



# Az COMMUNITY

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#AzConfDev



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Cloud Architect, Harman International



# Applying Data Science and Machine Learning Using Microsoft .Net

Praveen Raghuvanshi

# Acknowledgements



- Dataset – [John Hopkins University CSSE](#)
- Python Visualization – [Akshay Sb](#)
- Organizers – AzConf 2022
- Sponsors

# Identify Language



**Maidin mhaith**

**Guten Morgen**

おはよ ございます

शुभ प्रभात

**Good Morning**

# Programming Languages



# Data Science – Exploratory Data Analysis(EDA)

## As per Wiki...

*"In statistics, exploratory data analysis (EDA) is an approach of analyzing data sets to summarize their main characteristics, often with visual methods."*

- Buy a House
  - No of bedrooms
  - Type (Apartment, Villa)
  - Locality
  - Crime Rate



# EDA Datastructure : DataFrame

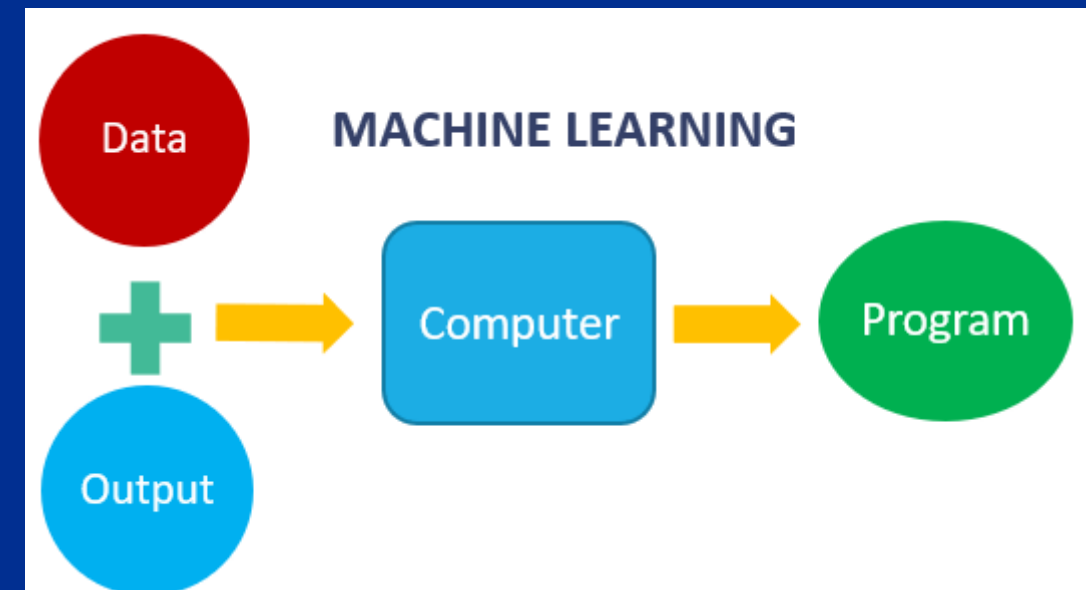
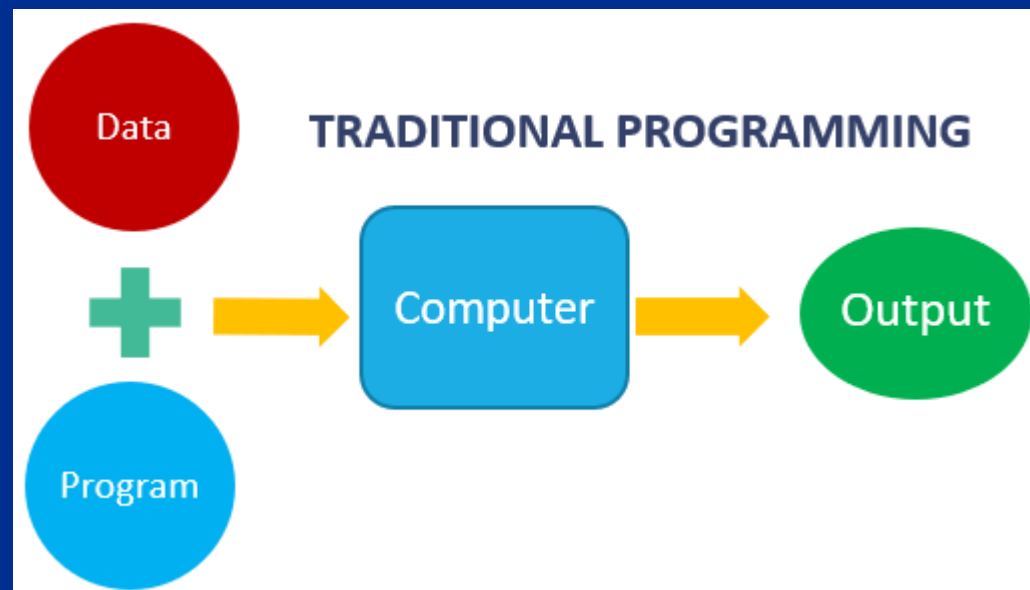
	NAME	AGE	DESIGNATION
1	a	20	VP
2	b	27	CEO
3	c	35	CFO
4	d	55	VP
5	e	18	VP
6	f	21	CEO
7	g	35	MD

	age	designation	name
0	20	VP	a
1	27	CEO	b
2	35	CFO	c
3	55	VP	d
4	18	VP	e
5	21	CEO	f
6	35	MD	g

