

**NAV  
TECH  
DAYS**  
2018

mibuso.com

# Add some magic to Business Central with Machine Learning

DMITRY KATSON, STEVEN RENDERS

[www.navtechdays.com](http://www.navtechdays.com)

When you are passionate about  
Microsoft Dynamics NAV/365 Business Central

**NAV  
TECH  
DAYS**  
2018

mibuso.com

# Agenda

“Use past to predict the future”

- What is AI?
- What is Machine Learning?
- How do ML algorithms work
- How to build ‘custom’ ML model
- How to build AI ready Business Central App



In the previous series...







WHEN YOU ARE PASS

## AI, ML, Insights, Cognitive Services

It became self  
aware at  
2:14 am EST...

In a panic,  
they tried to  
pull the plug,  
but it was  
too late...



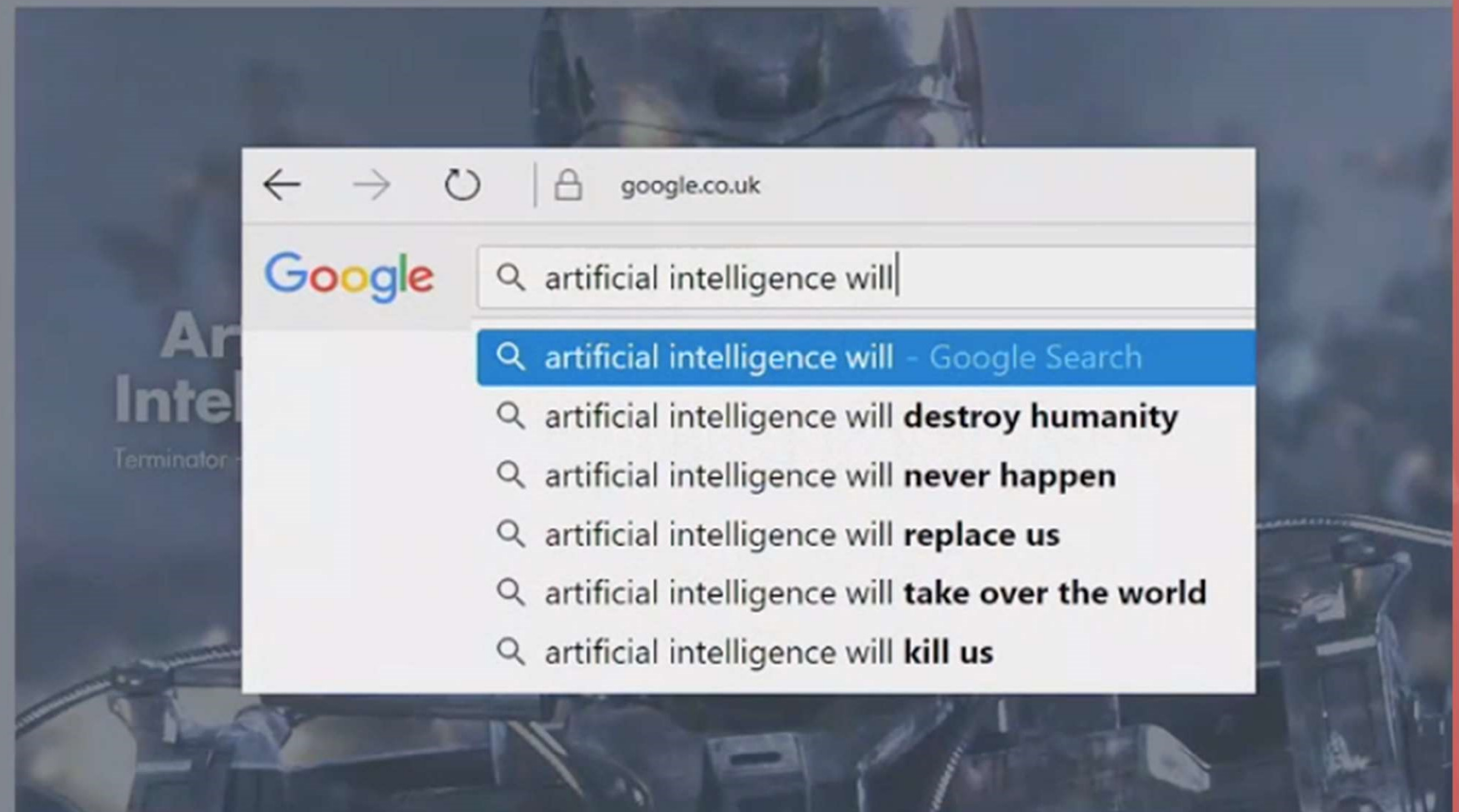




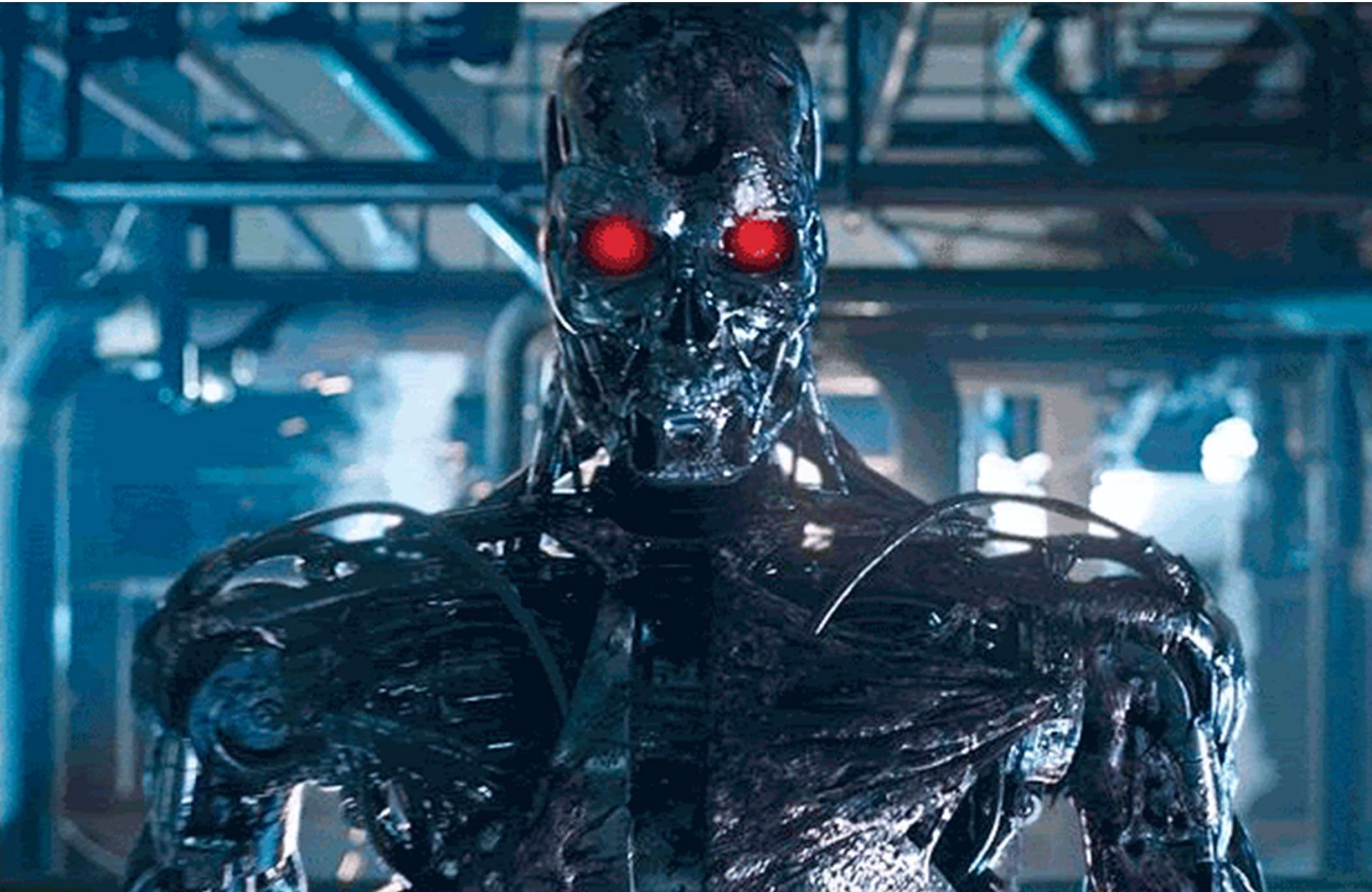
## AI, ML, Insights, Cognitive Services

It became self aware at 2:14 am EST...

In a panic, they tried to pull the plug, but it was too late...



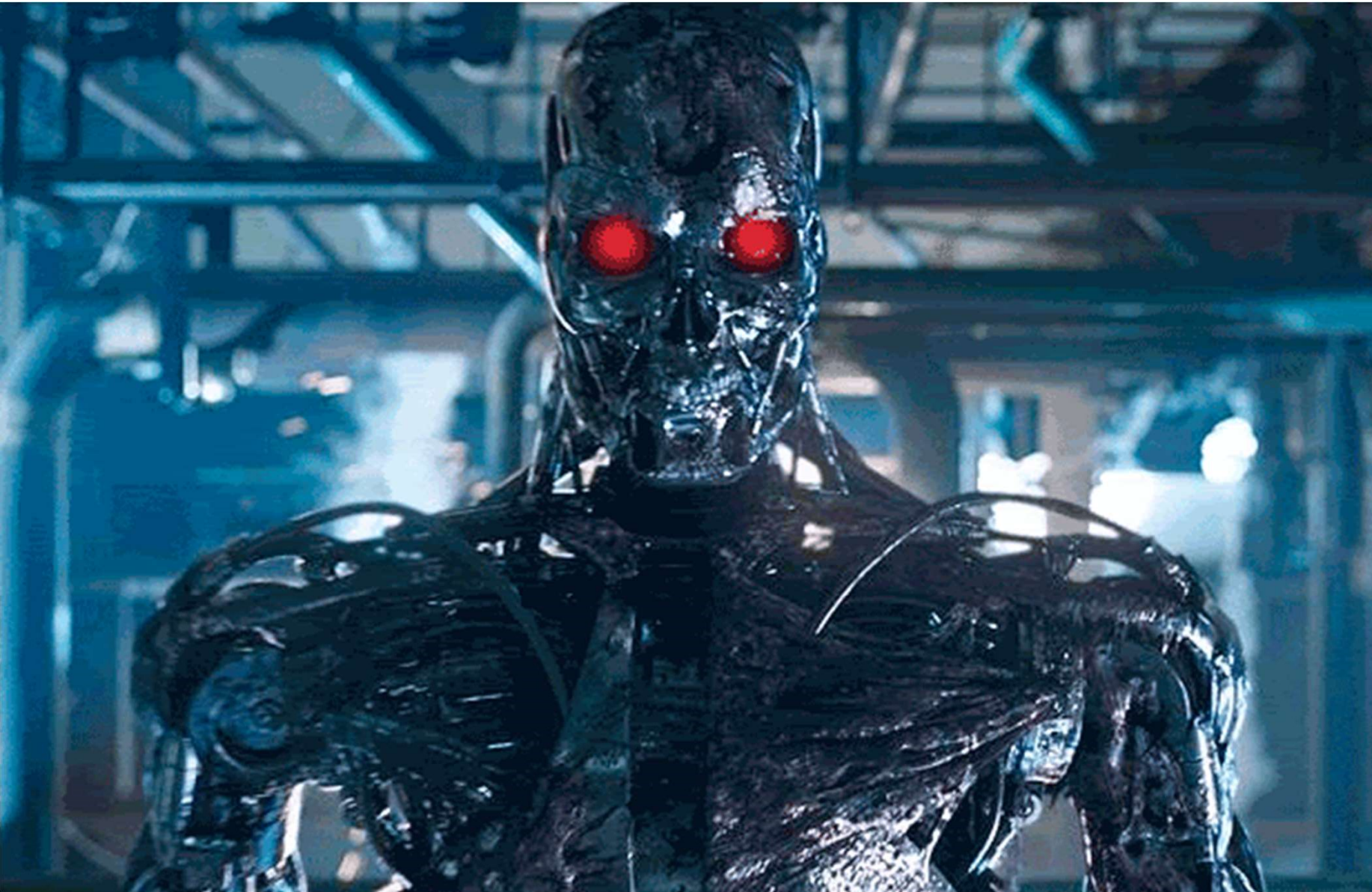




IS  
THIS  
AI?







No!

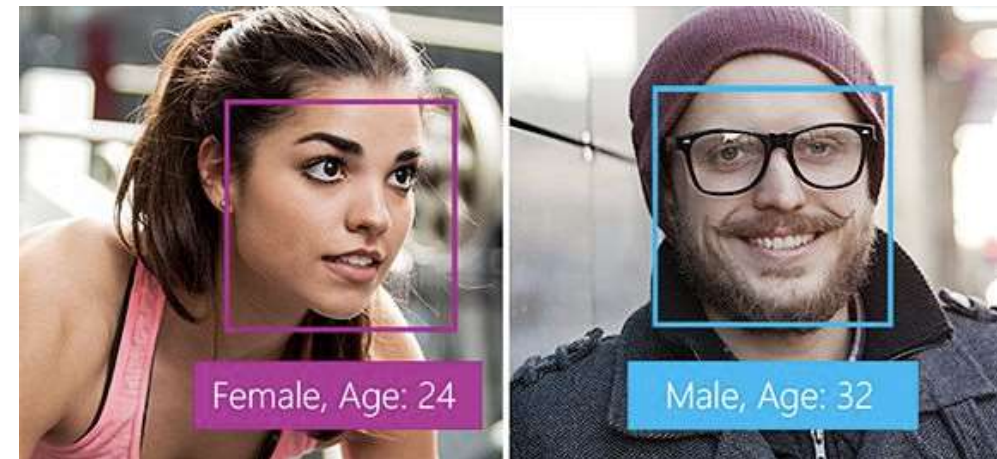
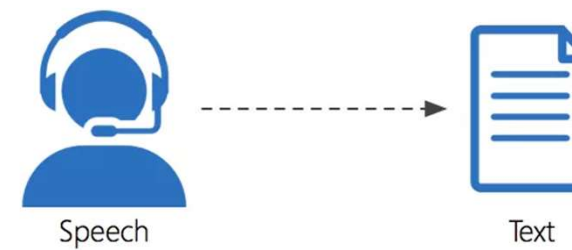
... At least nowadays 😊



# Intro to AI

Artificial Intelligence (AI) –  
tasks that are characteristic of human intelligence

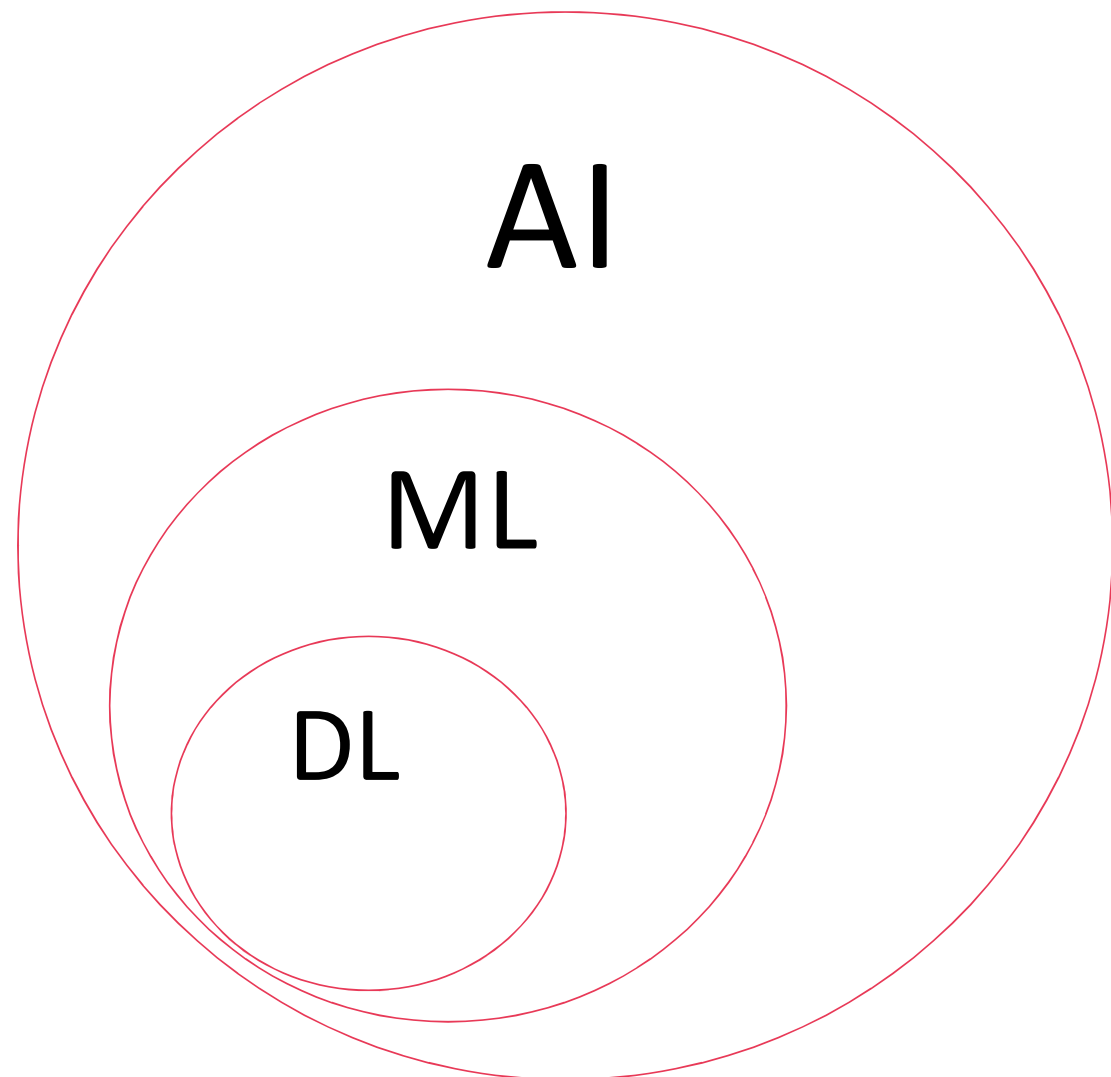
- Language and speech understanding
- Recognizing objects and sounds
- Prediction etc.







# Intro to AI, ML, DL



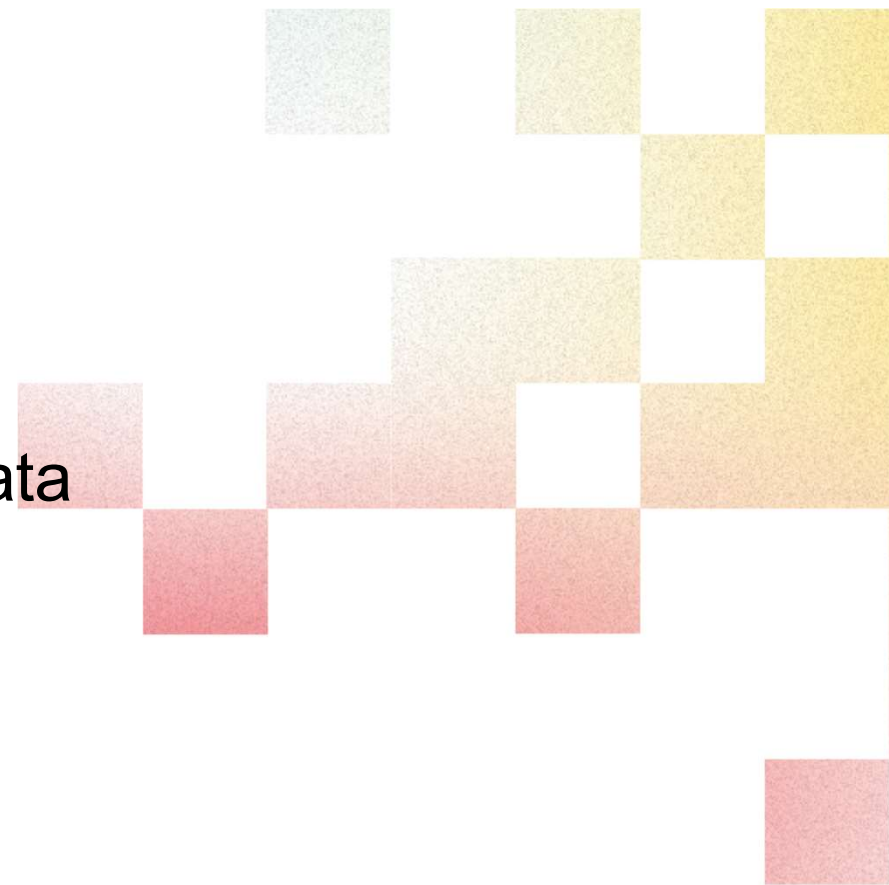
Artificial Intelligence (AI) –  
tasks that are characteristic of human intelligence

- Language and speech understanding
- Recognizing objects and sounds
- Prediction etc.

