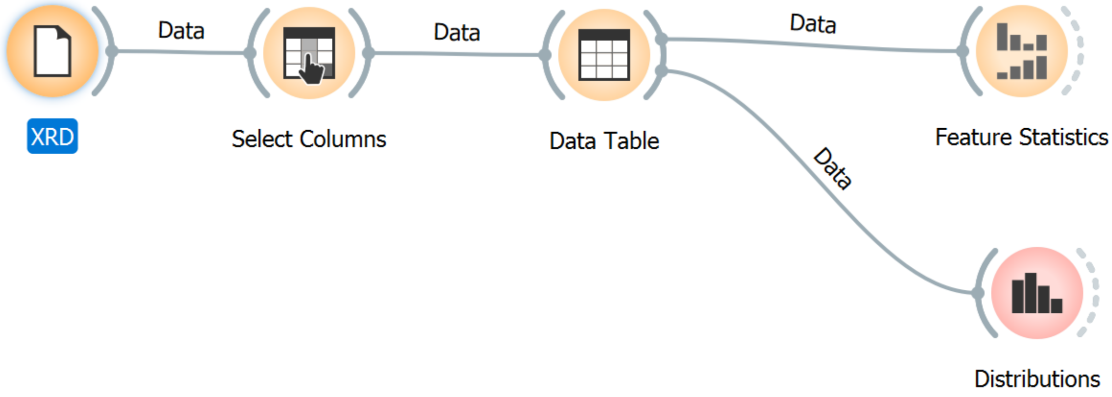
Problem 4/4. [20 points]

Data: For this lab, please download *58-32_thermal_conductivity_data.csv* from Canvas to your folder. We will use two datasets for this problem:

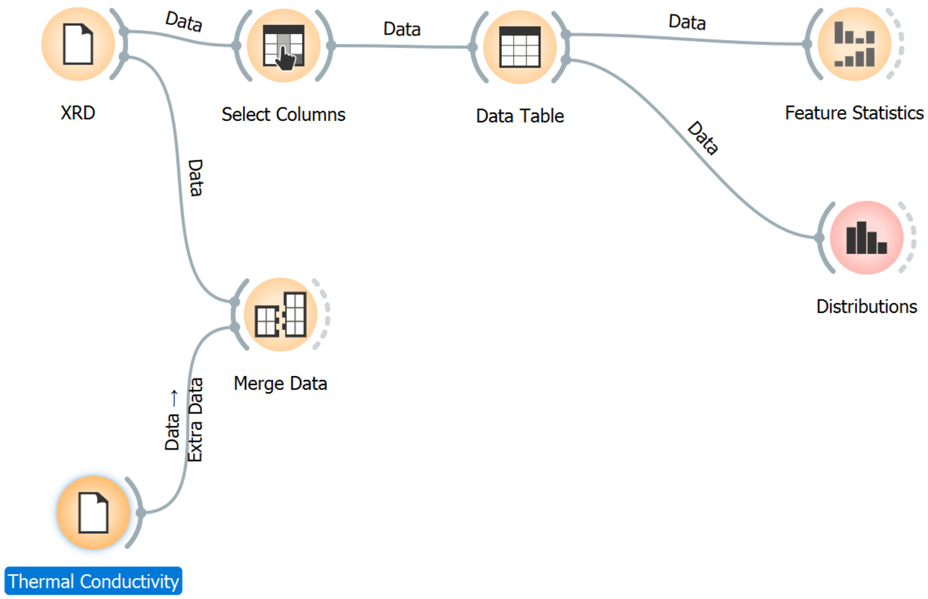
1. *58-32_xray_diffraction_data.csv, and*
2. *58-32_thermal_conductivity_data.csv*

Lab Instructions

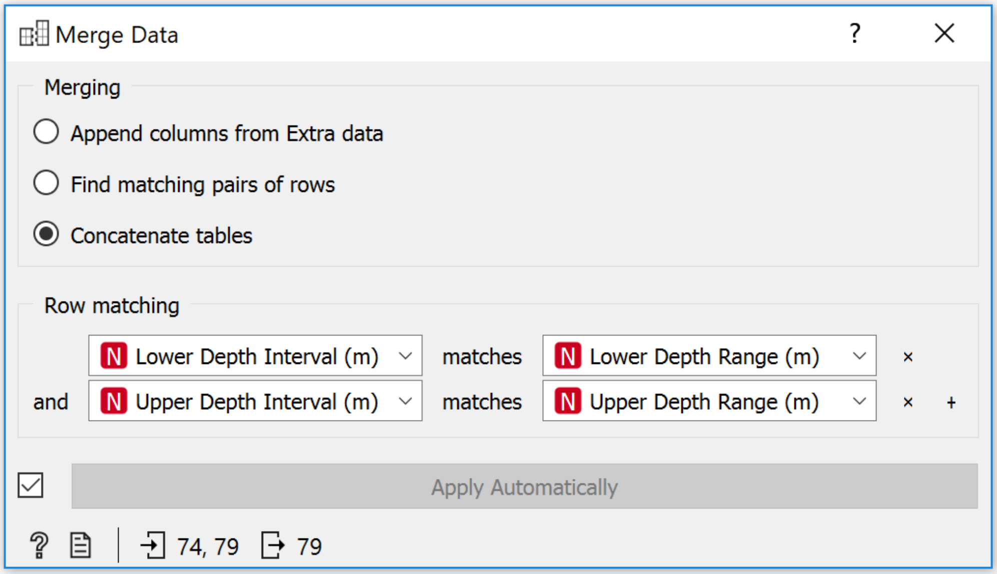
1. Right click on the **File** Widget and rename to *XRD*.