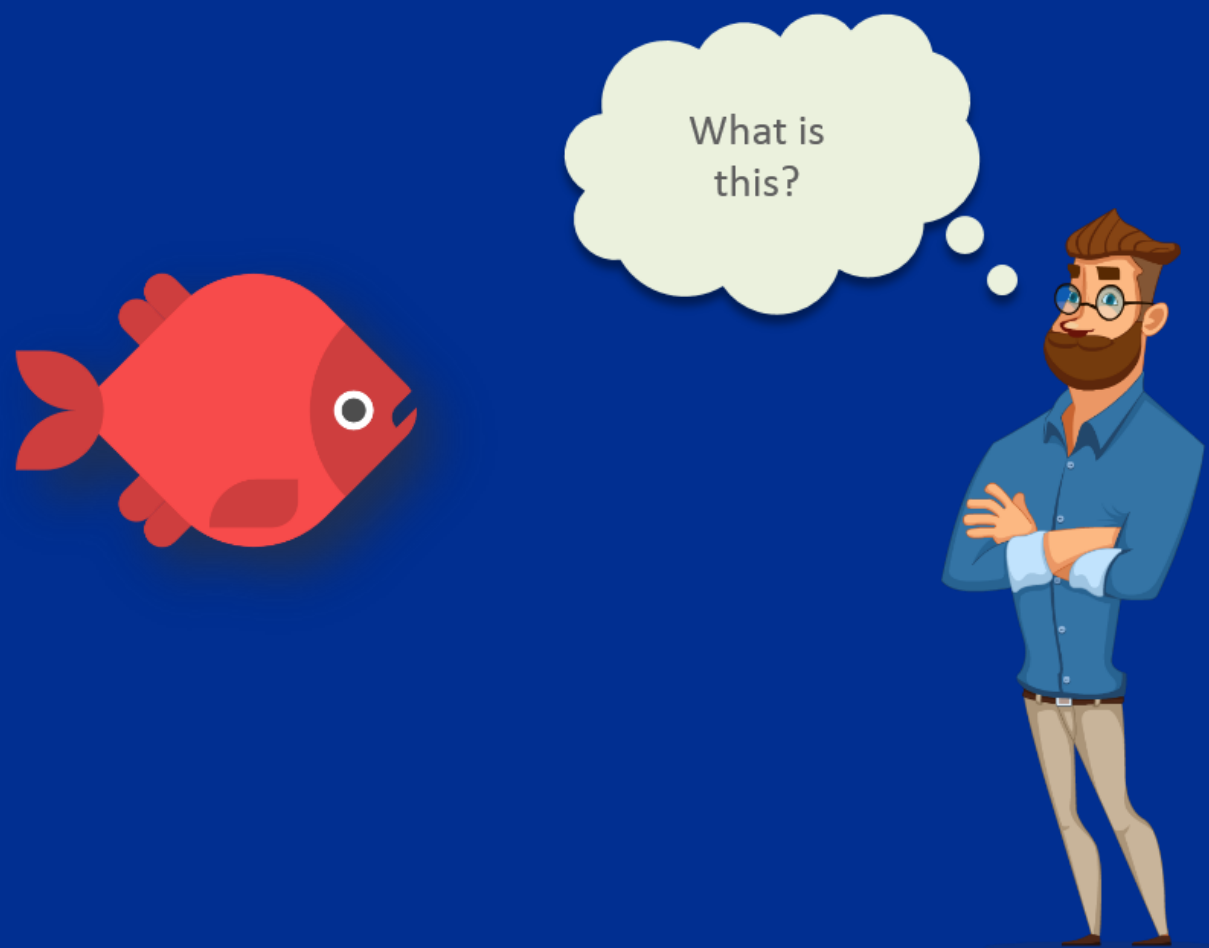


# Machine Learning

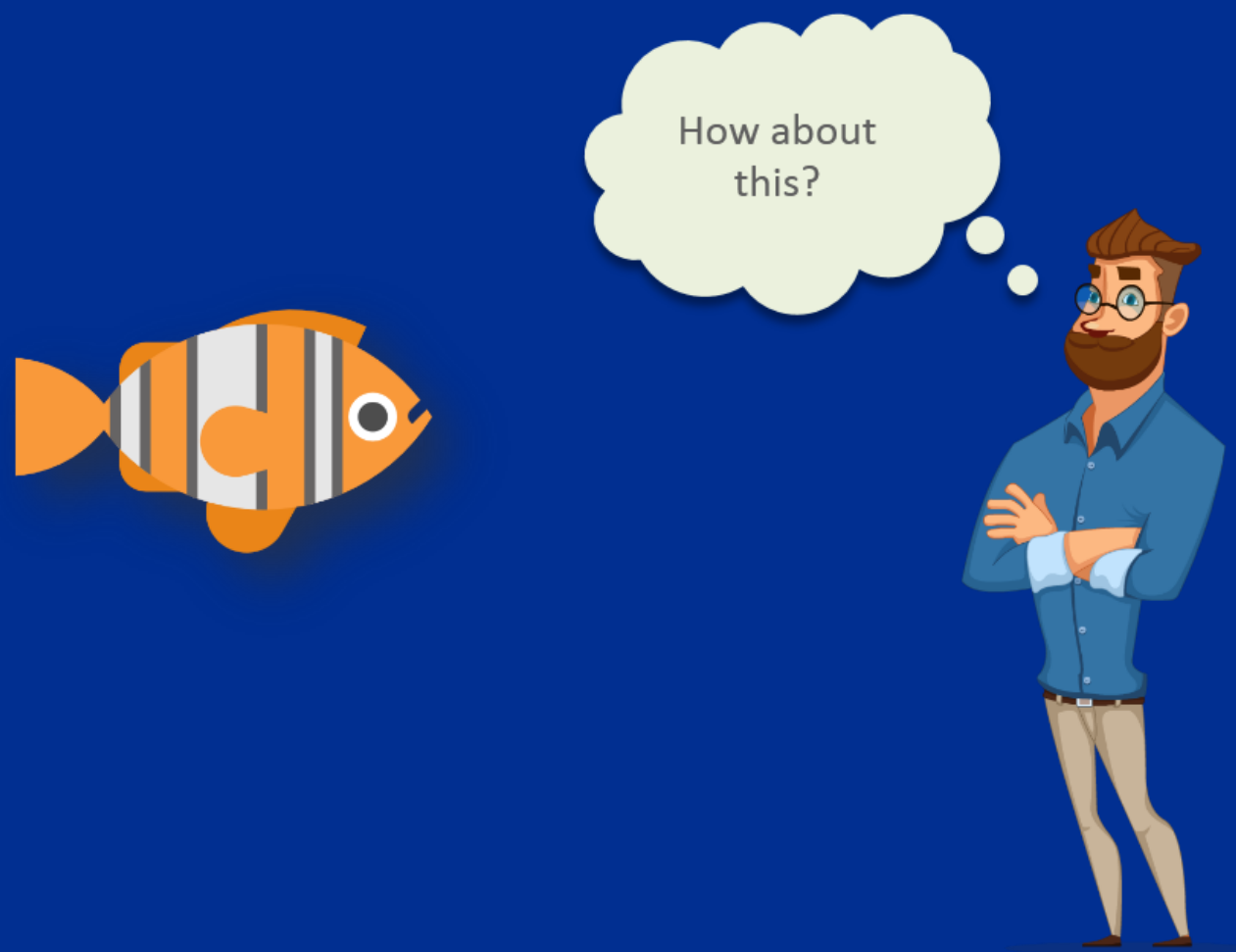
- Machine learning is getting computers to program themselves
- If programming is automation, then machine learning is automating the process of automation