Machine Learning (ML) –  
a way of achieving AI

- Algorithms
- Education from data

Deep Learning (DL) –  
only one type of ML algorithm

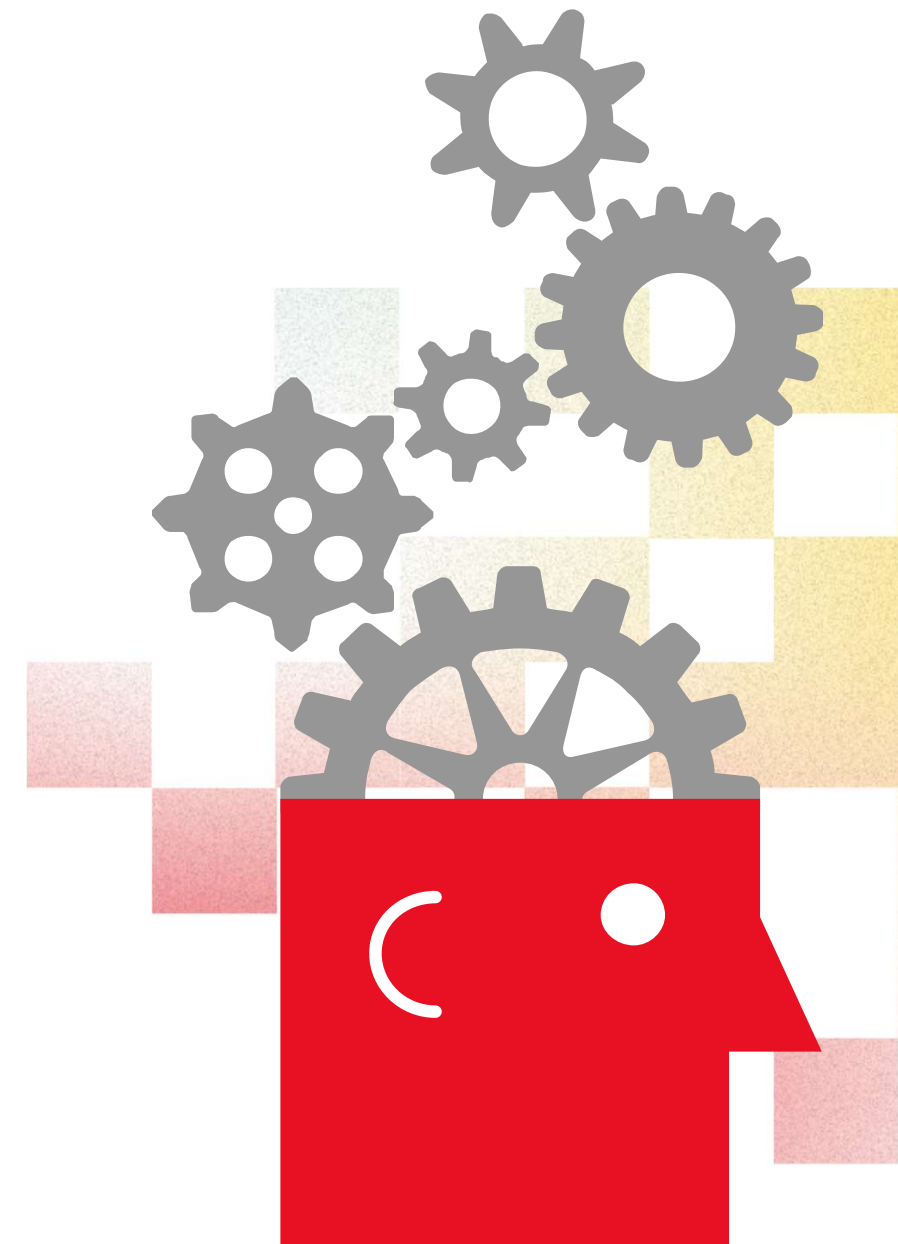




# What is Machine Learning?

**Machine learning** is the process by which a machine (computer) is capable of showing behavior that has not been explicitly programmed into it.  
(Arthur Samuel, 1959)

Computers “learn” from data in order to perform predictive analytics



# Types of Machine Learning

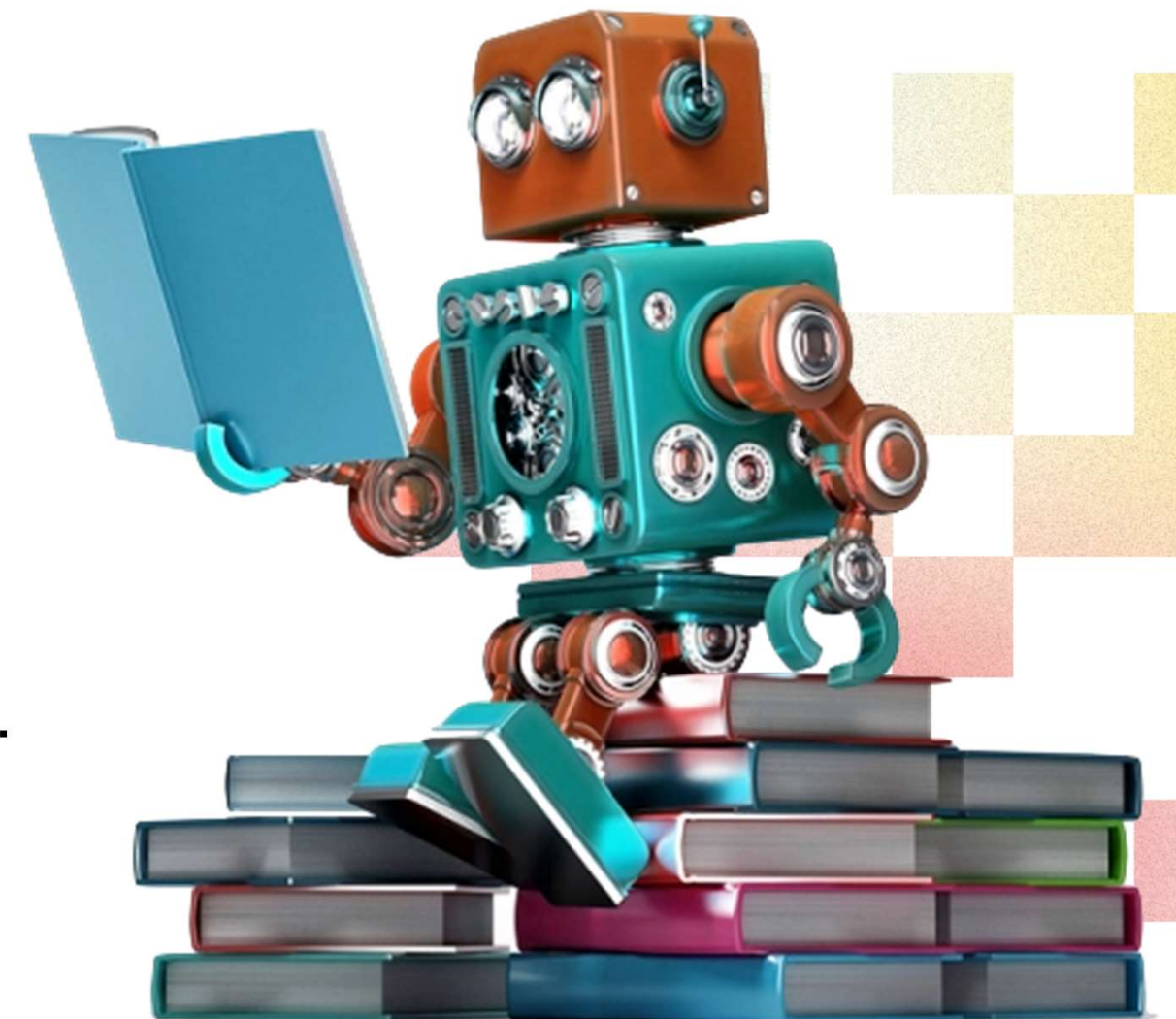
## Supervised Learning

Used when you want to find unknown answers and have data with known answers. Also known as training with a teacher.

## Unsupervised Learning

In this case there is no teacher and the "training sample" consists only of objects.

A student, having only a list of objects, must determine how objects are related to each other.





# Example of supervised learning

Which customers will buy a bike?



?



# Example of supervised learning

Analyze historical data set that includes predictive attributes and known answer

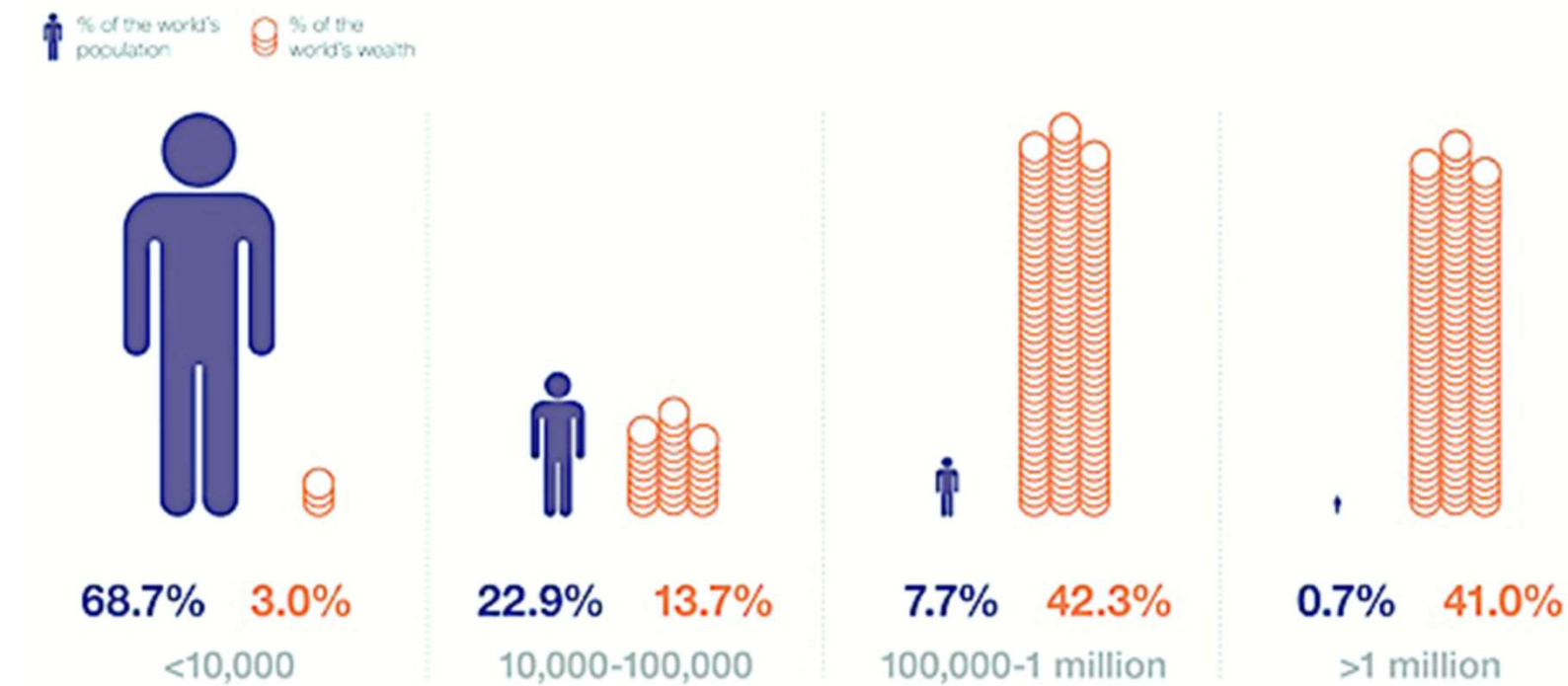
- Woman
- 20-30 Years Old
- Income 2-4K
- 0-1 kid
- Lives in the Center
- ...



# Example of unsupervised learning

Search for common insights in data and separate them in groups

How is the **world's wealth** shared amongst its population?

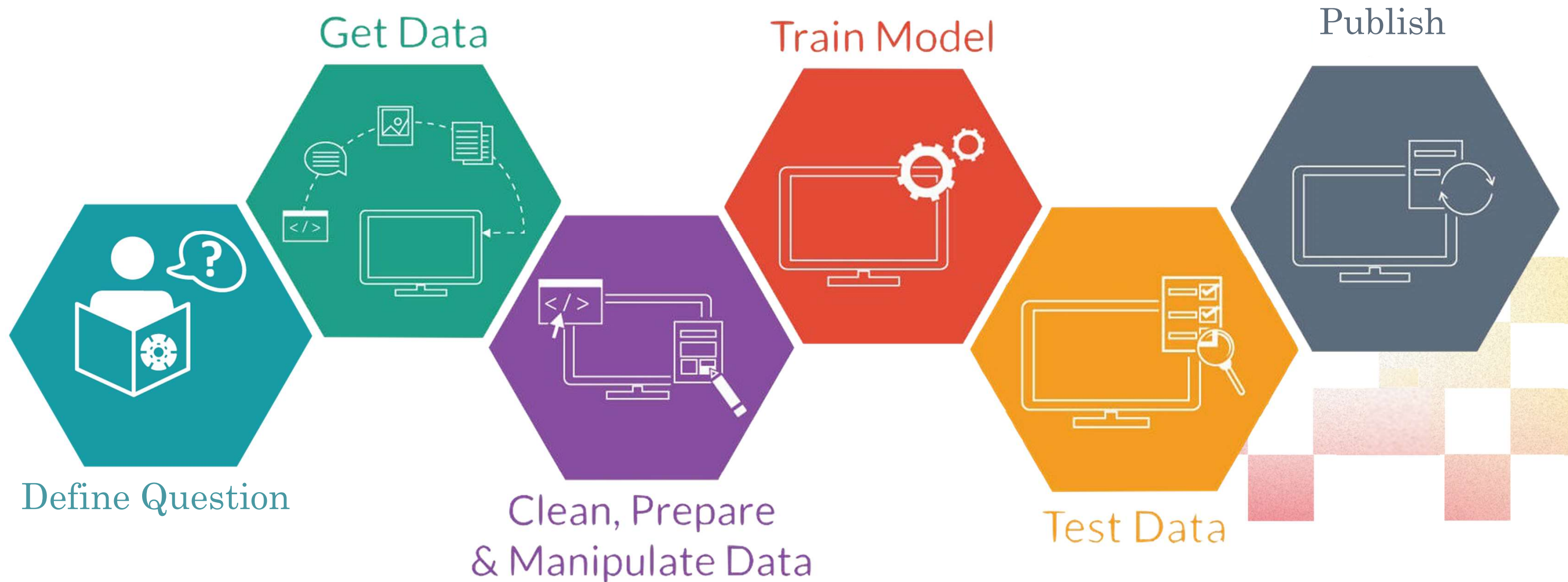




# How do Machine Learning works?



# Machine Learning process

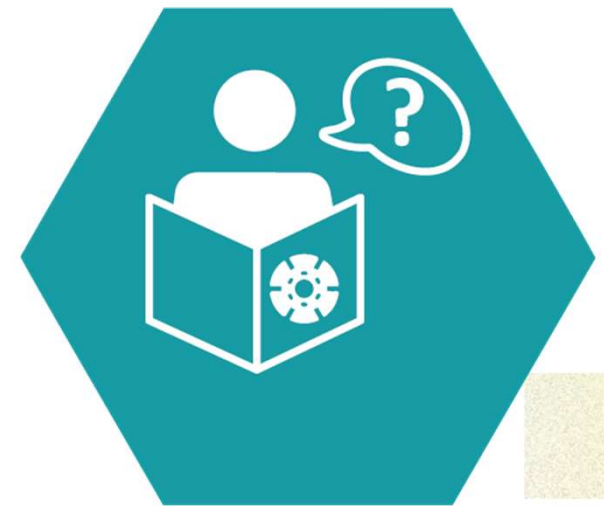


# Step 1

Define a business problem

Specify exact question. It should start with

- WHEN, HOW MUCH?
- WILL BE OR NOT, IS THIS?
- IN WHAT, WHERE?
- FIND ANOMALY
- HOW THIS IS ORGANIZED?



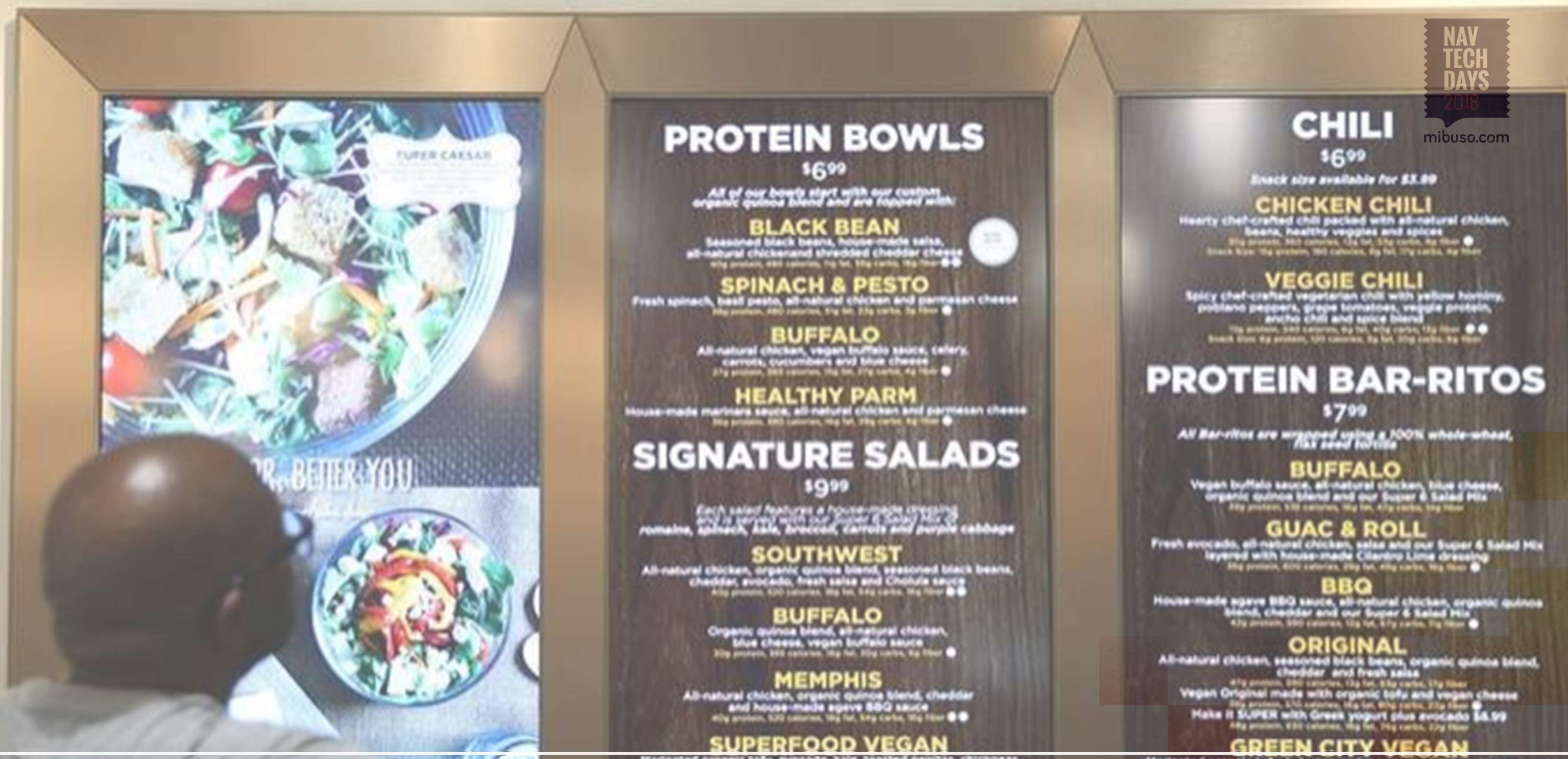
Define Question

**The exact question is the key to the answer!**



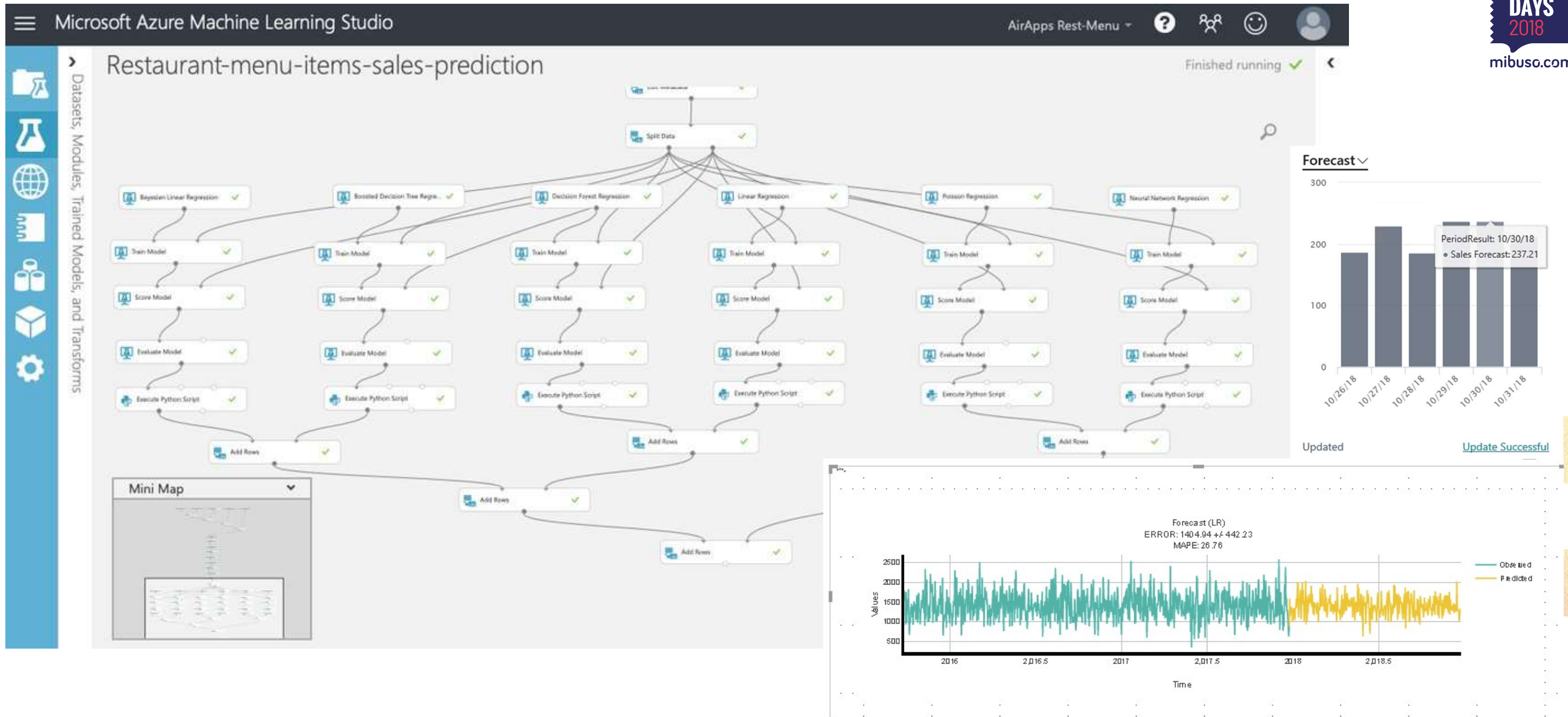
# What will we ask today?