2. Click on the **File** Widget under **Data** to add the widget to your Orange canvas. → Load the *58-32_xray_thermal_conductivity_data.csv*.
3. Right click on the **File** Widget and rename to *Thermal Conductivity*.
4. Add **Merge** Data Widget → Connect
   a. *XRD* to **Merge** Data
   b. *Thermal Conductivity* to **Merge** Data



5. Make the following changes in the **Merge Data** Widget by double clicking on it. → Concatenate tables as shown below.



Merging

○ Append columns from Extra data

○ Find matching pairs of rows

● Concatenate tables

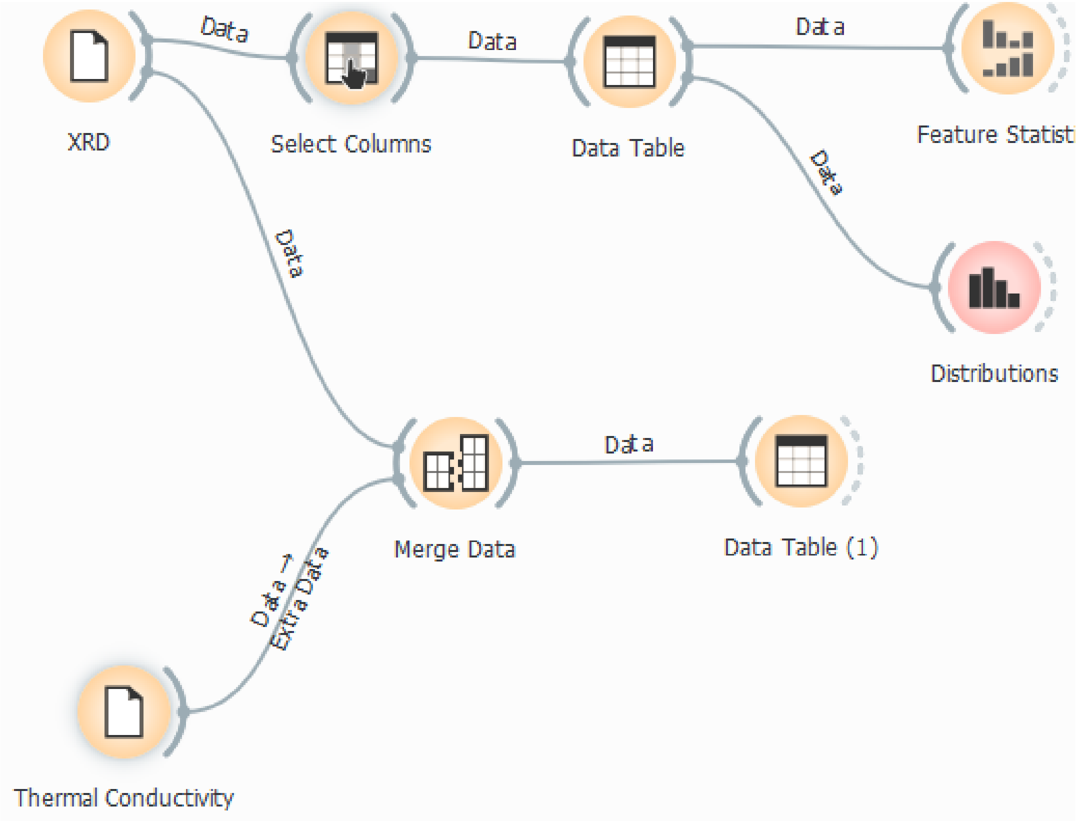
Row matching

	N Lower Depth Interval (m)	matches	N Lower Depth Range (m)	×
and	N Upper Depth Interval (m)	matches	N Upper Depth Range (m)	× +

☑ Apply Automatically

74, 79 79

6. Add **Data Table** as shown below.



7. Open **Data Table** window by double clicking on **Data Table**. → Answer the following questions for this data:

#	Write three observations from the Data Table.
1	79 data instances
2	18 Features
3	36.6% missing data
4	7 meta-attributes (65.3% missing data)
5	No target Variable