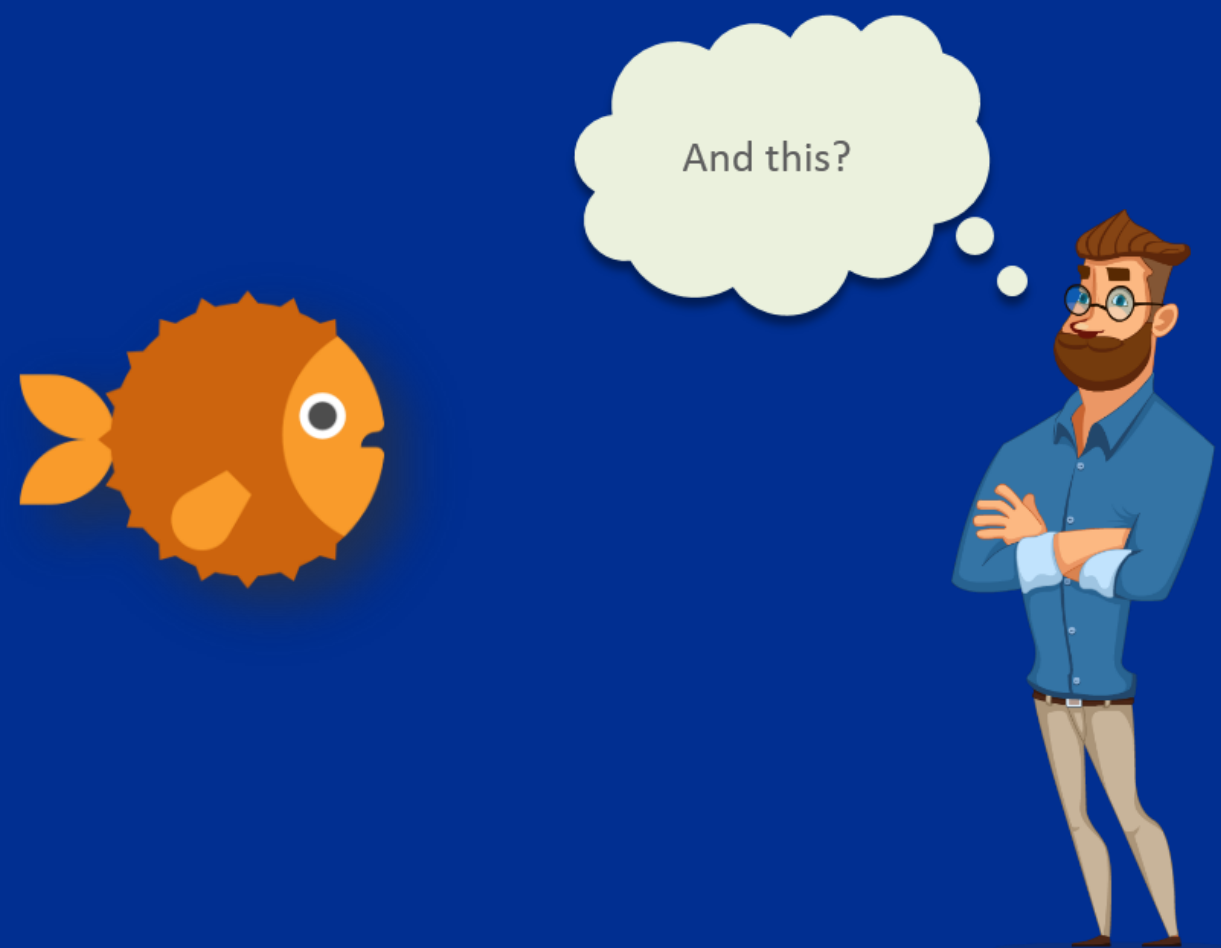
# Machine Learning



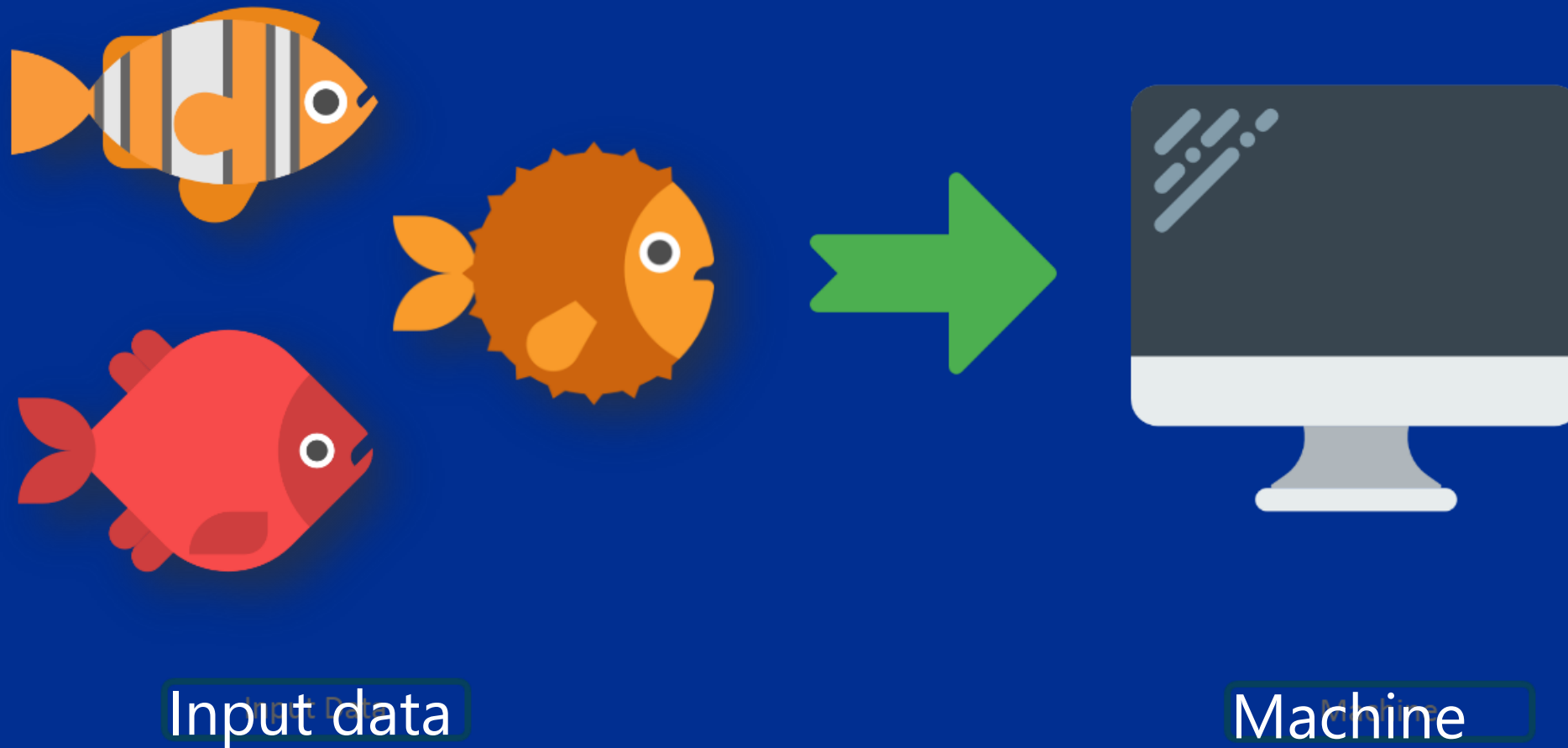
# Machine Learning



# Machine Learning



# Machine Learning



# Machine Learning



New Data

New Data

Machine

Machine

Result

Result



# Pre-Requisites of ML

- A Pattern should exist
- Mathematical model/algorithm is unknown
- Abundant data