How many of each menu item will my customers order next week?





This we will get at the end...



# Step 2

## Search for data

- Use any available source: public or private
- Should be: Relevant, Complete, Exact, Sufficient

## Search for data insights

- Use any available tool: Excel, Power BI, Jupiter Notebook
- Use any available language: Python, R, DAX, SQL
- Find: Relationships, correlations, features, statistics



# Where to search?

## Public

- <https://data.world>
- <https://toolbox.google.com/datasetsearch/>
- <https://archive.ics.uci.edu/ml/datasets.html>
- <https://www.kaggle.com>
- <https://msropendata.com/>
- <https://github.com/awesomedata/awesome-public-datasets>

## Private

- Customer ERP, CRM or other systems
- Customer Excel, PDF, CSV files

## Generate Data

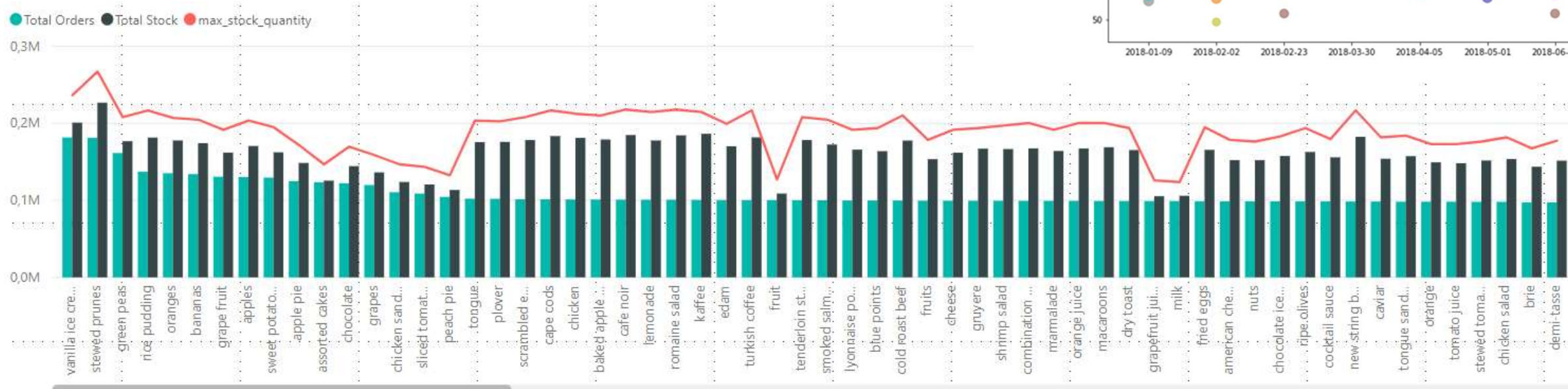
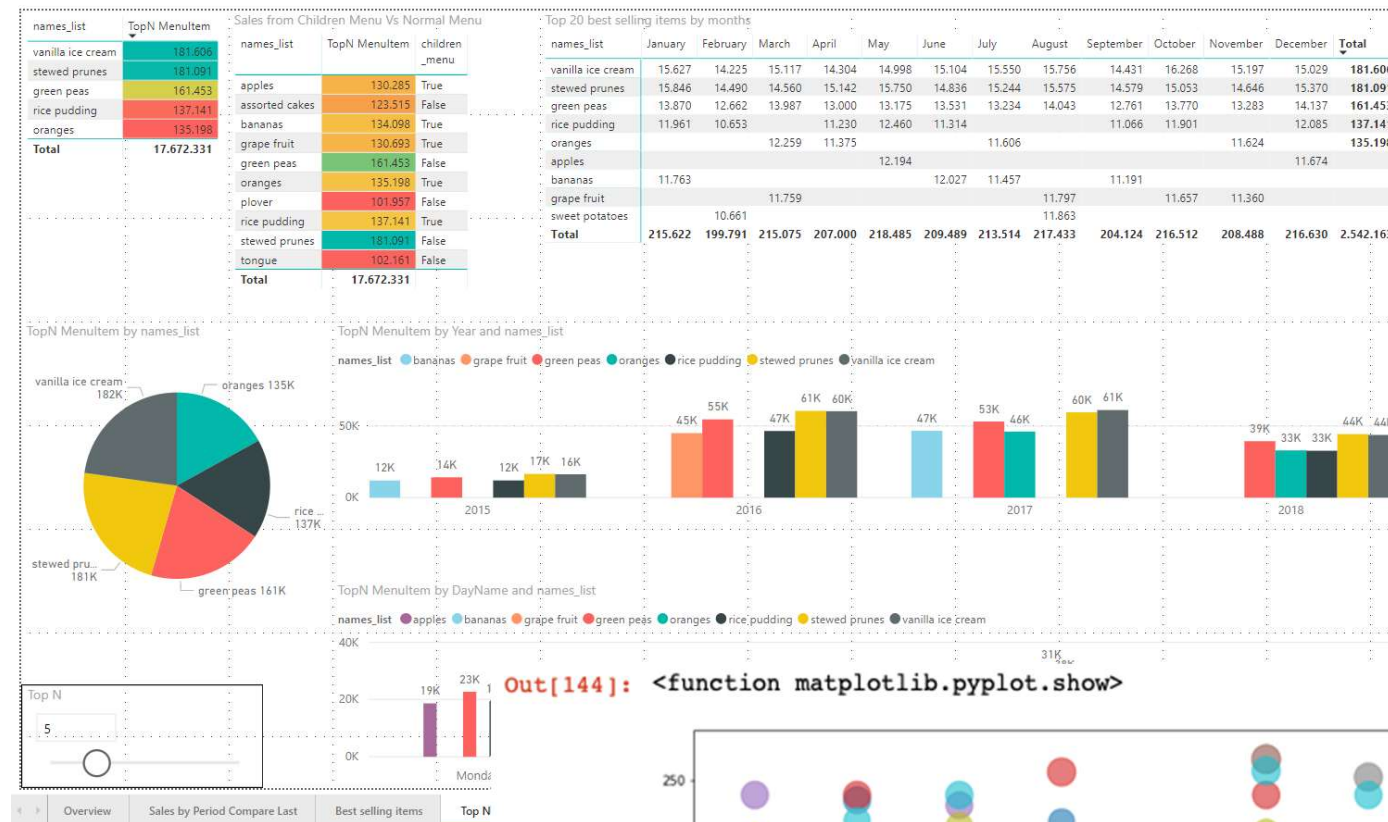




# Data insights

## Tools

- Jupiter Notebook
- Power BI
- Excel
- etc.





Demo





# Data insights

- Is your data relevant?
- Do you have connected data?
- Is your data accurate?
- Do you have enough data to work with?





# Data insights

- Is your data relevant?

## Irrelevant Data

Price of milk (\$/gal)	Red Sox batting avg.	Blood alcohol content (%)
3.79	.304	.03
3.45	.320	.09
4.06	.259	.01
3.89	.298	.05
4.12	.332	.13
3.92	.270	.06
3.23	.294	.10

## Relevant Data

Body mass (kg)	Margaritas	Blood alcohol content (%)
103	3	.03
67	5	.09
87	1	.01
52	2	.05
73	5	.13
79	3	.06
110	7	.10

# Data insights

- Do you have connected data?

## Disconnected Data

Grill temp. (Fahrenheit)	Weight of beef patty (lb)	Burger rating (out of 10)
<input type="text"/>	.33	8.2
<input type="text"/>	.24	5.6
550	<input type="text"/>	7.8
725	.45	9.4
600	<input type="text"/>	8.2
625	<input type="text"/>	6.8
<input type="text"/>	.49	4.2

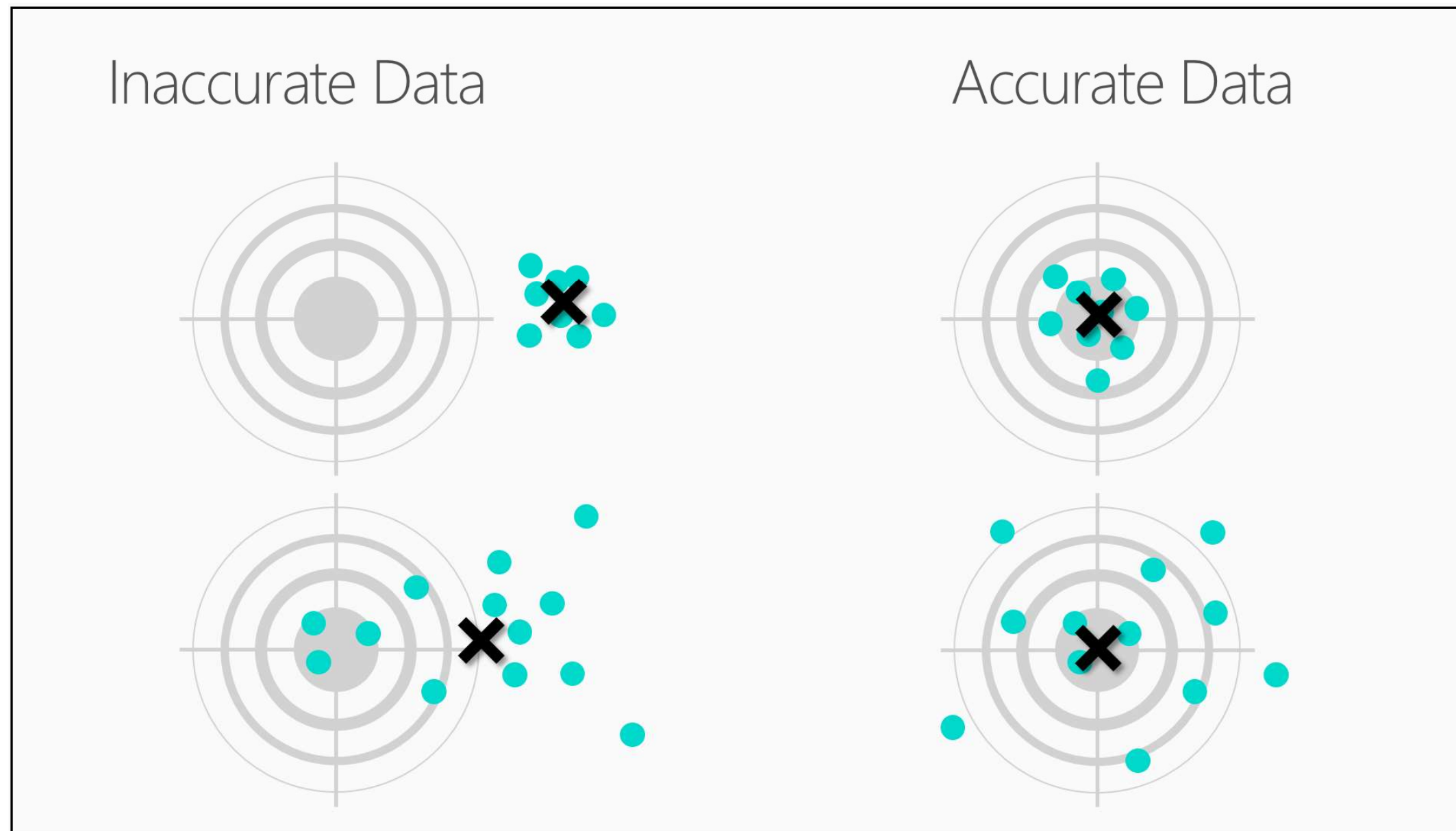
## Connected Data

Grill temp. (Fahrenheit)	Weight of beef patty (lb)	Burger rating (out of 10)
575	.33	8.2
550	.24	5.6
550	.69	7.8
725	.45	9.4
600	.57	8.2
625	.36	6.8
550	.49	4.2



# Data insights

- Is your data accurate?





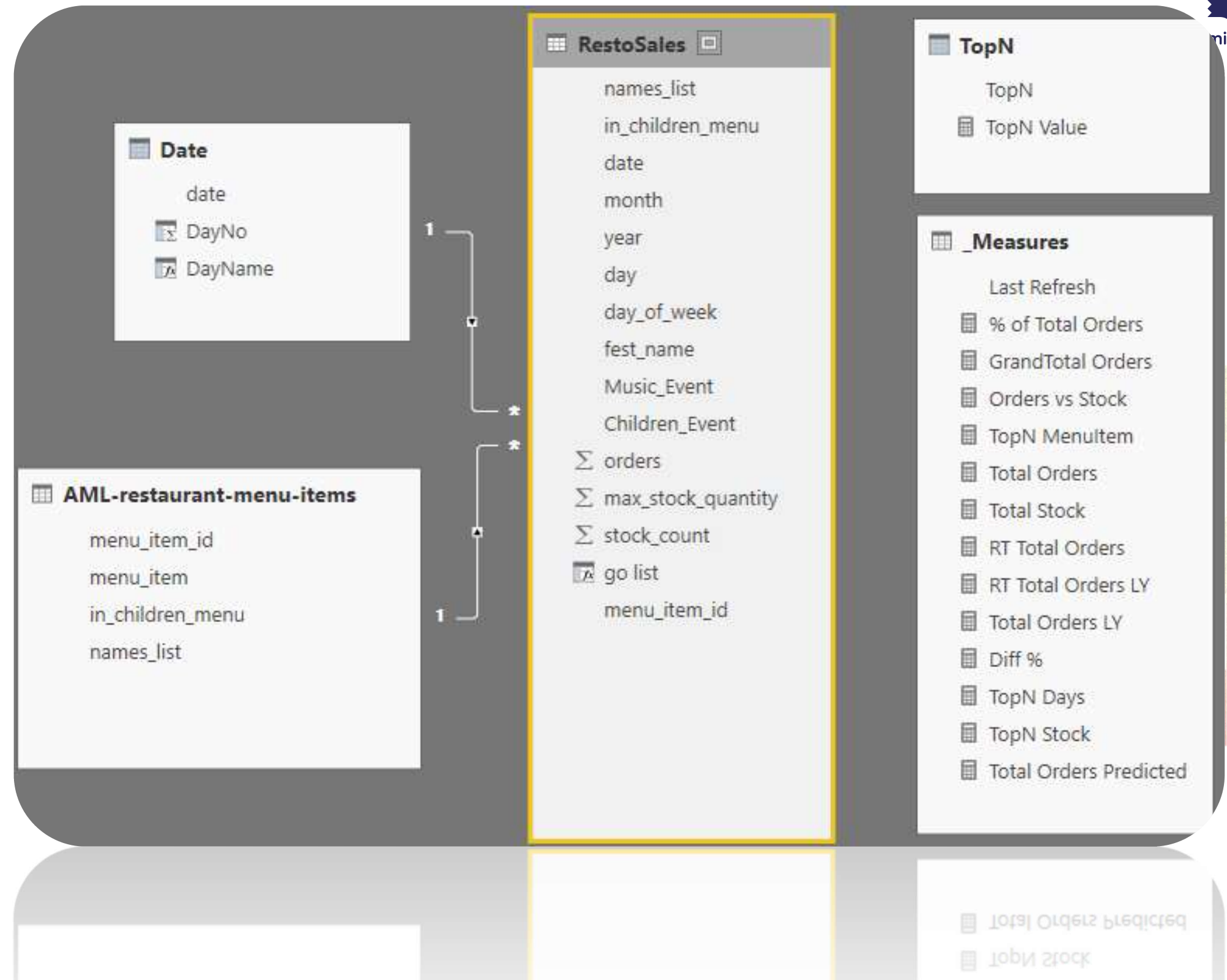
# Data insights

- Do you have enough data to work with?

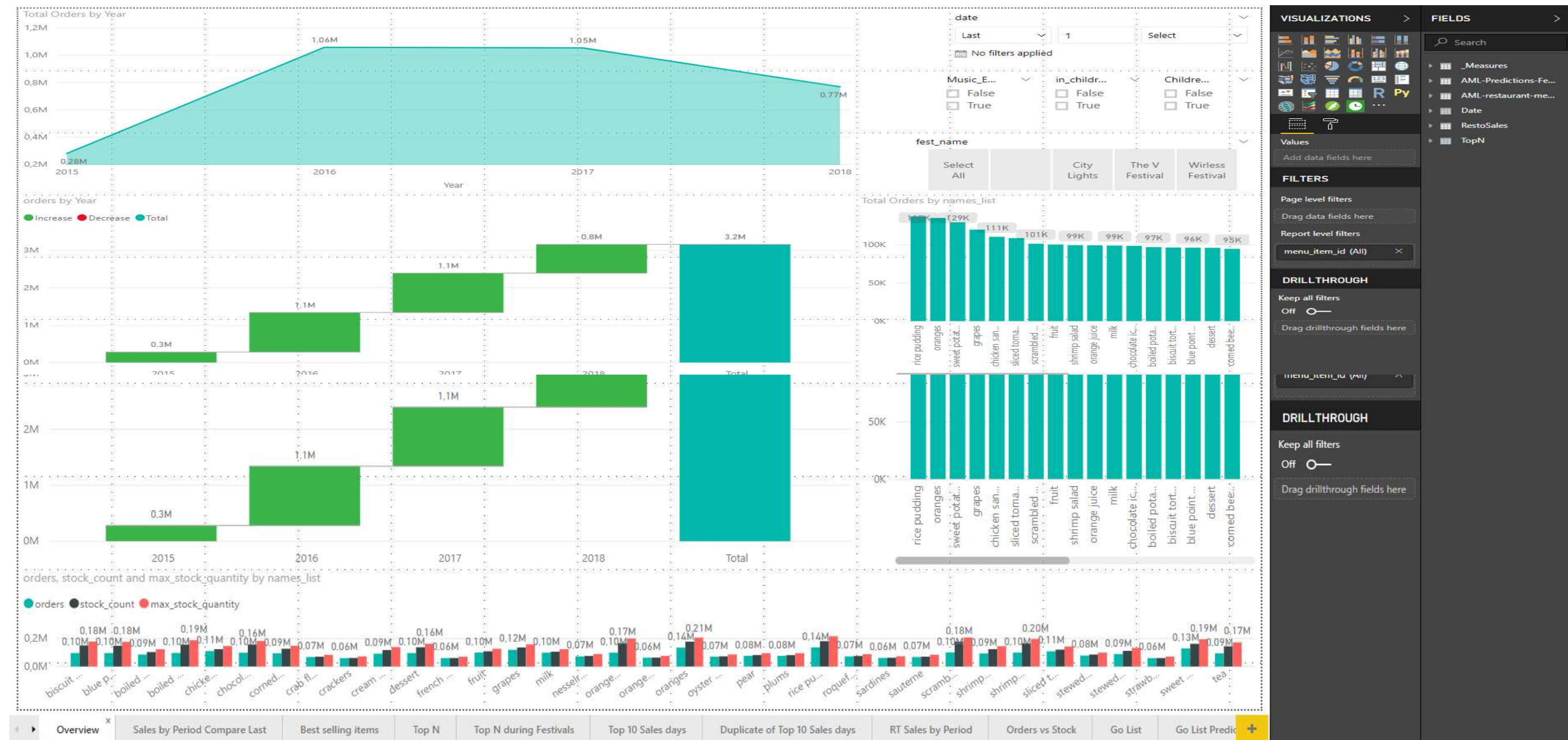
Barely enough data



# Data insights



# Data insights





# Data insights

## RestoSales

Display Options ?

```
let
    Source = Csv.Document(File.Contents("G:\Menu Items Forecasting\restaurant-sales-by-menu-item (1).csv"),
        [Delimiter=";", Columns=14, Encoding=1252, QuoteStyle=QuoteStyle.None]),
    #"Promoted Headers" = Table.PromoteHeaders(Source, [PromoteAllScalars=true])
```

## AML-restaurant-menu-items

Display Options ?

```
let
    Source = Csv.Document(File.Contents("G:\Menu Items Forecasting\AML-restaurant-menu-items.csv"),[Delimiter=";", Columns=3, Encoding=1252,
    QuoteStyle=QuoteStyle.None]),
    #"Promoted Headers" = Table.PromoteHeaders(Source, [PromoteAllScalars=true]),
    #"Changed Type" = Table.TransformColumnTypes(#"Promoted Headers",{{"", Int64.Type}, {"menu_item", type text}, {"in_children_menu", Int64.Type}}),
    #"Renamed Columns" = Table.RenameColumns(#"Changed Type",{{"", "ID"}}),
    #"Changed Type1" = Table.TransformColumnTypes(#"Renamed Columns",{{"in_children_menu", type logical}}),
    #"Duplicated Column" = Table.DuplicateColumn(#"Changed Type1", "menu_item", "menu_item - Copy"),
    #"Renamed Columns1" = Table.RenameColumns(#"Duplicated Column",{{"menu_item - Copy", "menu_item_key"}}),
    #"Lowercased Text" = Table.TransformColumns(#"Renamed Columns1",{{"menu_item_key", Text.Lower, type text}}),
    #"Renamed Columns2" = Table.RenameColumns(#"Lowercased Text",{{"menu_item_key", "names_list"}, {"ID", "menu_item_id"}})
in
    #"Renamed Columns2"
```

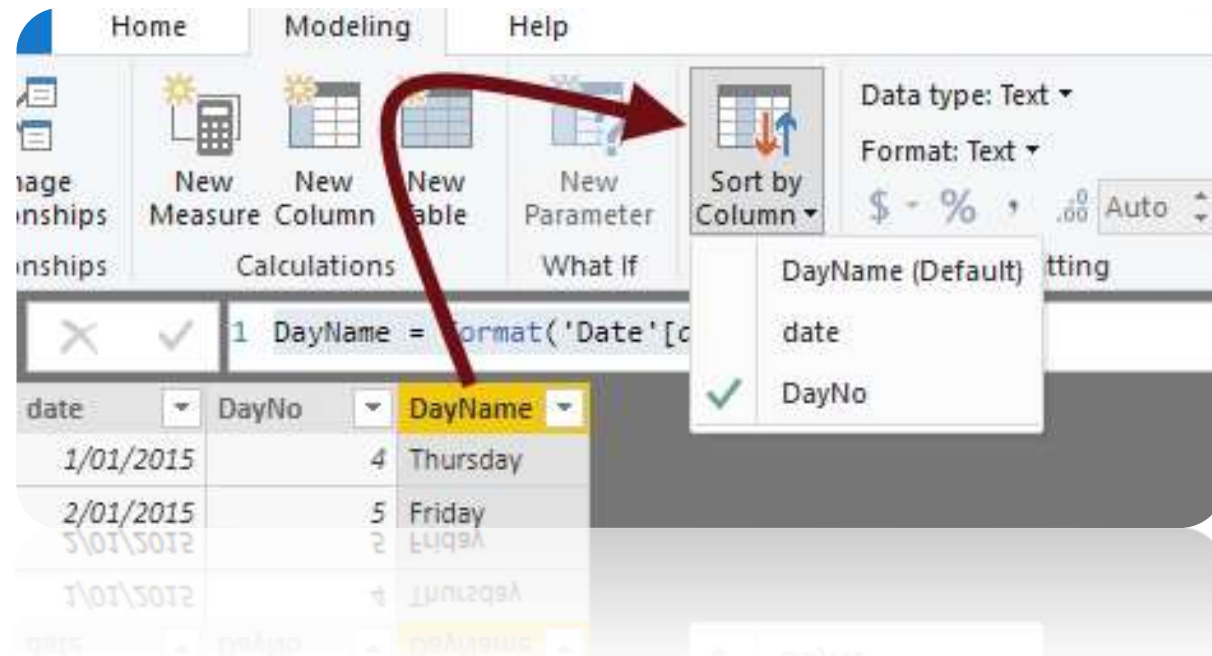
✓ No syntax errors have been detected.

Done

Cancel

# Data insights

- Date = CALENDARAUTO()
- DayNo = WEEKDAY('Date'[date];2)
- DayName =  
format('Date'[date];"DDDD")



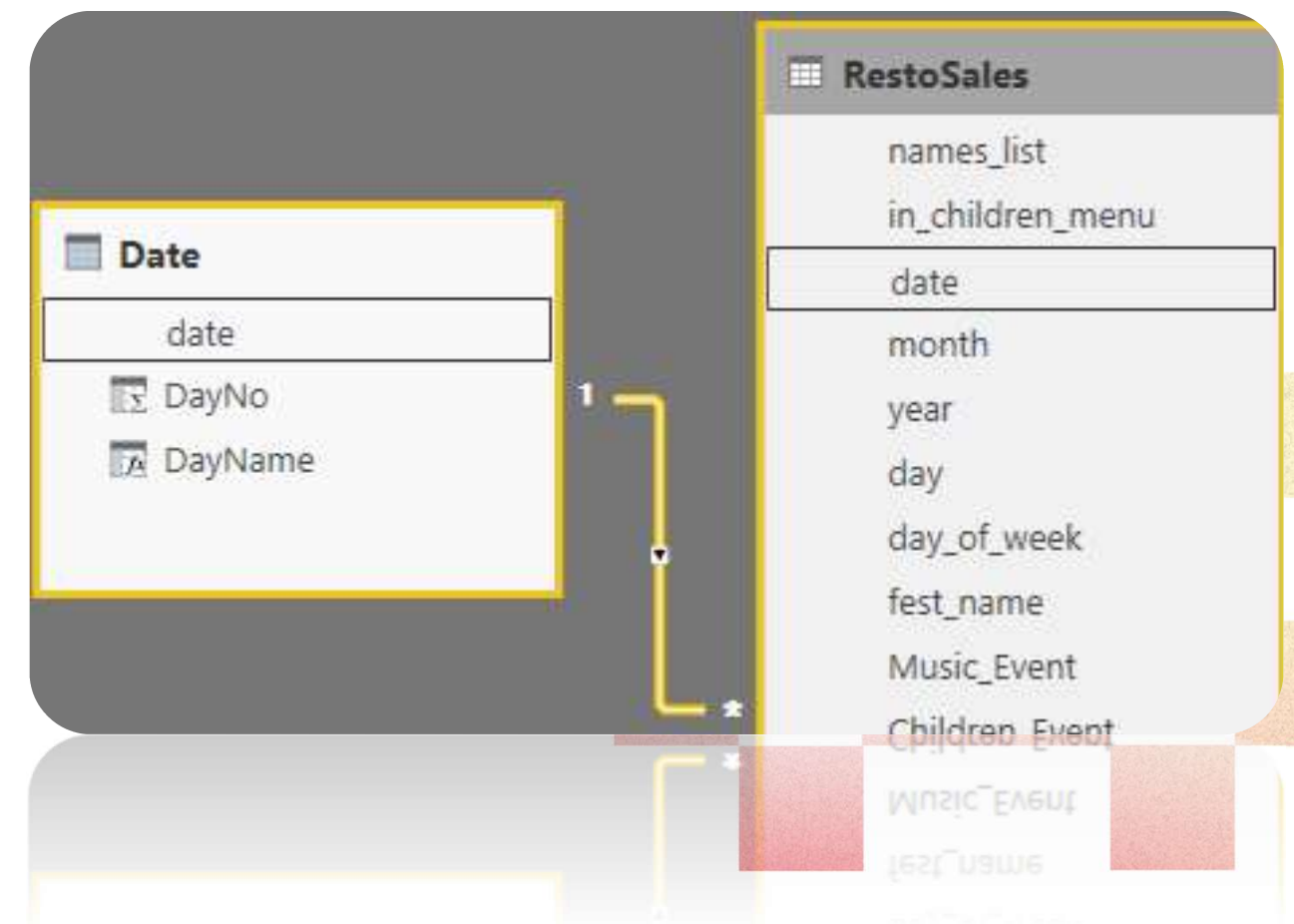
date	DayNo	DayName
1/01/2015	4	Thursday
2/01/2015	5	Friday
3/01/2015	6	Saturday
4/01/2015	7	Sunday
5/01/2015	1	Monday
6/01/2015	2	Tuesday
7/01/2015	3	Wednesday
8/01/2015	4	Thursday
9/01/2015	5	Friday
10/01/2015	6	Saturday

# Data insights

Date = CALENDARAUTO()

DayNo = WEEKDAY('Date'[date];2)

DayName = format('Date'[date];"DDDD")





# Data insights

```
Total Orders =  
SUM ( RestoSales[orders] )
```

```
Total Orders LY =  
CALCULATE (   
    SUM ( RestoSales[orders] );  
    SAMEPERIODLASTYEAR ( 'Date'[date] )  
)
```

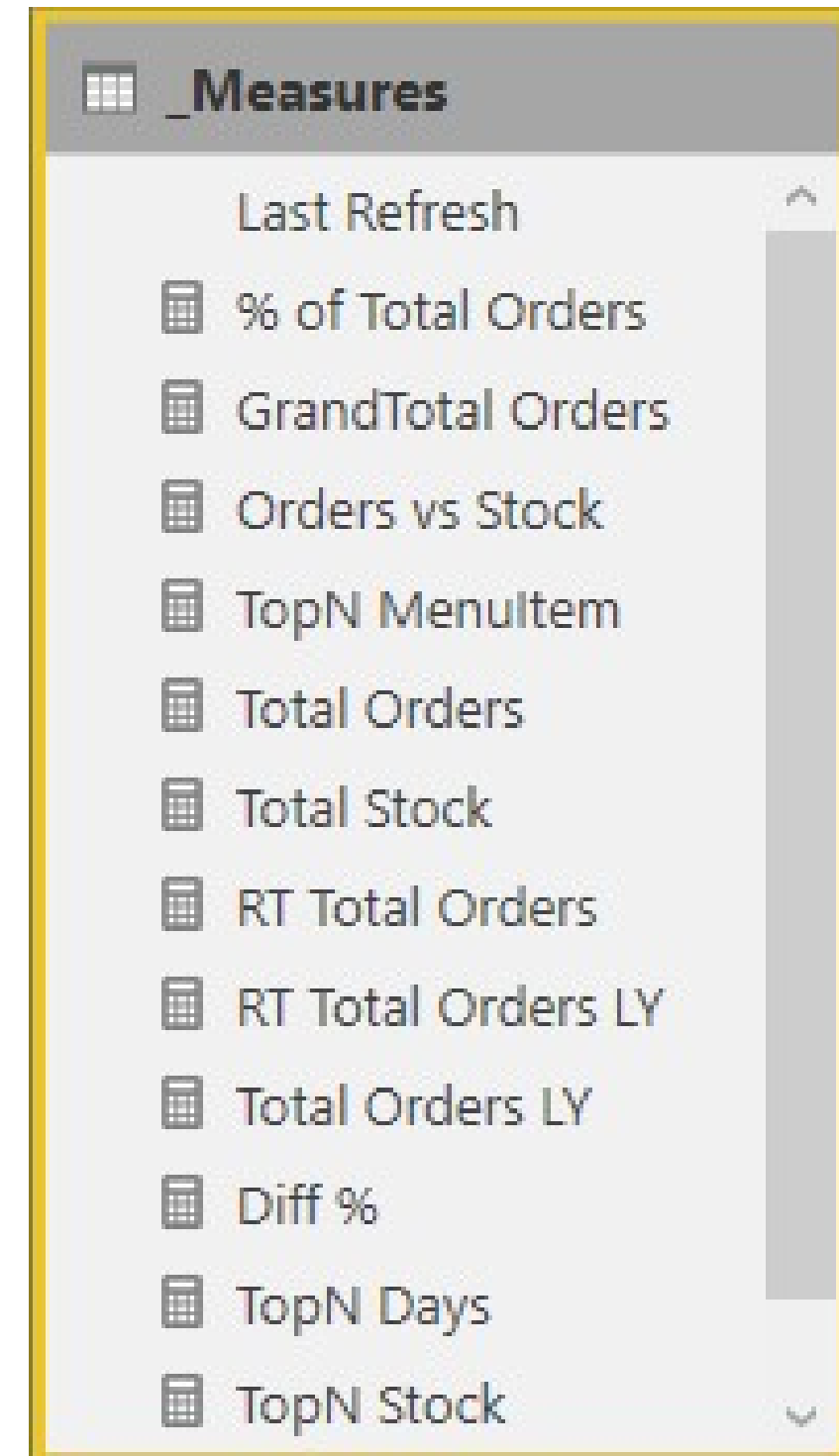
```
Diff % =  
DIVIDE (   
    ( [Total Orders] - [Total Orders LY] );  
    [Total Orders LY]  
)
```

_Measures	
	Last Refresh
📊	% of Total Orders
📊	GrandTotal Orders
📊	Orders vs Stock
📊	TopN MenuItem
📊	Total Orders
📊	Total Stock
📊	RT Total Orders
📊	RT Total Orders LY
📊	Total Orders LY
📊	Diff %
📊	TopN Days
📊	TopN Stock

# Data insights

```
GrandTotal Orders =  
CALCULATE (  
    [Total Orders];  
    ALL ( RestoSales )  
)
```

```
% of Total Orders =  
[Total Orders] / [GrandTotal Orders]
```



# Data insights

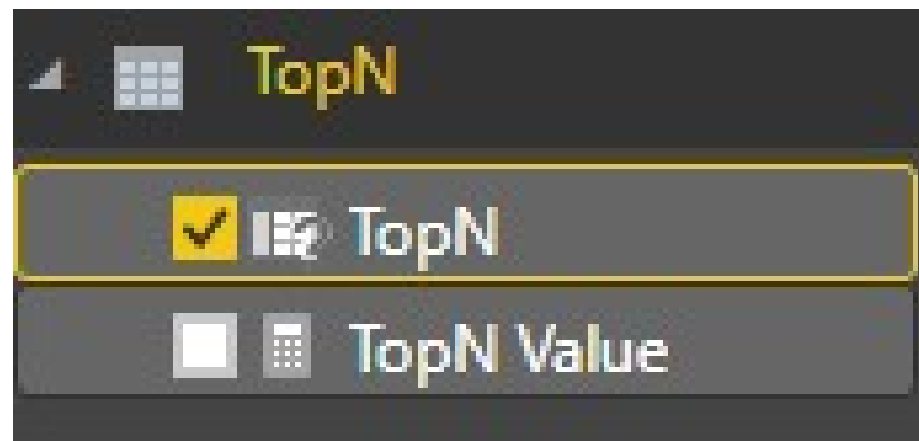
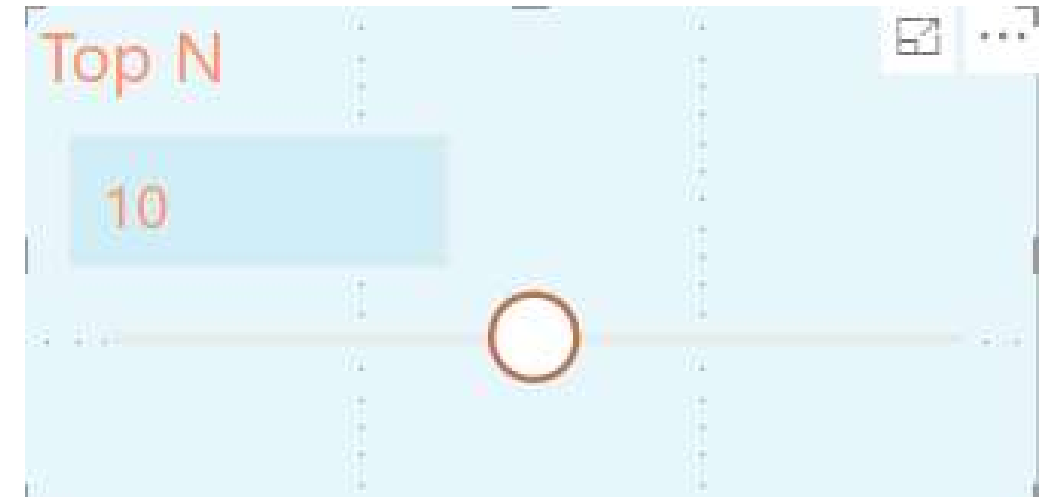
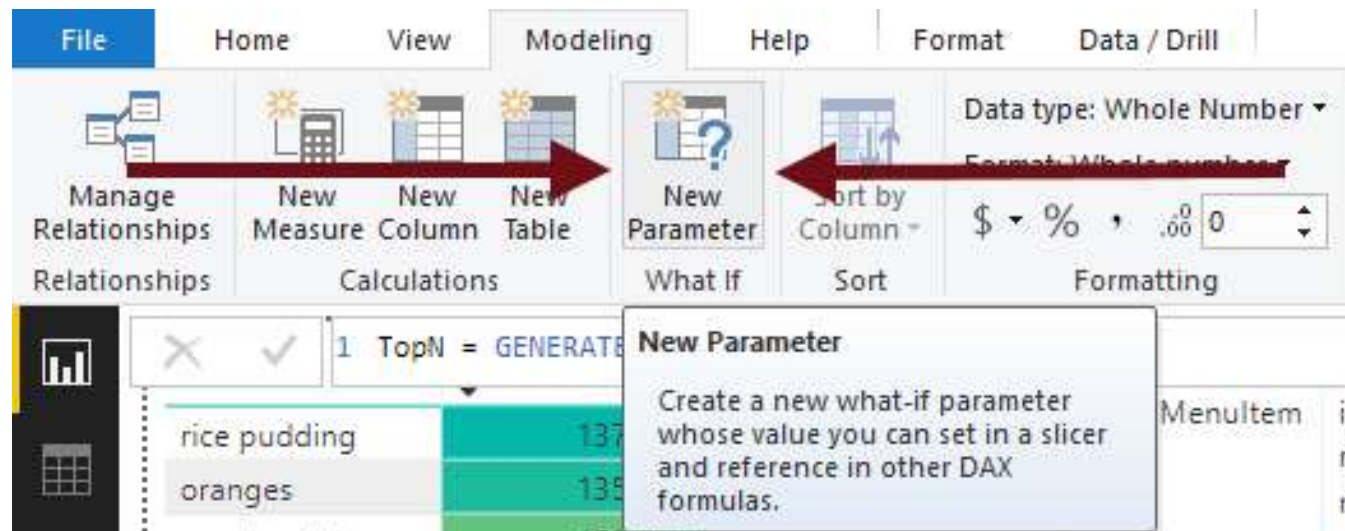




# Data insights



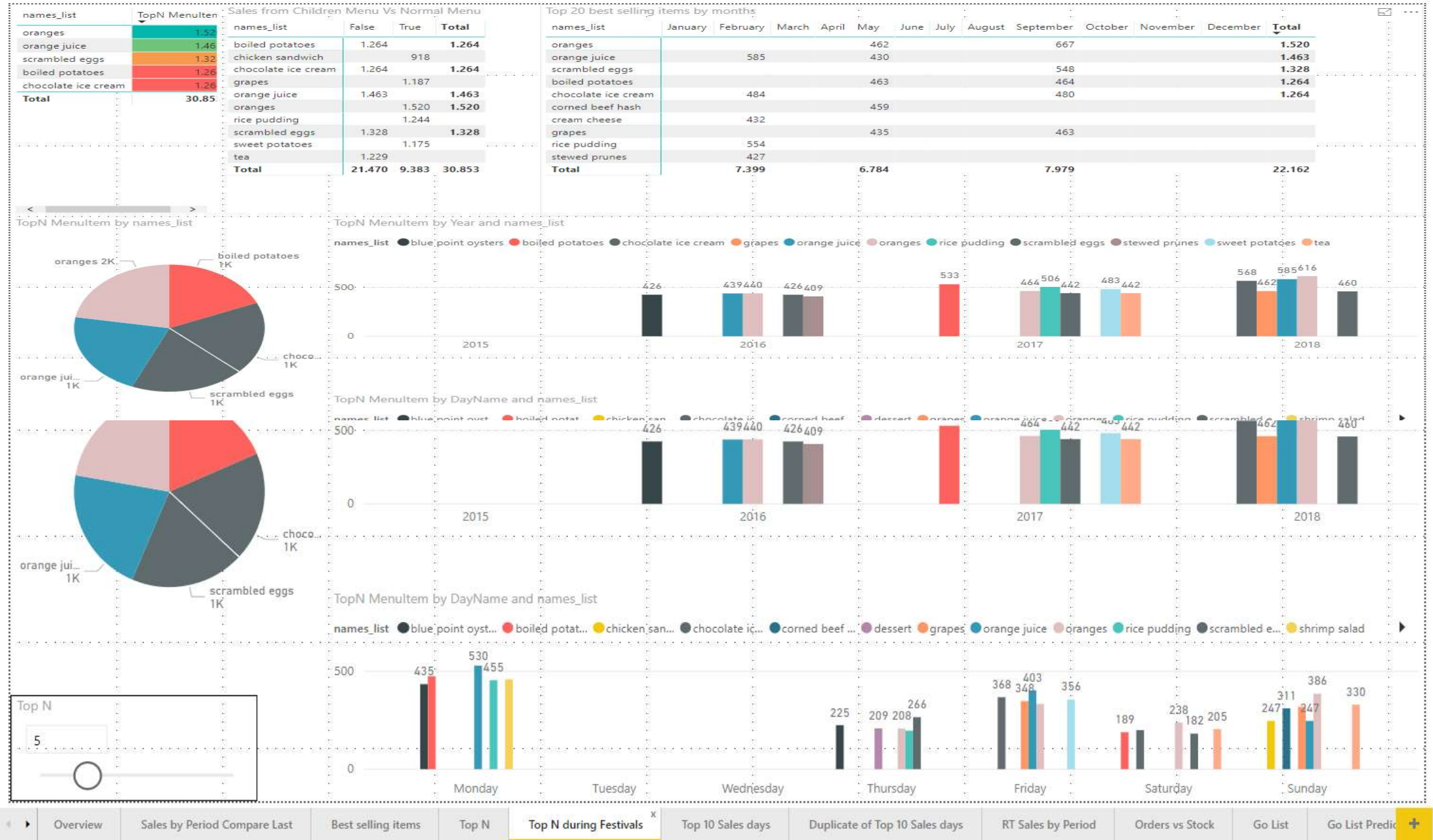
# Data insights



```
TopN MenuItem =
VAR SelectedTop =
    SELECTEDVALUE ( 'TopN'[TopN] )
RETURN
    SWITCH (
        TRUE ();
        SelectedTop = 0; [Total Orders];
        RANKX (
            ALLSELECTED ( RestoSales[names_list] );
            [Total Orders]
        ) <= SelectedTop; [Total Orders]
    )
```