# ML Frameworks

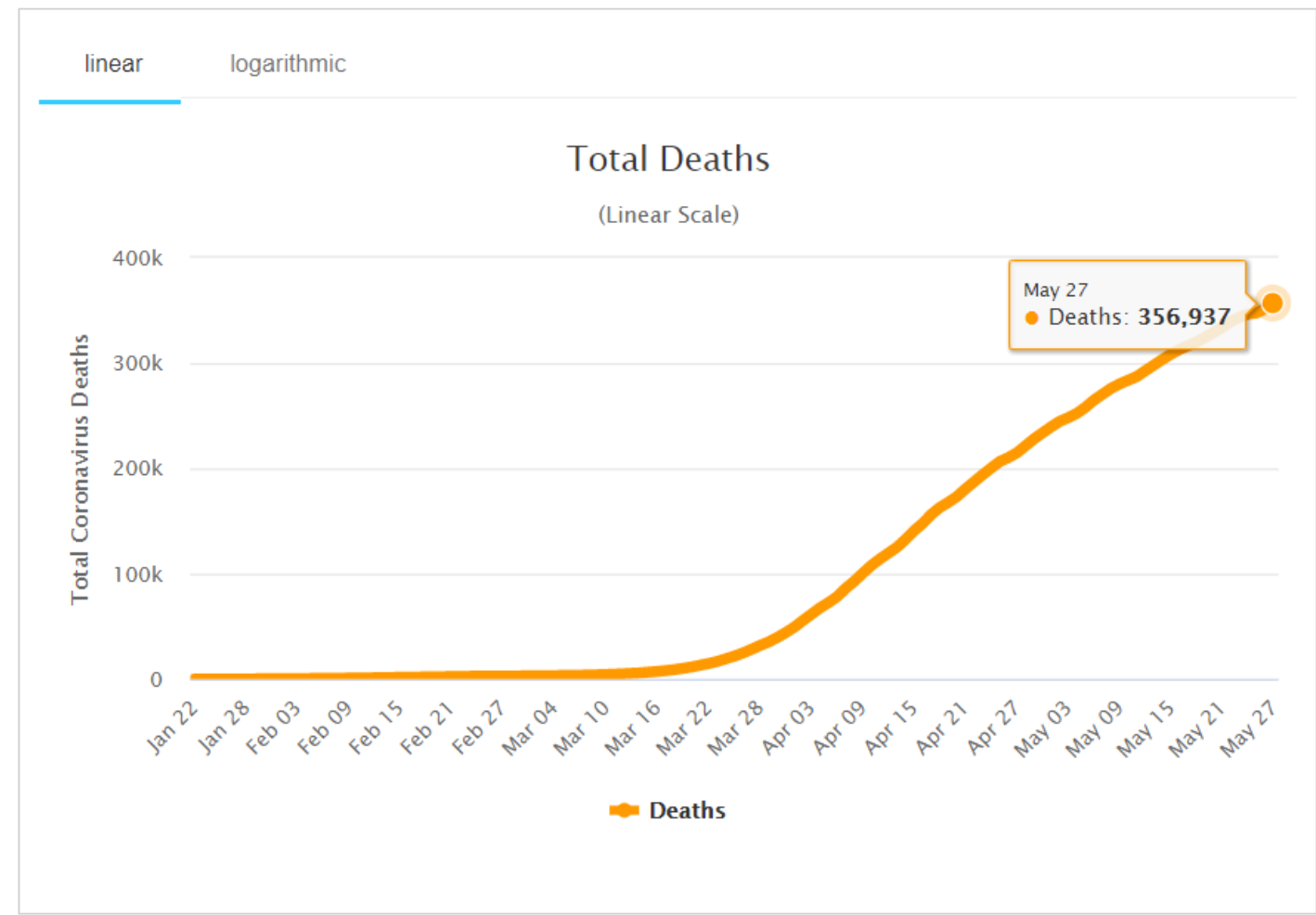




# Predictions – Time Series Analysis

- The analysis of data organized across unit of time.
- It helps understand past trends
- Types: Trends, Seasonality, Irregularity, Cyclic

Total Deaths



# Why .NET ?



## .NET ecosystem momentum

>1.5M  
.NET Core developers  
in Visual Studio

#1 Most Loved  
Framework (2019 & 2020)

.NET Core



Top 30  
Highest velocity OSS projects

[github.com/dotnet](https://github.com/dotnet)  
[github.com/aspnet](https://github.com/aspnet)



Top 5  
Language on GitHub  
C#



7x  
Faster than Node.js

ASP.NET Core



40%  
New to .NET are students

[dot.net download survey](#)

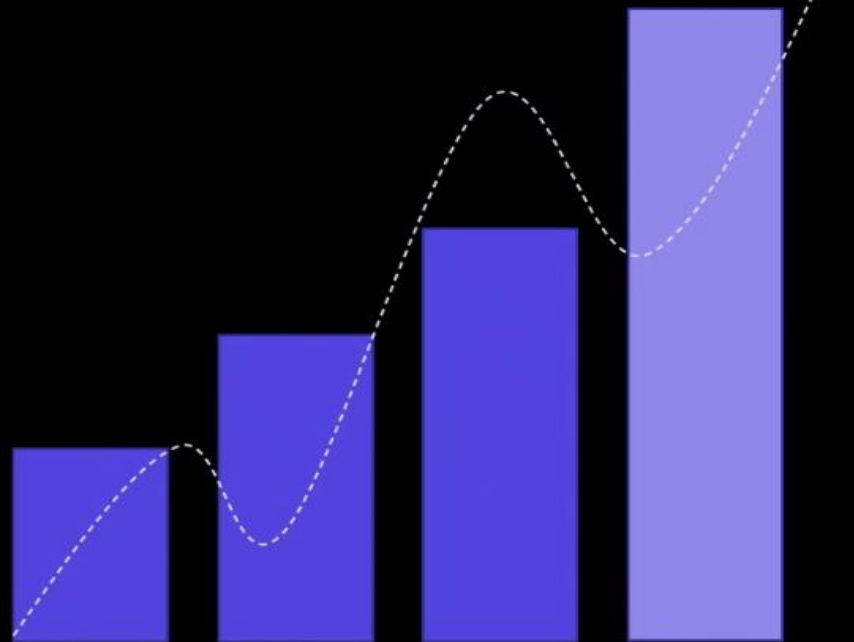
# Why .NET ?