# Data insights

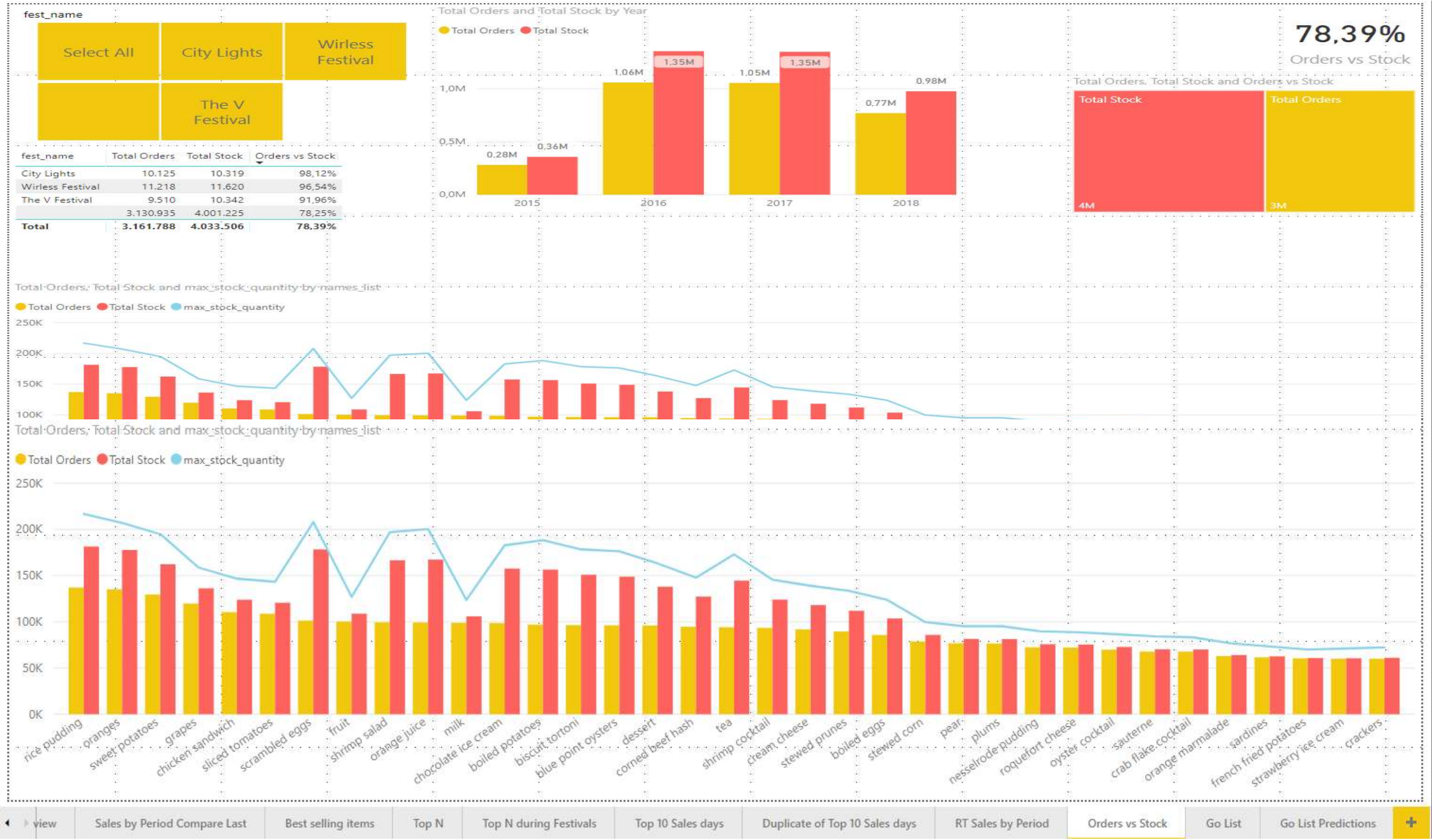




# Data insights



# Data insights





# Data insights

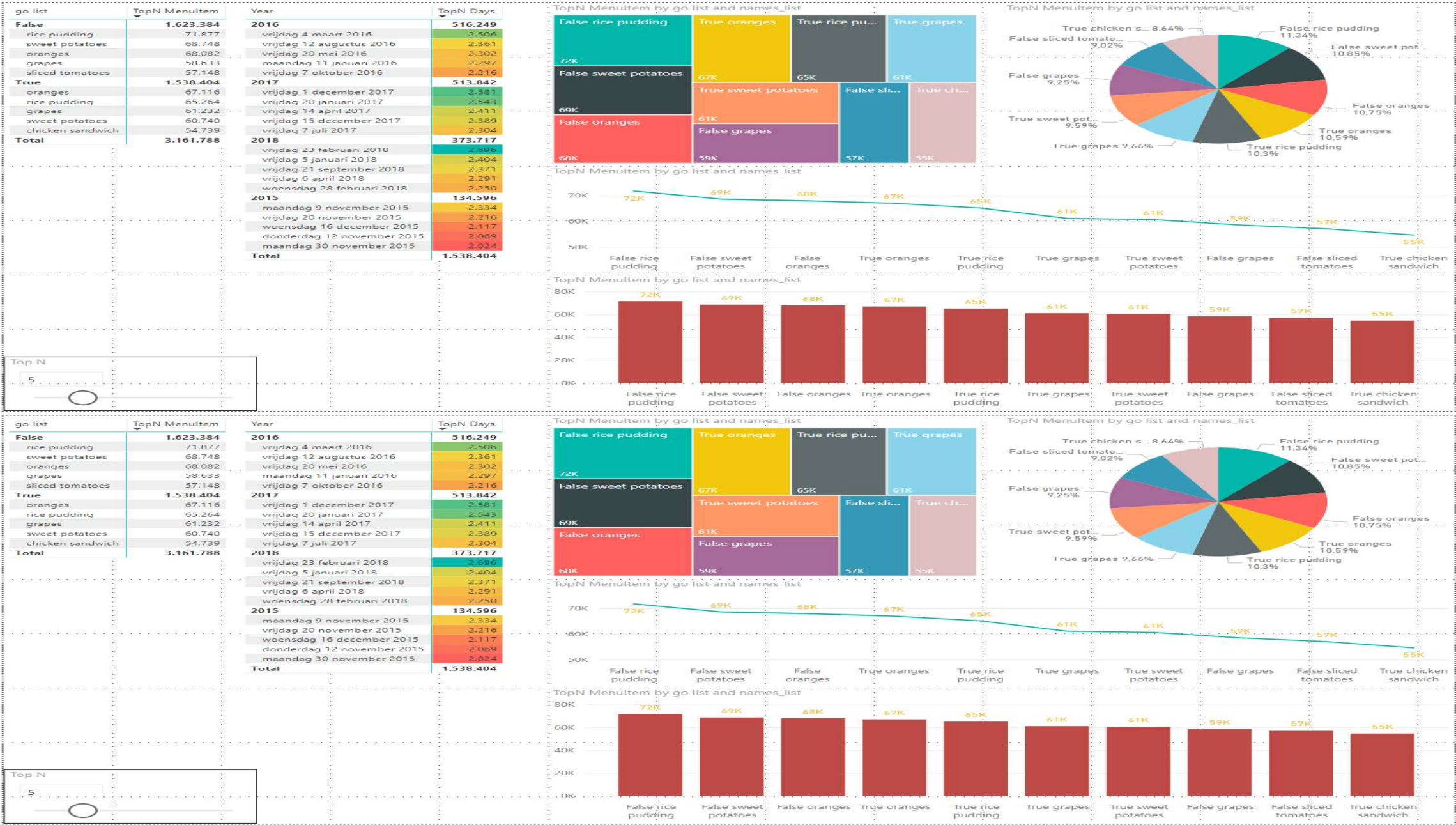
```
go list =
IF (
    RestoSales[stock_count] > RestoSales[max_stock_quantity];
    TRUE;
    FALSE
)
```

```
TopN MenuItem =
VAR SelectedTop =
    SELECTEDVALUE ( 'TopN'[TopN] )
RETURN
    SWITCH (
        TRUE ();
        SelectedTop = 0; [Total Orders];
        RANKX (
            ALLSELECTED ( RestoSales[names_list] );
            [Total Orders]
        ) <= SelectedTop; [Total Orders]
    )
```

go list	TopN MenuItem	Year	TopN Days
False	1.623.384	2016	516.249
rice pudding	71.877	vrijdag 4 maart 2016	2.506
sweet potatoes	68.748	vrijdag 12 augustus 2016	2.361
oranges	68.082	vrijdag 20 mei 2016	2.302
grapes	58.633	maandag 11 januari 2016	2.297
sliced tomatoes	57.148	vrijdag 7 oktober 2016	2.216
True	1.538.404	2017	513.842
oranges	67.116	vrijdag 1 december 2017	2.581
rice pudding	65.264	vrijdag 20 januari 2017	2.543
grapes	61.232	vrijdag 14 april 2017	2.411
sweet potatoes	60.740	vrijdag 15 december 2017	2.389
chicken sandwich	54.739	vrijdag 7 juli 2017	2.304
Total	3.161.788	2018	373.717
		vrijdag 23 februari 2018	2.696
		vrijdag 5 januari 2018	2.404
		vrijdag 21 september 2018	2.371
		vrijdag 6 april 2018	2.291
		woensdag 28 februari 2018	2.250
		2015	134.596
		maandag 9 november 2015	2.334
		vrijdag 20 november 2015	2.216
		woensdag 16 december 2015	2.117
		donderdag 12 november 2015	2.069
		maandag 30 november 2015	2.024
		Total	1.538.404
		Total	1.538.404
		maandag 30 november 2012	5.034
		donderdag 15 november 2012	5.088
		woensdag 16 december 2012	5.088
		vrijdag 30 november 2012	5.088
		maandag 5 november 2012	5.088



# Data insights



# Data insights

- Is your data relevant?
- Do you have connected data?
- Is your data accurate?
- Do you have enough data to work with?



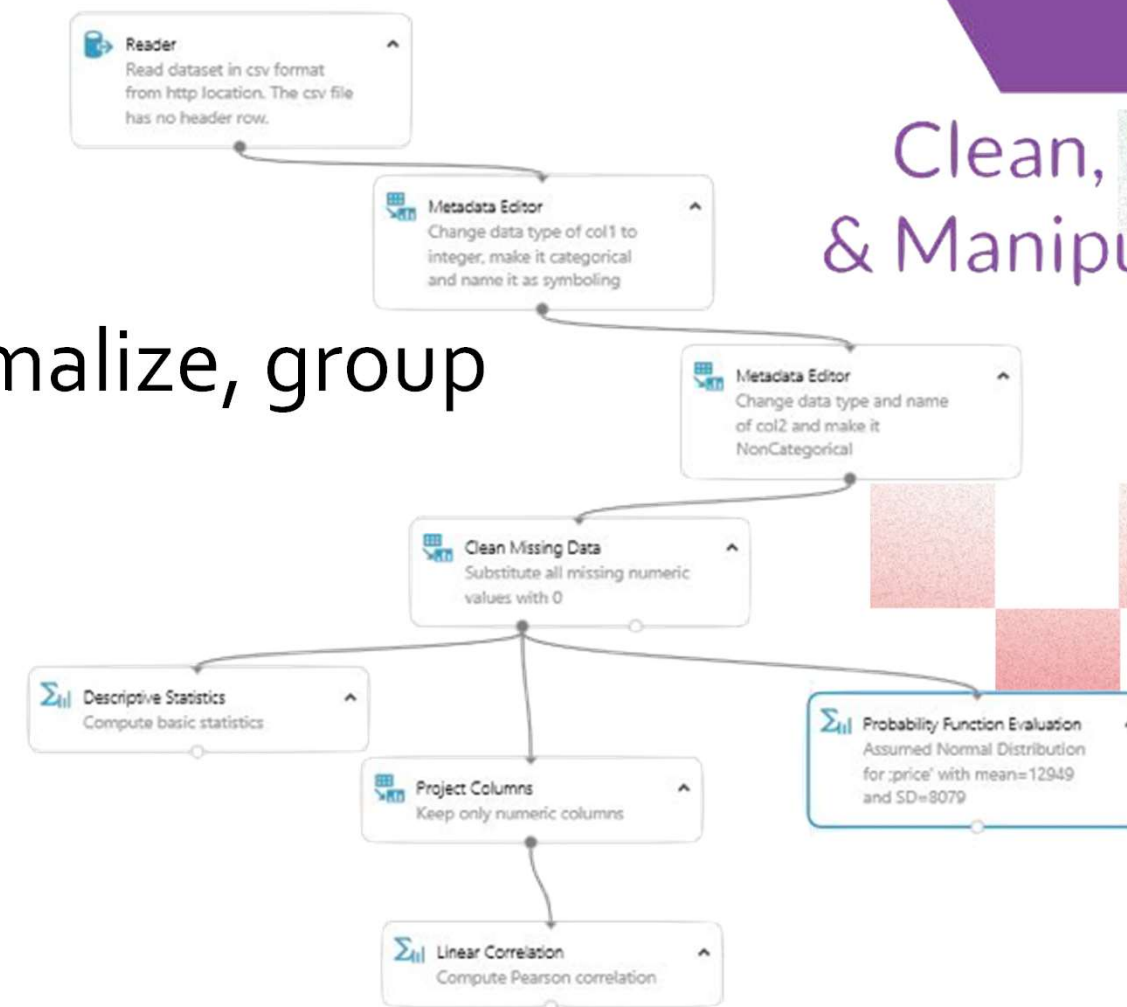
# Step 3

## Import Data

- Storages: SQL, Azure HD, Azure Blob & Tables
- IDE: Jupiter Notebook, VS Code
- Services: Azure ML Studio

## Transform data

- Add missing values, clear, normalize, group
- Choose and generate features
- Change data types



Clean, Prepare  
& Manipulate Data



# Azure Machine Learning Studio

Simple, scalable, cutting edge

Welcome to Machine Learning Studio, the Azure Machine Learning solution you've grown to love. Machine Learning Studio is a powerfully simple browser-based, visual drag-and-drop authoring environment where no coding is necessary. Go from idea to deployment in a matter of clicks.

Get started now >



<https://azure.microsoft.com/en-us/services/machine-learning-studio/>

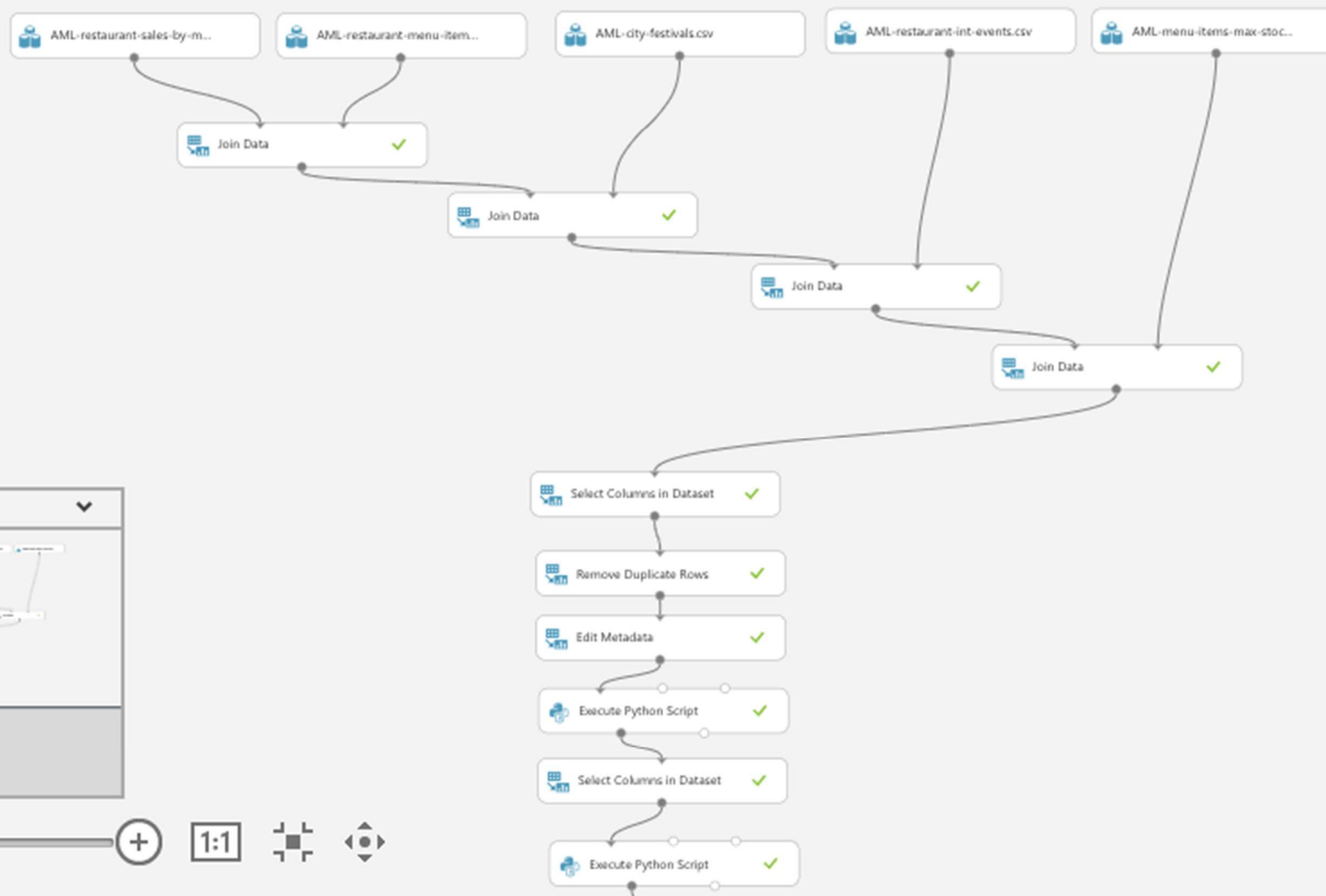




Demo



# [D-AML-01] Restaurant-menu-items-sales-prediction [Prepare-data]

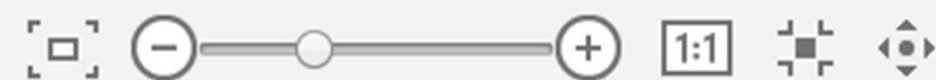
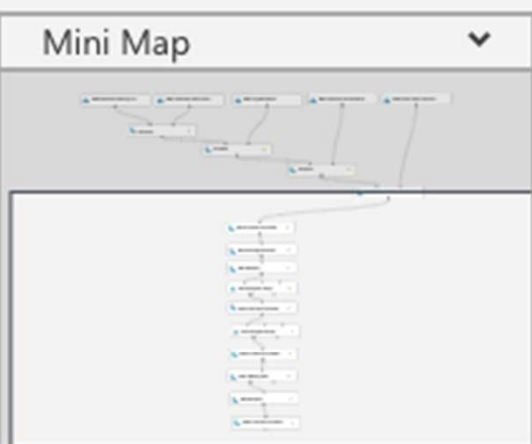




# [D-AML-01] Restaurant-menu-items-sales-prediction [Prepare-data]

Finished running ✓

Draft saved at 00:28:43



## [D-AML-01] Restaurant-menu-items-sales-prediction [Prepare-data]

[D-AML-01] Restaurant-menu-items-sales-pred... ▶ Select Columns in Dataset ▶ Results dataset

rows columns

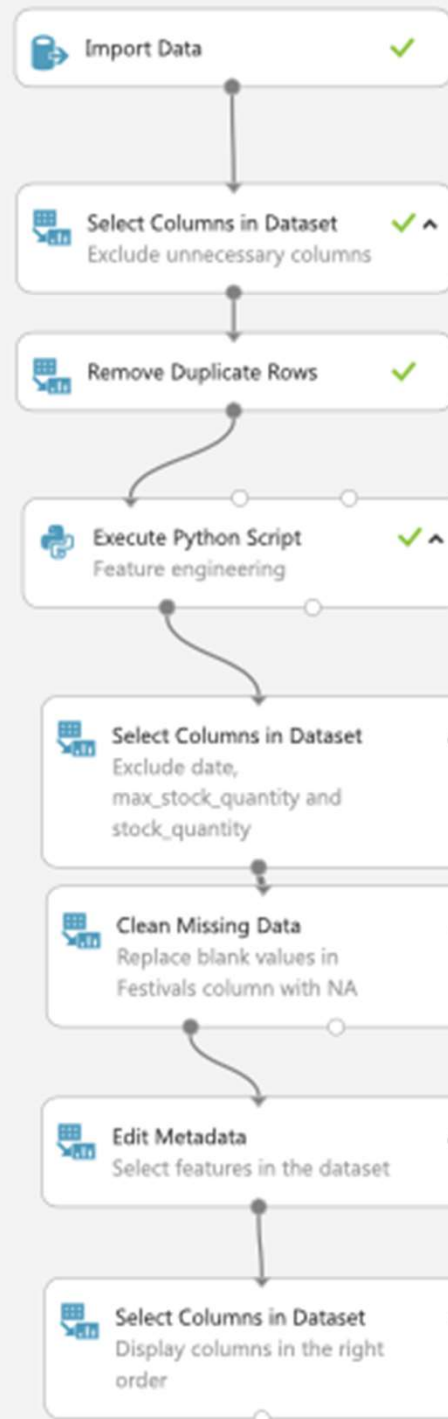
38325 12

menu_item_id	in_children_menu	day	month	day_of_week	fest_name	Children_Event	Music_Event	max_stock_quantity	stock_count	go_list	orders
33	0	23	9	7	NA	0	0	158	47	0	47
14	1	23	9	7	NA	0	0	113	158	1	158
3	0	23	9	7	NA	0	0	172	138	0	82
12	1	23	9	7	NA	0	0	116	46	0	46
24	0	23	9	7	NA	0	0	67	74	1	74
18	1	23	9	7	NA	0	0	189	208	1	197
11	1	23	9	7	NA	0	0	64	77	1	77
5	0	23	9	7	NA	0	0	167	100	0	77
29	1	23	9	7	NA	0	0	131	65	0	65
22	0	23	9	7	NA	0	0	81	81	0	78
9	0	23	9	7	NA	0	0	127	178	1	121
8	0	23	9	7	NA	0	0	66	73	1	73

# NAVTechDays Workshop

In draft

Draft saved at 2:26:10 PM



Properties Project

## Experiment Properties

START TIME	11/12/2018...
END TIME	11/12/2018...
STATUS CODE	InDraft
STATUS DETAILS	None

[Prior Run](#)

## Summary

Enter a few sentences describing your experiment (up to 140 characters).

## Description

Enter the detailed description for your experiment.

## Quick Help

Identifies the features in a dataset with the greatest predictive power  
([more help...](#))



# Step 4

Divide data

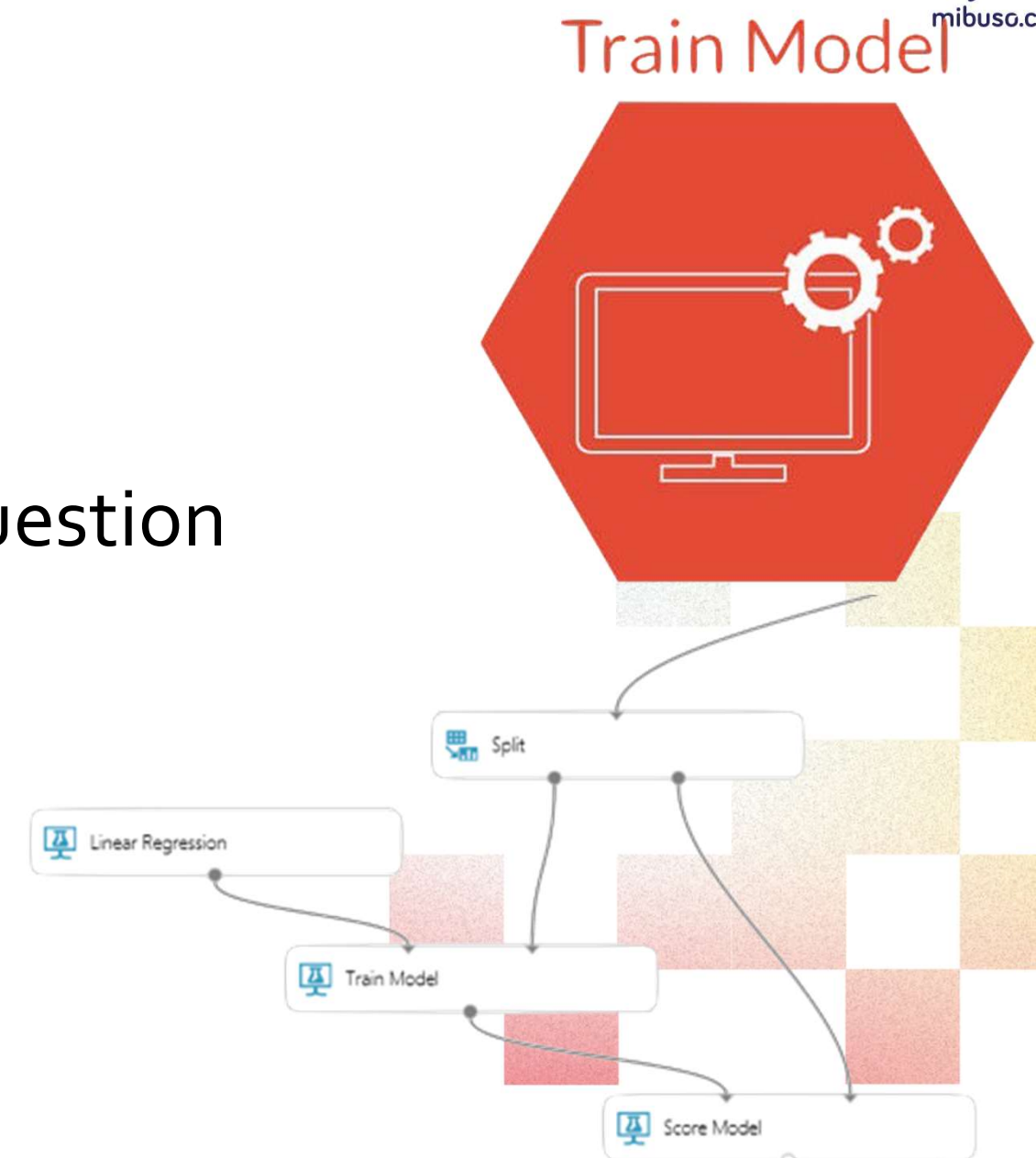
- Training sample, Evaluation sample

Training

- Choose an ML algorithm according to a question

Model types

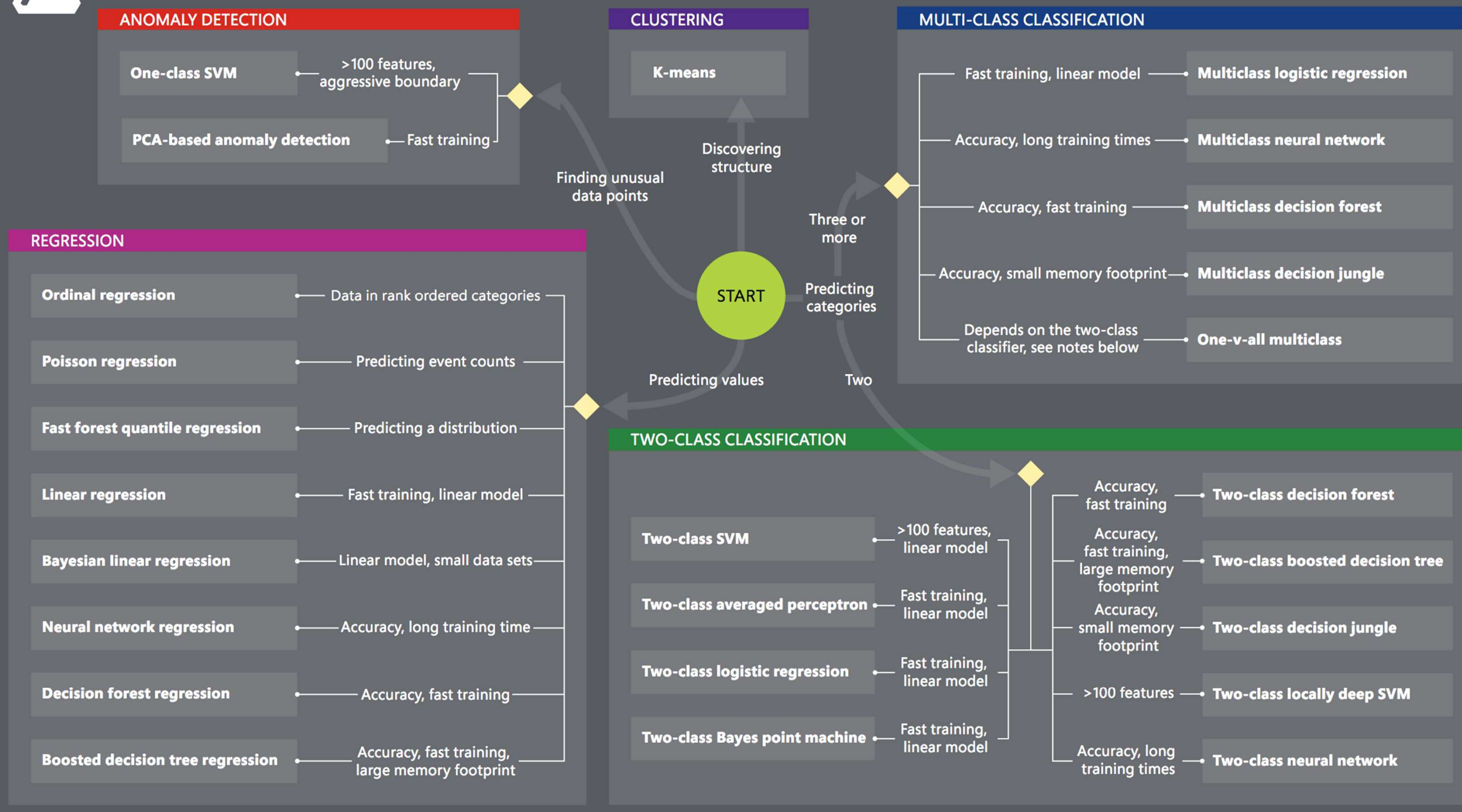
- Regression (When, How much?)
- Classification (Will be or not, Where?)
- Clustering (How this is organized?)
- Anomaly detection (Find anomaly?)





# Microsoft Azure Machine Learning: Algorithm Cheat Sheet

This cheat sheet helps you choose the best Azure Machine Learning Studio algorithm for your predictive analytics solution. Your decision is driven by both the nature of your data and the question you're trying to answer.



# Regression model

Goal: Function  $f$  applied to training data should produce values as close as possible in aggregate to actual outputs



# Regression model

Goal: Function  $f$  applied to training data should produce values as close as possible in aggregate to actual outputs

## Training Data

$w_1, x_1, y_1, z_1 \rightarrow o_1$   
 $w_2, x_2, y_2, z_2 \rightarrow o_2$   
 $w_3, x_3, y_3, z_3 \rightarrow o_3$   
 .....

## Learning function

$$f(w, x, y, z) = o$$

## Prediction

$$\begin{aligned}
 f(w_1, x_1, y_1, z_1) &= o_1' \\
 f(w_2, x_2, y_2, z_2) &= o_2' \\
 f(w_3, x_3, y_3, z_3) &= o_3'
 \end{aligned}$$

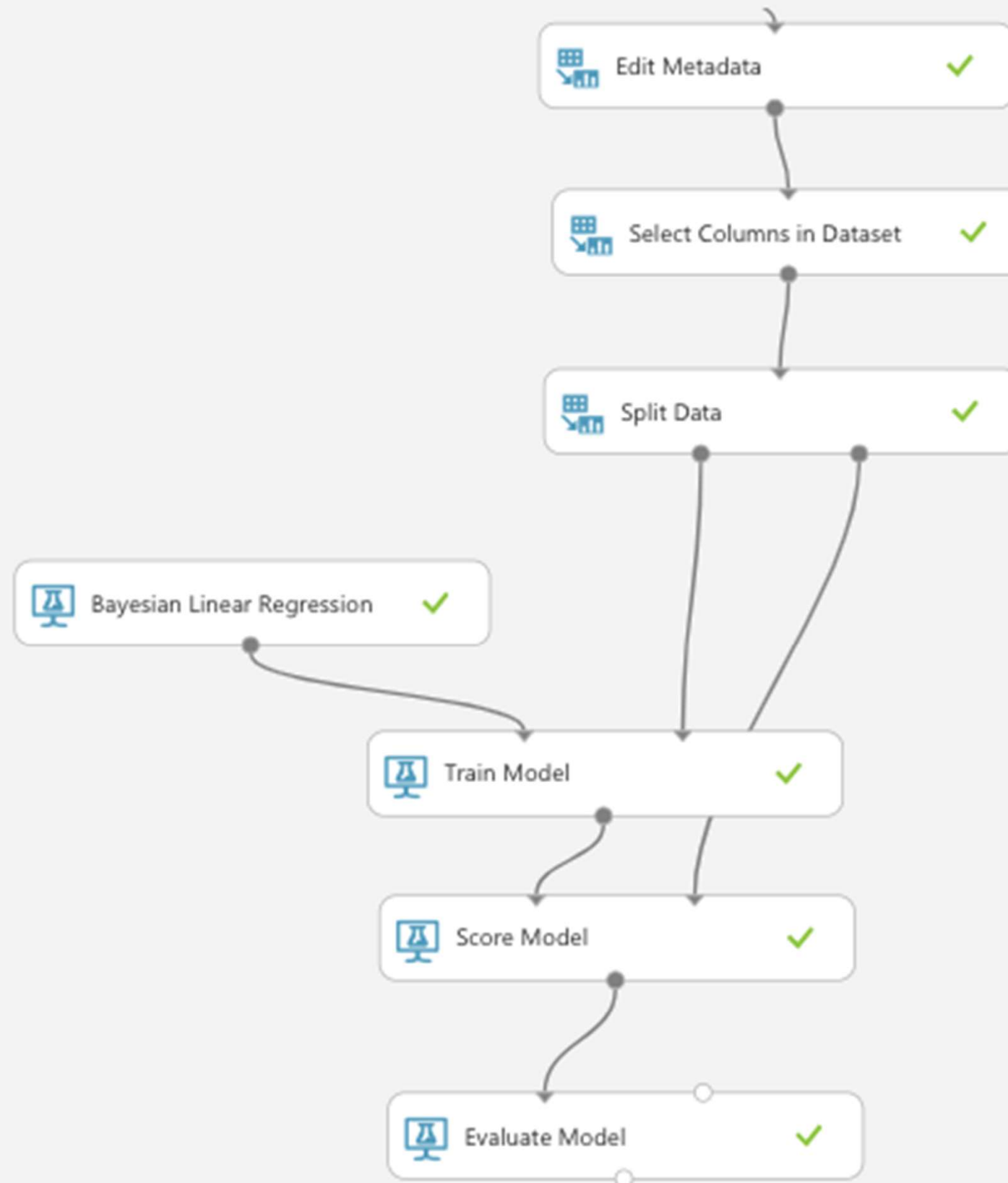


Demo



# [D-AML-02] Restaurant-menu-items-sales-prediction [T...

In draft

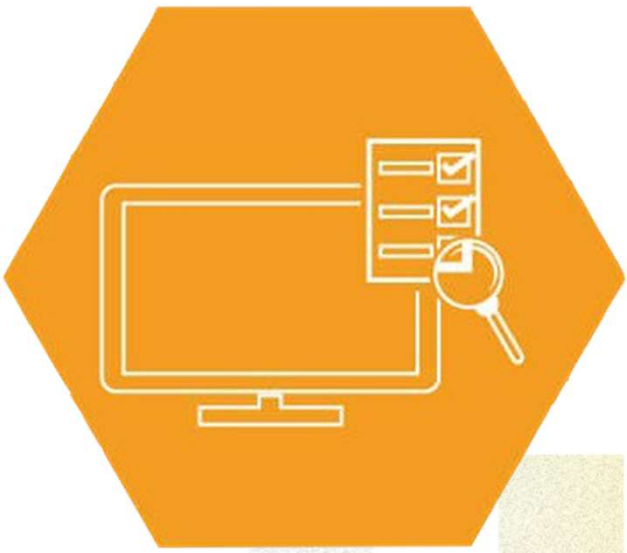
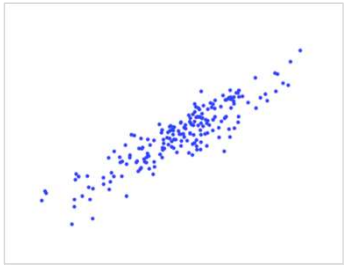
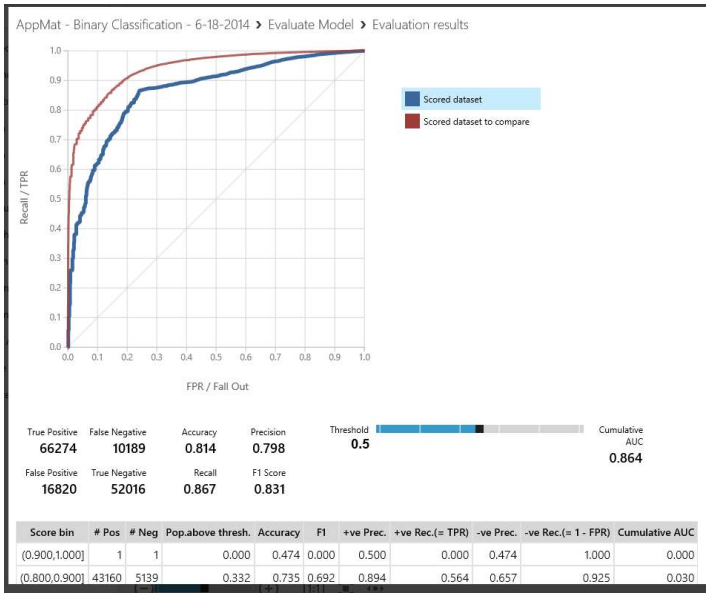




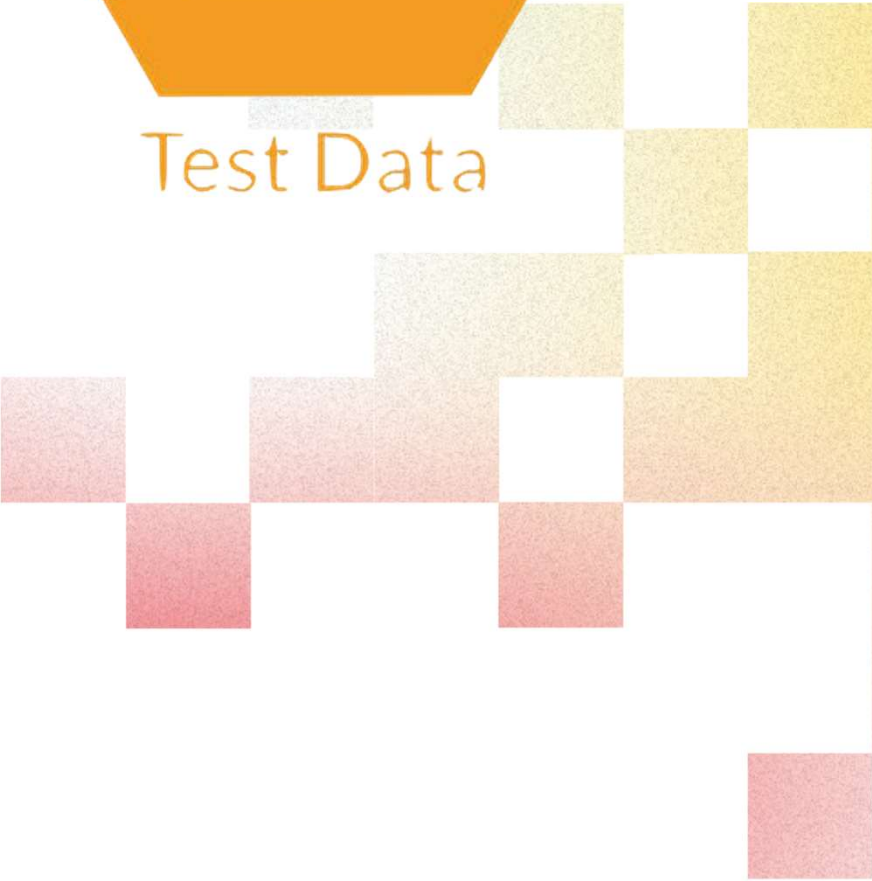
# Step 5

- Use evaluation sample
- Check on visual graphs

• Check Accuracy =  $\frac{\text{Number of correct prediction}}{\text{Total Number of predictions}}$