## .NET adoption

**5 million .NET devs**

Monthly active developers in Visual Studio Family



Visual Studio

**+1 million new**

Monthly active .NET developers in the last year

.NET Core

**+600K new**

Monthly active .NET Core developers in the last year

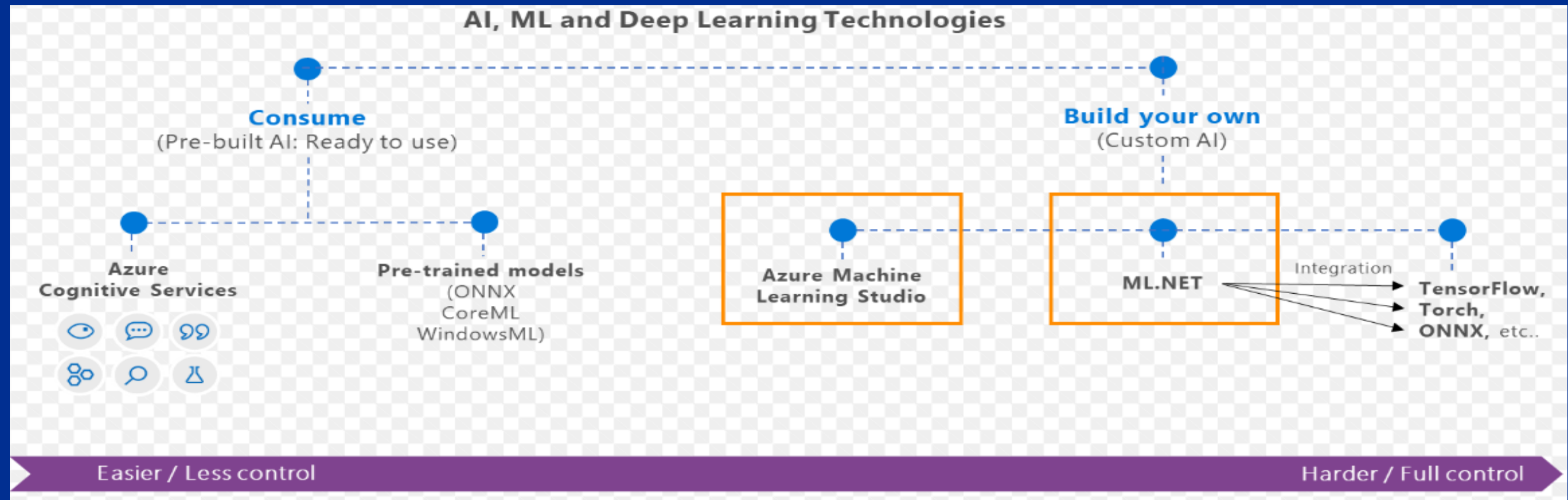
.NET on Linux

**2 million**

Publishes to Linux from Visual Studio

# What is ML.Net ?

- ML Framework from Microsoft for developing custom AI/ML applications.
- Originated in 2002 as part of Microsoft Research Project



# What is ML.Net ?

## ML.NET

Machine Learning framework made for .NET developers



### **Build-your-own**

Build your own custom models by writing C# or F# code



### **Developer focused**

ML.NET provides just the right amount of productivity and control



### **Extensible**

Tap into other machine learning toolkits with the rich extensibility model like TensorFlow



### **Proven**

ML.NET has been used internally in products like Office and Bing for years



### **Open source and Cross-platform**



Runs on Windows, macOS and Linux and developed in the open on GitHub

<https://github.com/dotnet/machinelearning>



# ML.Net – Proven at Scale, Enterprise ready

A list of five applications using ML.NET, each with an icon in a circle on the left and a grey arrow pointing right containing the application name and its use case. The applications are: Bing Ads (Ad Predictions), Excel (Chart Recommendations), Power Point (Design Ideas), Windows 10 (Windows Defender), and Azure Stream Analytics (Anomaly Detection). A "+ more" link is at the bottom right.

-  **Bing Ads** (Ad Predictions)
-  **Excel** (Chart Recommendations)
-  **Power Point** (Design Ideas)
-  **Windows 10** (Windows Defender)
-  **Azure Stream Analytics** (Anomaly Detection) [+ more](#)

# ML.Net – Possibilities



Sentiment Analysis



Issue Classification



Image classification



Object detection



Forecasting



Predictive maintenance



Recommendations

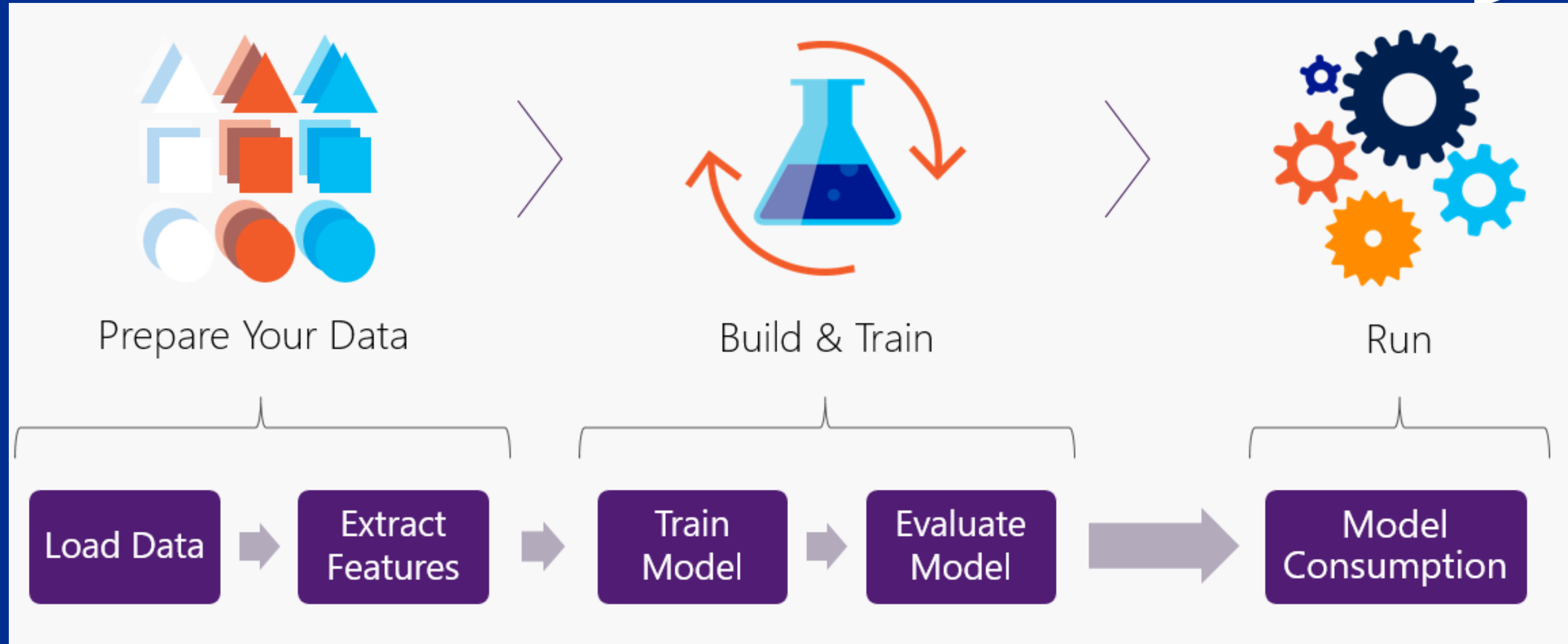


Customer segmentation