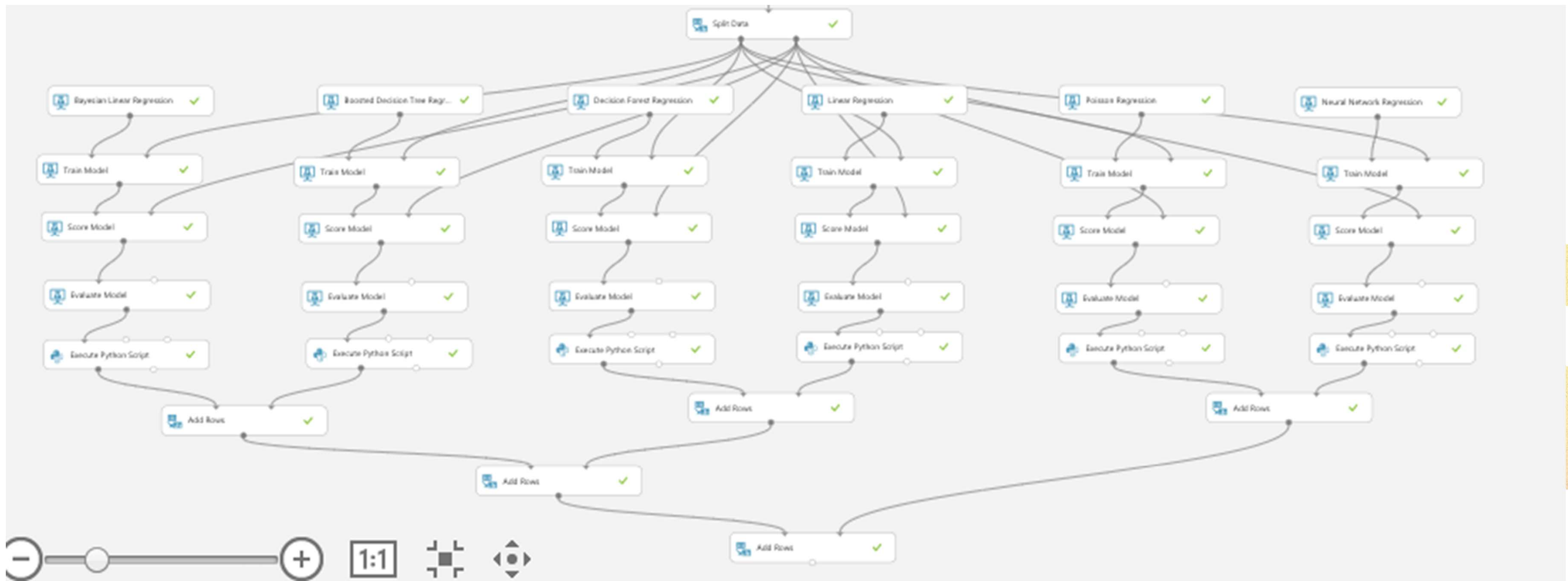
Test Data





# Demo







[D-AML-02] Restaurant-menu-items-sales-pred... > Add Rows > Results dataset

rows  
6

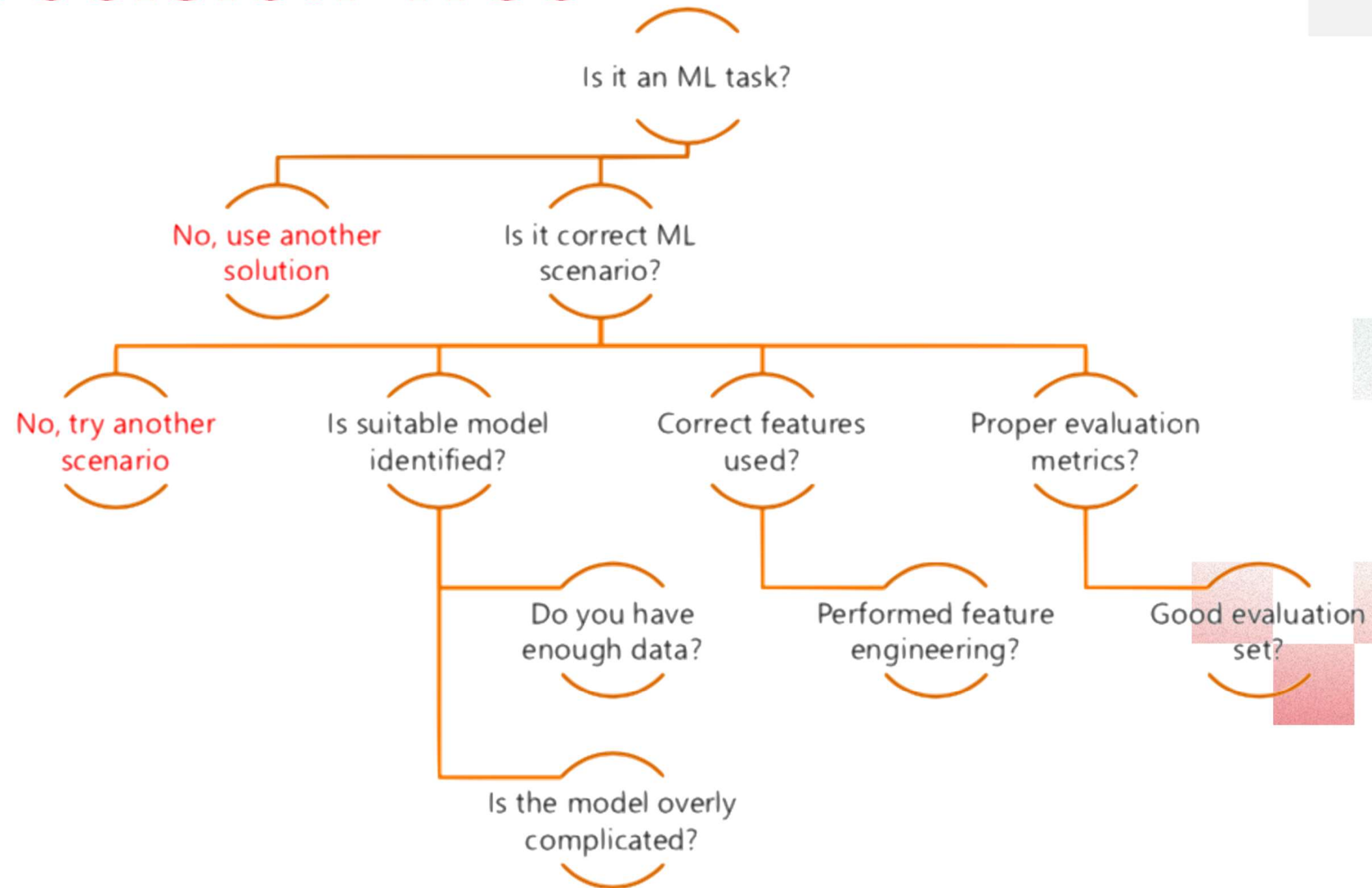
columns  
6

view as

Algorithm	Mean Absolute Error	Root Mean Squared Error	Relative Absolute Error	Relative Squared Error	Coefficient of Determination
Bayesian Linear Regression	15.058801	20.87807	0.473592	0.25391	0.74609
Boosted Decision Tree Regression	10.819085	18.16292	0.340255	0.192163	0.807837
Decision Forest Regression	11.193705	19.433286	0.352037	0.219984	0.780016
Linear Regression	15.059214	20.878245	0.473605	0.253914	0.746086
Poisson Regression	15.933943	21.400145	0.501115	0.266767	0.733233
Neural Network Regression	13.373381	19.519155	0.420586	0.221933	0.778067

Statistics and Visualizations

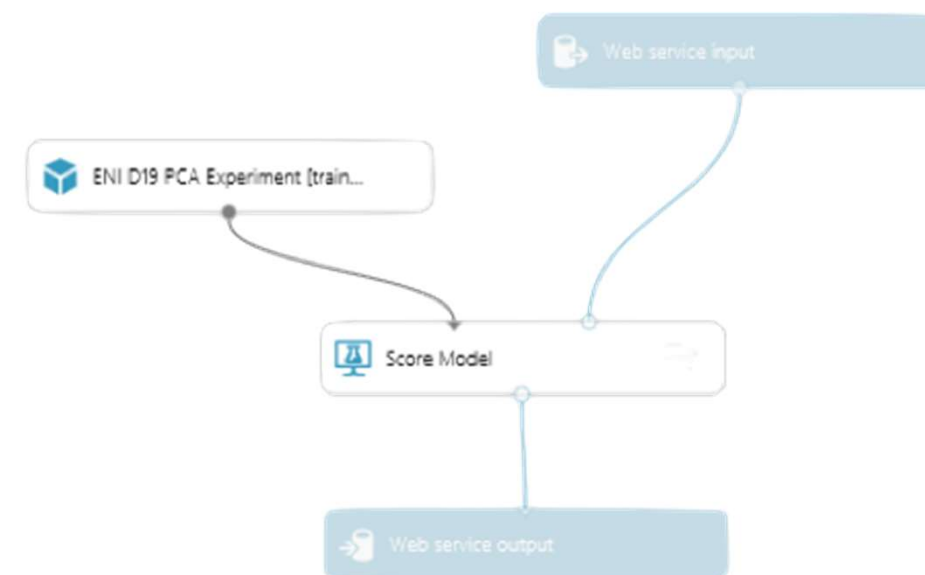
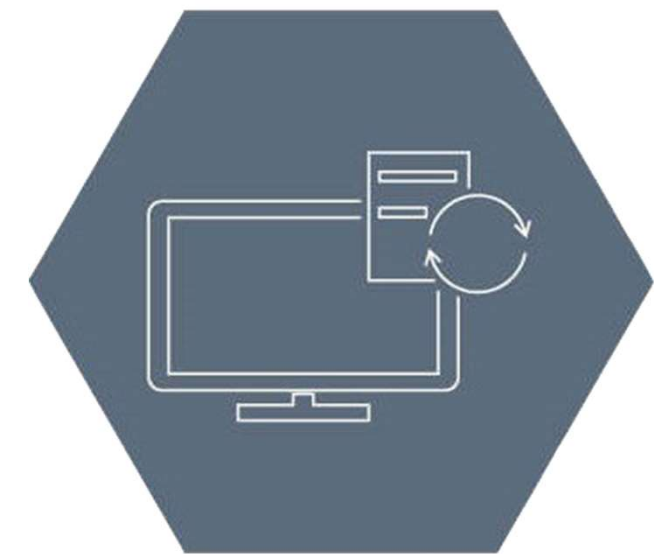
# ML Decision Tree



# Step 6

- Prepare Scoring experiment
- Publish as a web service
- Publish on Azure Marketplace (optional)

Publish







Demo

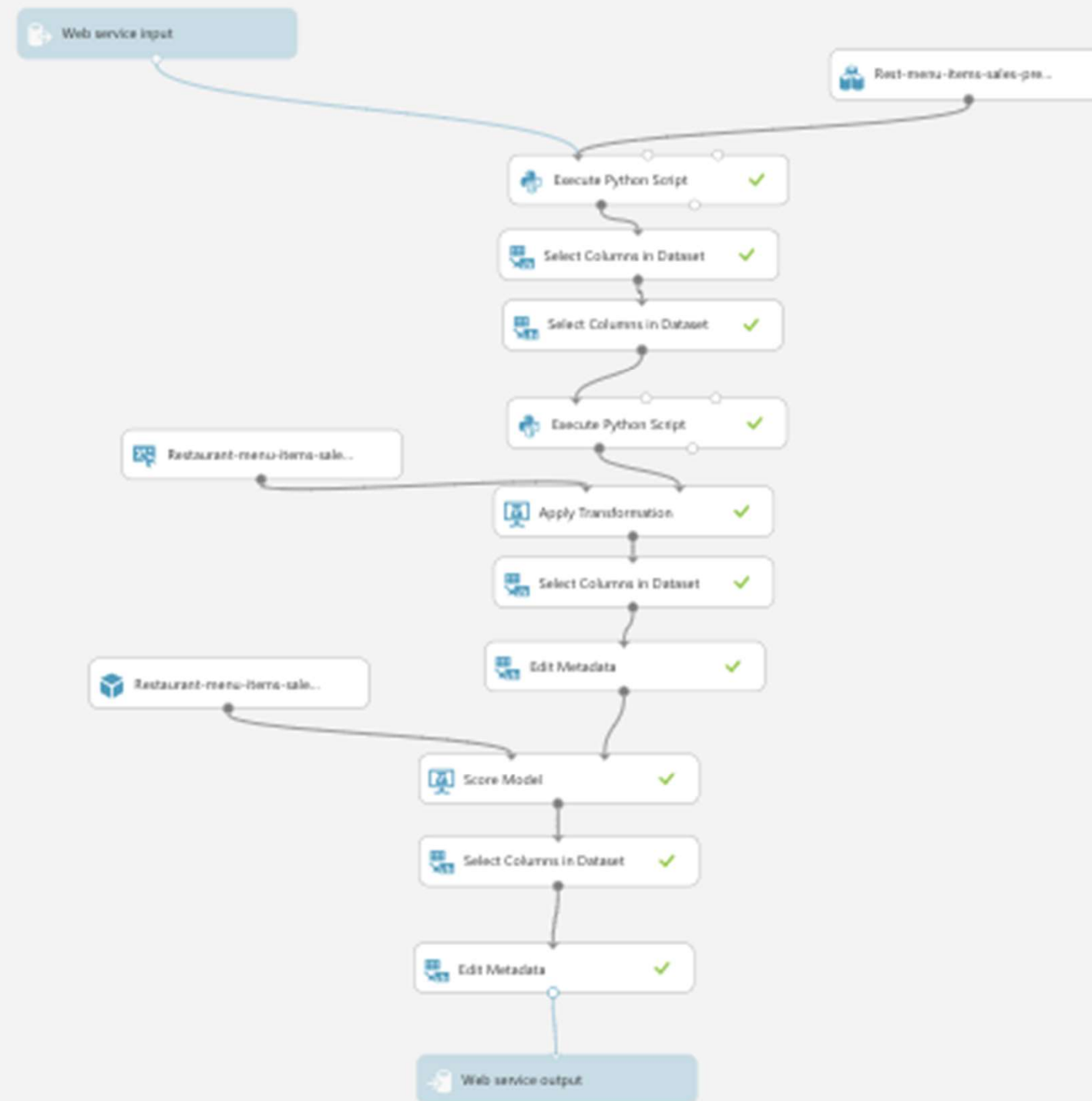


# [D-AML-04] Restaurant-menu-items-sales-prediction [...]

Finished running ✓

NAV  
TECH  
DAYS  
2018

mibuso.com



# Step 7

- Consume ML Web Service
  - From anywhere using REST API
  - From R, Python using packages
  - From Excel, Power BI using plugins
  - From AL using Azure ML Connector codeunit



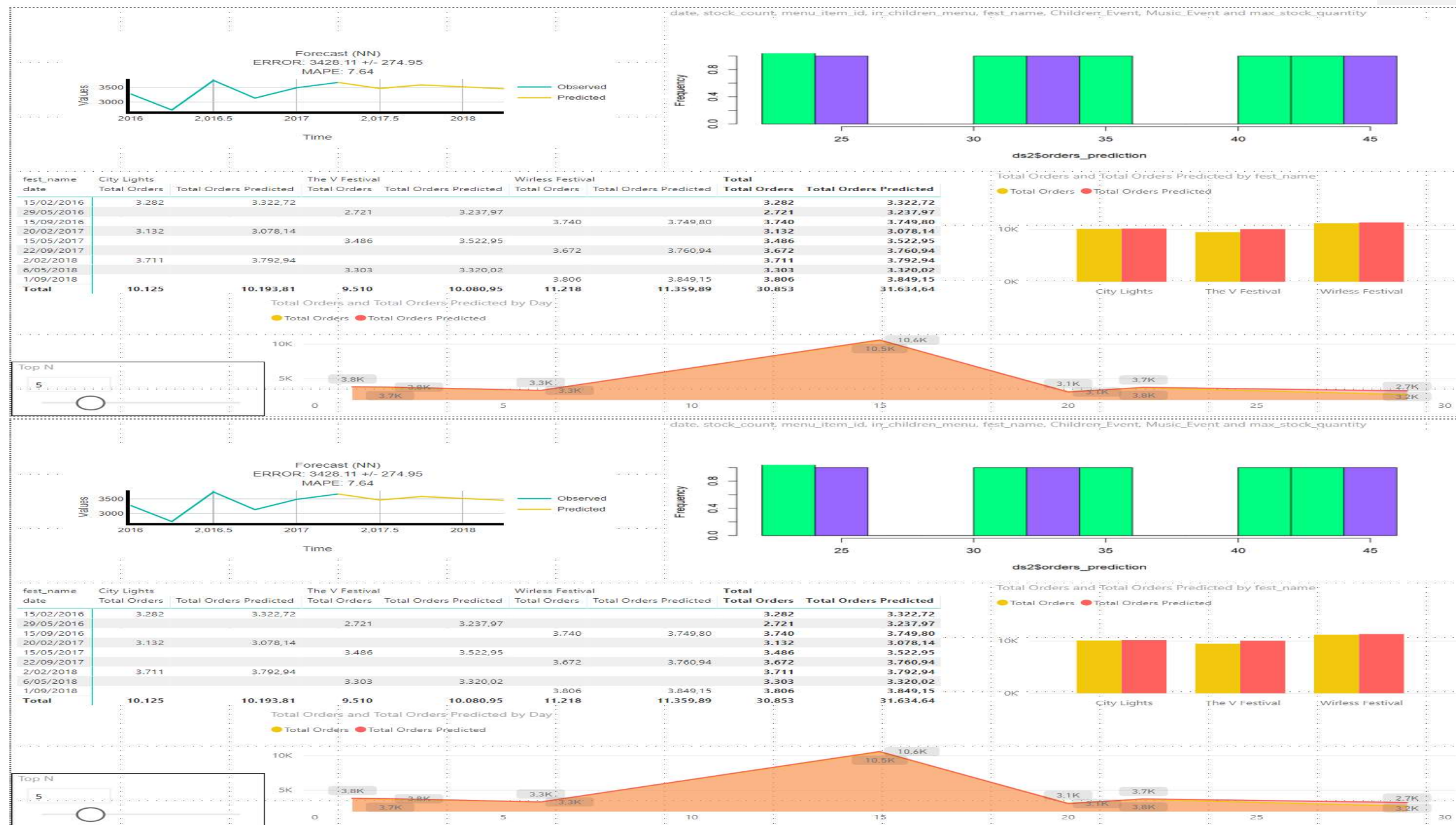




Demo



# Consume Azure ML from Power BI





# Consume Azure ML from Power BI

```
# Set Settings
wsid = "054bd4f47005426fbb76455717ea8513"
auth = "dgHPQ50js93EYQyUnKD7fAi6BFtppQeFMzdHrUz1d1tc4DG+QzHXpxnMxDsHX1z2HNtqBMej0lJC55DpNEjMkQ=="
serviceName = "Restaurant-menu-items-sales-prediction - Final [Predictive Exp.]"

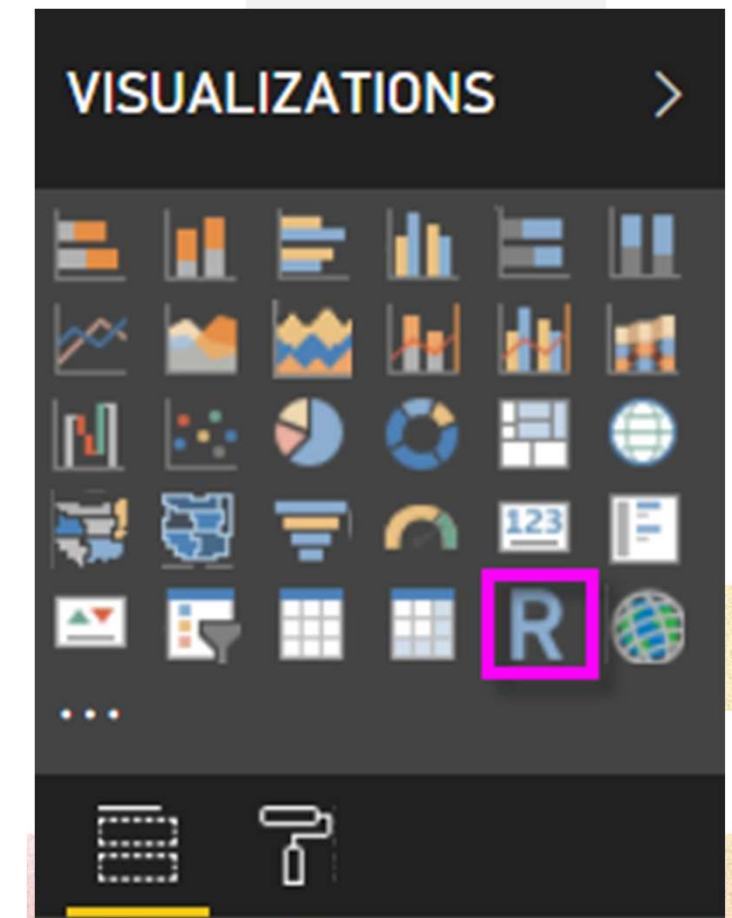
# Use the AzureML Library
library("AzureML")

# Get a Sample for Testing
datasetsample <- head(dataset)

# Convert Datatypes
datasetsample$in_children_menu <- as.numeric(datasetsample$in_children_menu)
datasetsample$Children_Event <- as.numeric(datasetsample$Children_Event)
datasetsample$Music_Event <- as.numeric(datasetsample$Music_Event)

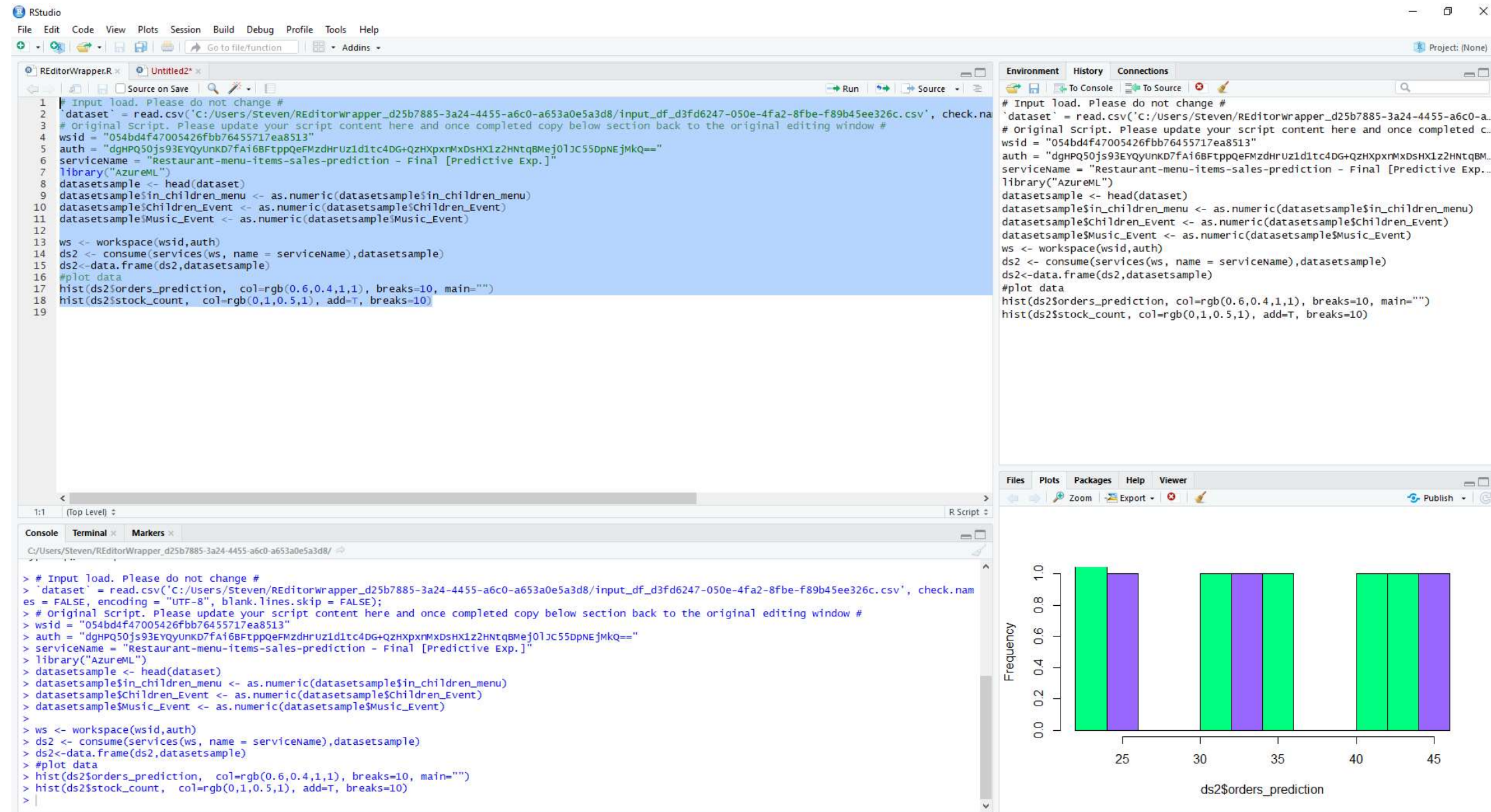
# Call the AML Webservice
ws <- workspace(wsid,auth)
ds2 <- consume(services(ws, name = serviceName),datasetsample)
ds2<-data.frame(ds2,datasetsample)

# Plot data
hist(ds2$orders_prediction, col=rgb(0.6,0.4,1,1), breaks=10, main="")
hist(ds2$stock_count, col=rgb(0,1,0.5,1), add=T, breaks=10)
```