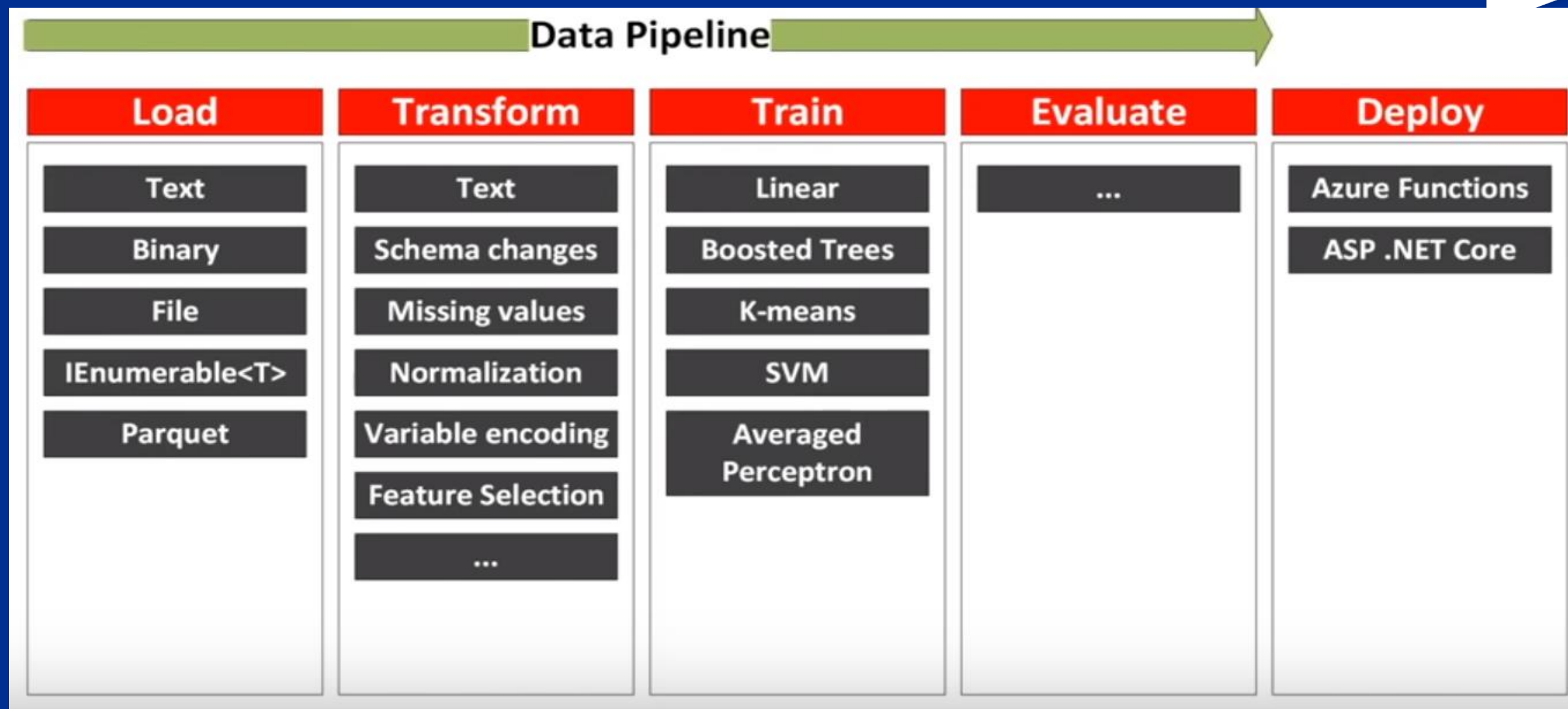
And more! Samples @ <https://github.com/dotnet/machinelearning-samples>

# ML.Net – Workflow

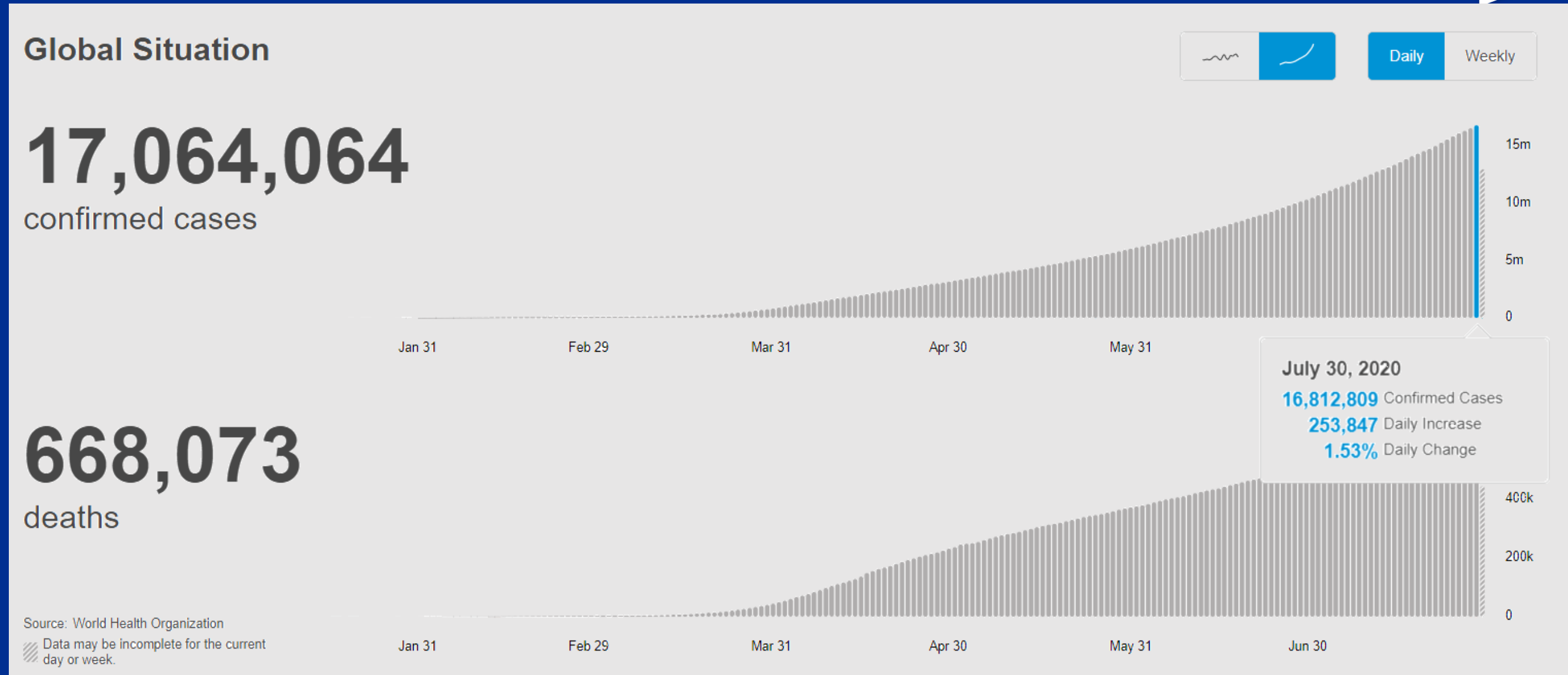
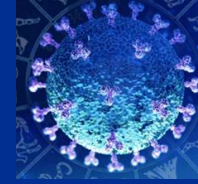