# Consume Azure ML from Power BI



# Consume Azure ML from Power BI



THE R GRAPH  
GALLERY



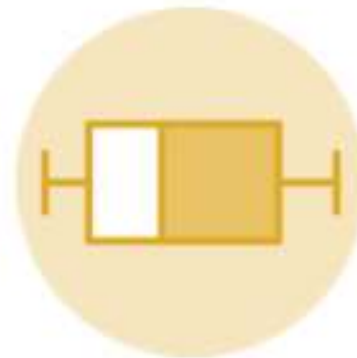
Violin



Density



Histogram



Boxplot



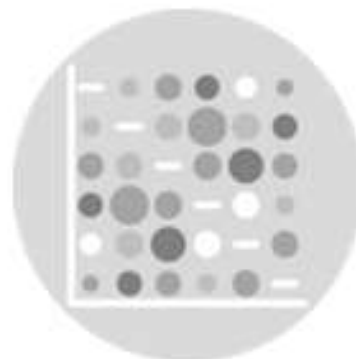
Ridgeline / Joyplot



Scatter



Heatmap



Correlogram



Bubble



Connected Scatter

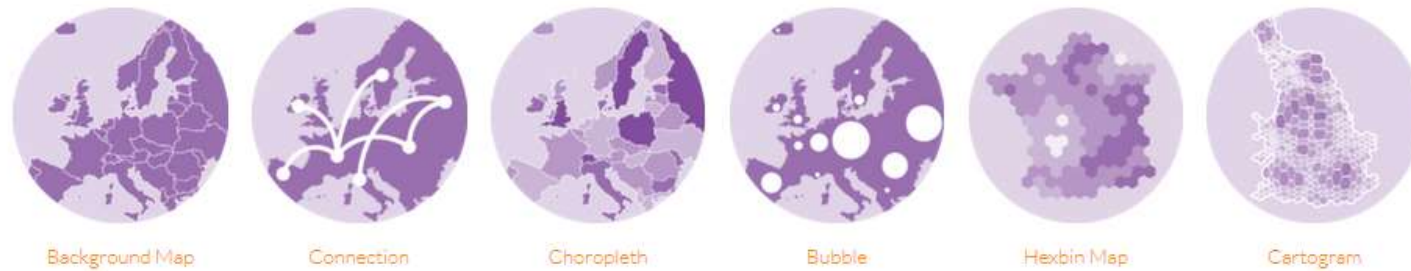


Density 2D

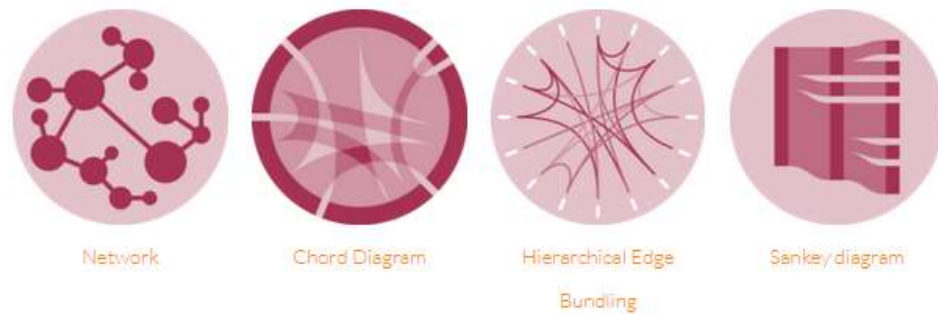


# Consume Azure ML from Power BI

## Maps



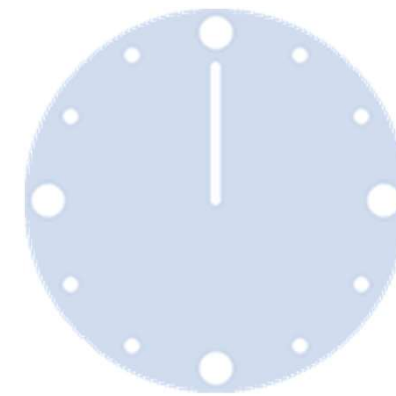
## Flow



## Other



<https://www.r-graph-gallery.com/>





# Consume Azure ML from Power BI

The screenshot shows the Power BI Desktop interface. The 'Transform' ribbon is selected, and the 'Run R script' button is highlighted with a red circle and an arrow. The main view displays a table with columns: date, menu\_item\_id, and fest\_name. The table contains 17 rows of data. The 'Queries' pane on the left shows the query 'AML-Predictions-Festivals'. The 'QUERY SETTINGS' pane on the right shows the 'APPLIED STEPS' list, which includes 'Run R script' and 'Changed Type1'.

	1.2 orders_prediction	date	menu_item_id	fest_name
1	213,3688507	1/09/2018 0:00:00	4467	Wirless Festival
2	105,4646378	1/09/2018 0:00:00	4472	Wirless Festival
3	200,1551361	1/09/2018 0:00:00	4473	Wirless Festival
4	146,8022461	1/09/2018 0:00:00	4474	Wirless Festival
5	91,94428253	1/09/2018 0:00:00	4484	Wirless Festival
6	209,8958893	1/09/2018 0:00:00	4485	Wirless Festival
7	57,82087326	1/09/2018 0:00:00	4486	Wirless Festival
8	221,8015594	1/09/2018 0:00:00	4493	Wirless Festival
9	149,4232788	1/09/2018 0:00:00	4499	Wirless Festival
10	56,11826706	1/09/2018 0:00:00	4505	Wirless Festival
11	60,28847504	1/09/2018 0:00:00	4512	Wirless Festival
12	45,93160629	1/09/2018 0:00:00	4515	Wirless Festival
13	133,2379456	1/09/2018 0:00:00	4520	Wirless Festival
14	112,7109451	1/09/2018 0:00:00	4528	Wirless Festival
15	127,53759	1/09/2018 0:00:00	4545	Wirless Festival
16	163,6149292	1/09/2018 0:00:00	4553	Wirless Festival
17	81,71969604	1/09/2018 0:00:00	4569	Wirless Festival

# Consume Azure ML from Power BI

## Run R script

Enter R scripts into the editor to transform and shape your data.

Script

```
# 'dataset' holds the input data for this script
wsid = "054bd4f47005426fbb76455717ea8513"
auth = "dgHPQ50js93EYQyUnKD7fAi6BFtppQeFMzdHrUz1d1tc4DG+QzHXpxnMxDsHX1z2HntqBMej01JC55DpNEjMk0"
serviceName = "Restaurant-menu-items-sales-prediction - Final [Predictive Exp.]"
library("AzureML")
#dataset sample <- head(dataset)
dataset sample <- dataset
dataset sample $in_children_menu <- as.numeric(dataset sample $in_children_menu)
dataset sample $Children_Event <- as.numeric(dataset sample $Children_Event)
dataset sample $Music_Event <- as.numeric(dataset sample $Music_Event)

ws <- workspace(wsid,auth)
```

The script will run with the following R installation C:\Program Files\R\R-3.5.1.

To configure your settings and change which R installation you want to run, go to Options and settings.

OK

Cancel



# Consume Azure ML from Power BI

AML-Predictions-Festivals

Display Options ?

```
let
    Source = Csv.Document(File.Contents("G:\Menu Items Forecasting\restaurant-sales-by-menu-item (1).csv"),[Delimiter=";", Columns=14, Encoding=1252, QuoteStyle=QuoteStyle.None]),
    #"Promoted Headers" = Table.PromoteHeaders(Source, [PromoteAllScalars=true]),
    #"Renamed Columns" = Table.RenameColumns(#"Promoted Headers",{{"", "menu_item_id"}}),
    #"Removed Columns" = Table.RemoveColumns(#"Renamed Columns",{"names_list"}),
    #"Renamed Columns1" = Table.RenameColumns(#"Removed Columns",{{"children_menu", "in_children_menu"}}),
    #"Removed Columns1" = Table.RemoveColumns(#"Renamed Columns1",{"month", "year", "day", "day_of_week", "orders"}),
    #"Reordered Columns" = Table.ReorderColumns(#"Removed Columns1",{"date", "stock_count", "menu_item_id", "in_children_menu", "fest_name", "Children_Event", "Music_Event", "max_stock_quantity"}),
    ,
    #"Changed Type" = Table.TransformColumnTypes(#"Reordered Columns",{{"date", type datetime}}),
    #"Filtered Rows" = Table.SelectRows(#"Changed Type", each [fest_name] <> null and [fest_name] <> ""),
    #"Run R script" = R.Execute("# 'dataset' holds the input data for this script#\nwsid = ""054bd4f47005426fbb76455717ea8513""#\nauth = ""dgHPQ50js93EYQyUnKD7fAi6BFtpqQeFMzdHrUz1d1tc4DG+QzHXpxnMxDsHX1z2HNTqBMej0lJC55DpNEjMkQ==""#\nserviceName = ""Restaurant-menu-items-sales-prediction - Final [Predictive Exp.]""#\nlibrary(""AzureML"")#\ndatetsample <- head(dataset)#(1f) datetsample <- dataset#\ndatetsample$in_children_menu <- as.numeric(datetsample$in_children_menu)#(1f) datetsample$Children_Event <- as.numeric(datetsample$Children_Event)#(1f) datetsample$Music_Event <- as.numeric(datetsample$Music_Event)#(1f)#(1f)ws <- workspace(wsid,auth)#(1f)ds2 <- consume(services(ws, name = serviceName),datetsample)#(1f)ds2<-data.frame(ds2, datetsample)",[dataset="#Filtered Rows"]),
    ds2 = #"Run R script"{{Name="ds2"}}[Value],
    #"Removed Other Columns" = Table.SelectColumns(ds2,{"orders_prediction", "date", "menu_item_id", "fest_name"}),
    #"Changed Type1" = Table.TransformColumnTypes(#"Removed Other Columns",{{"date", type datetime}}),
in
    #"Changed Type1"
```

✓ No syntax errors have been detected.

Done Cancel



# Consume Azure ML from Power BI

```
# 'dataset' holds the input data for this script
wsid = "054bd4f47005426fbb76455717ea8513"
auth = "dgHPQ50js93EYQyUnKD7fAi6BFtppQeFMzdHrUz1d1tc4DG+QzHXpxnMxDsHX1z2HNtqBMej0lJC55DpNEjMkQ=="
serviceName = "Restaurant-menu-items-sales-prediction - Final [Predictive Exp.]"

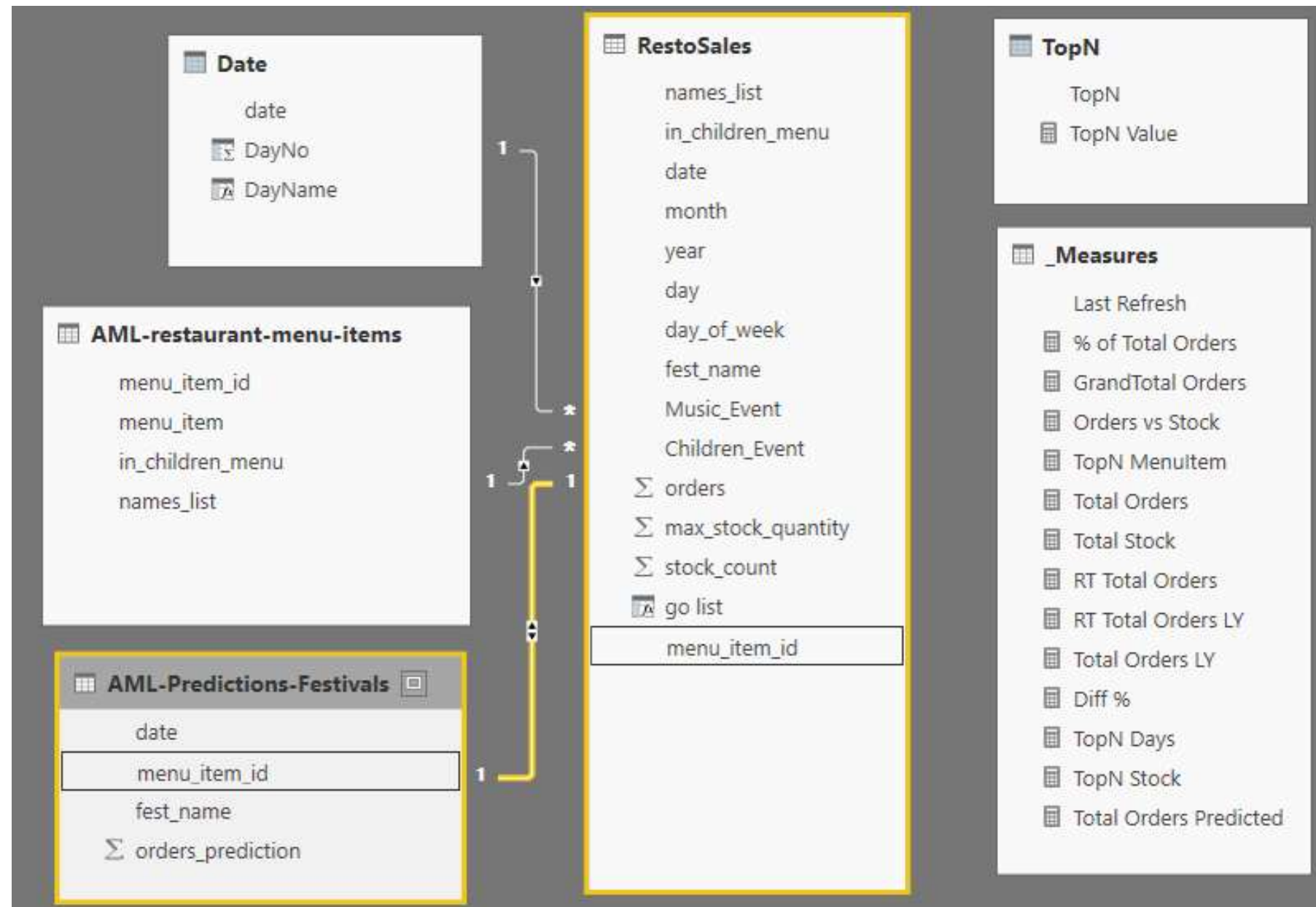
# Use AzureML Library
library("AzureML")

# Convert Dataset Datatypes
datasetsample <- dataset
datasetsample$in_children_menu <- as.numeric(datasetsample$in_children_menu)
datasetsample$Children_Event <- as.numeric(datasetsample$Children_Event)
datasetsample$Music_Event <- as.numeric(datasetsample$Music_Event)

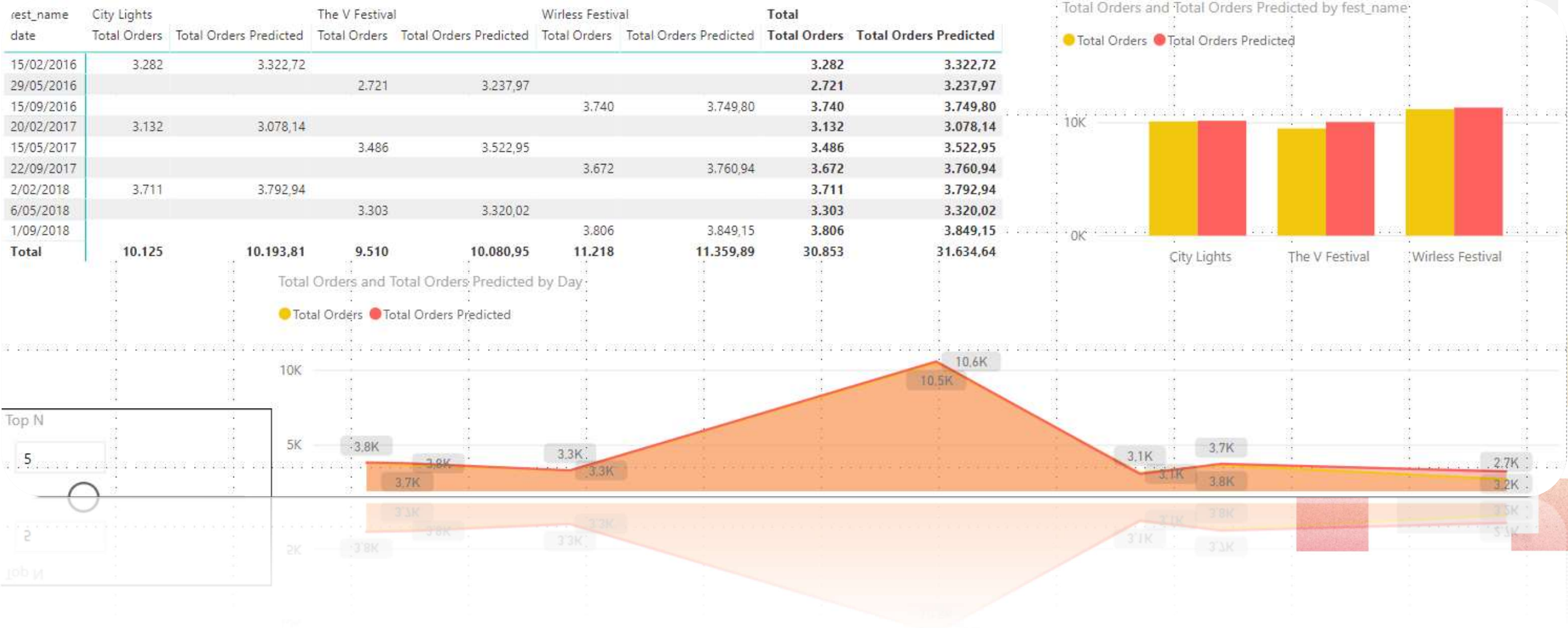
# Call AzureML Webservice
ws <- workspace(wsid,auth)
ds2 <- consume(services(ws, name = serviceName),datasetsample)

# Return Data & Predictions
ds2<-data.frame(ds2,datasetsample)
```

# Consume Azure ML from Power BI



# Consume Azure ML from Power BI





# Consume Azure ML from AL

- Codeunit 2001 "Azure ML Connector"
- Set connection URI and API Key
- Set Input and Output name for dataset
- Set input column names
- Add input values
- Send Request
- Receive Response
- Use result

```
codeunit 50103 "Prediction Codeunit"
{
    0 references
    procedure Predict() PredictionOfWatches :Text;
    var
        AzureMLConnector : Codeunit "Azure ML Connector";
    begin
        AzureMLConnector.Initialize(
            '/4xamOeu5b4JvhH0ThYNssIt5I1h5PkbPte0qzFDVqjms2U2KaB9Utxcq5ToH',
            'https://europewest.services.azureml.net/subscriptions/d0e75c330');
        AzureMLConnector.SetInputName('input1');
        AzureMLConnector.SetOutputName('output1');

        AzureMLConnector.AddInputColumnName('Category');
        AzureMLConnector.AddInputColumnName('Auditory size');

        AzureMLConnector.AddInputRow();
        AzureMLConnector.AddInputValue('Developers');
        AzureMLConnector.AddInputValue('Wide');

        AzureMLConnector.SendToAzureML(false);

        IF AzureMLConnector.GetOutput(1,1,PredictionOfWatches) then
            Exit(PredictionOfWatches);

        Exit('0');
    end;
```



Demo





# Machine Learning. Where to start?

- To build your ML  
<https://studio.azureml.net>
- AI  
<https://azure.microsoft.com/en-us/overview/ai-platform/>
- Education  
<https://github.com/Azure-Readiness/hol-azure-machine-learning>  
<https://docs.microsoft.com/en-us/azure/machine-learning/>
- Courses  
<https://developers.google.com/machine-learning/crash-course/>  
<https://academy.microsoft.com/en-us/professional-program/tracks/artificial-intelligence/>
- Ready examples  
<https://gallery.azure.ai>





## AI, ML, Insights, Cognitive Services

It became self  
aware at  
2:14 am EST...

In a panic,  
they tried to  
pull the plug,  
but it was  
too late...

# A year later...

artificial intelligence will|



artificial intelligence will **change the future**  
artificial intelligence will **change the world**  
artificial intelligence will **redefine management**  
artificial intelligence will **change everything**  
artificial intelligence will **replace**  
artificial intelligence will **reshape the global order**  
artificial intelligence will **revolutionize our lives**  
artificial intelligence will **affect jobs**  
artificial intelligence will **affect our lives**

Google Search

I'm Feeling Lucky

“

We all die twice in our life, the first time is when we stop learning, the second time is just a formality

”

Marko Perisic

# Contacts



Dmitry Katson, MVP

[Dmitry.Katson@gmail.com](mailto:Dmitry.Katson@gmail.com)

<https://www.linkedin.com/in/dmitry-katson/>

@DmitryKatson



Steven Renders, MVP

[Steven.Renders@Plataan.be](mailto:Steven.Renders@Plataan.be)

[www.Plataan.tv](http://www.Plataan.tv)

@srenders





**Any Questions?**

Thank  
**THANK YOU**  
you