# ML.Net – Data Pipeline



# Covid-19 EDA and Prediction





# EDA using .Net DataFrame

- A collection of columns
- In-memory representation of structured data
- Similar to Python Dataframe
- Load dataset from CSV
- Row/Column Selection
- Join/Merge DataFrame
- GroupBy
- Null Values



# Machine Learning using ML.Net

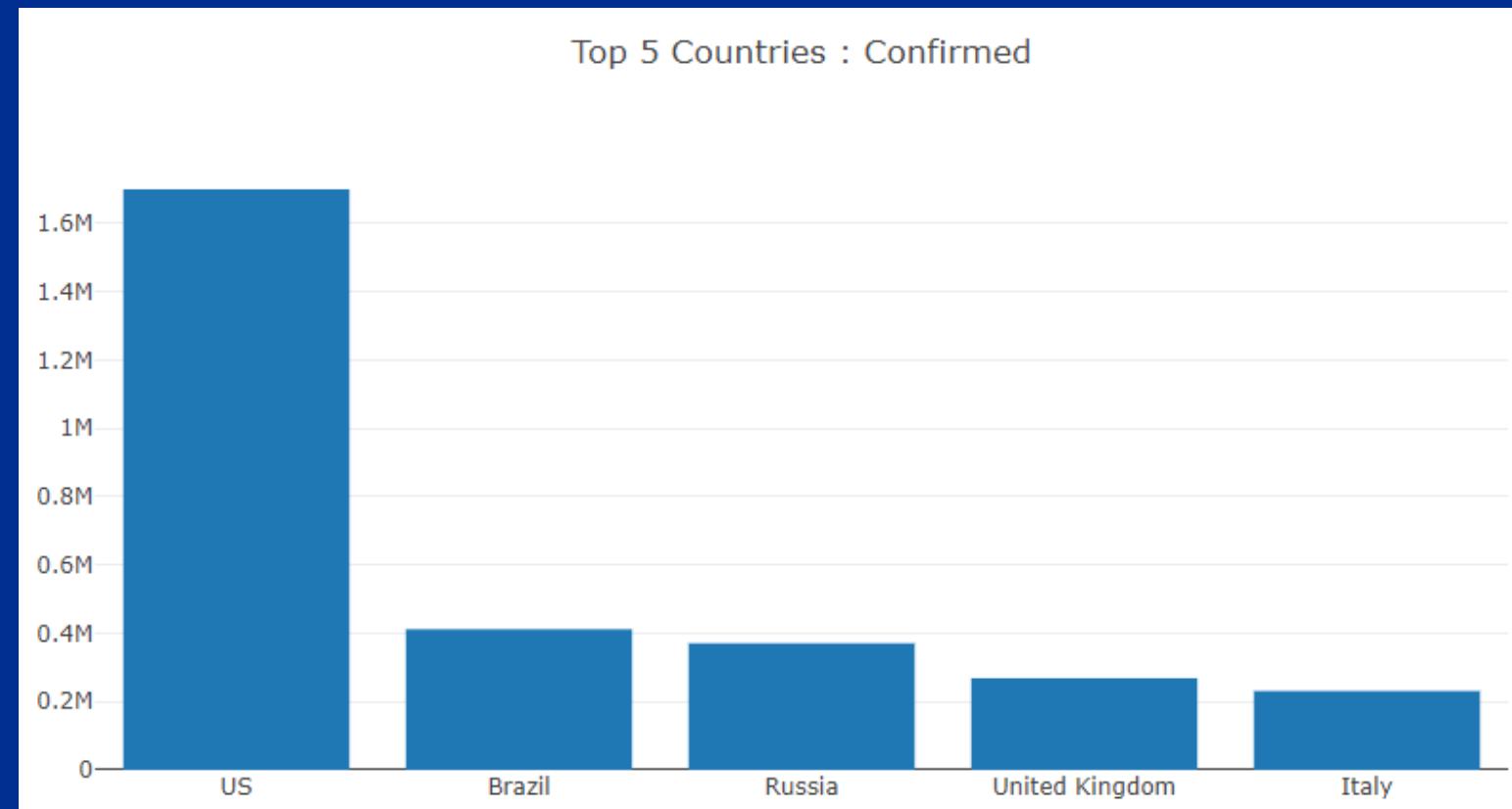
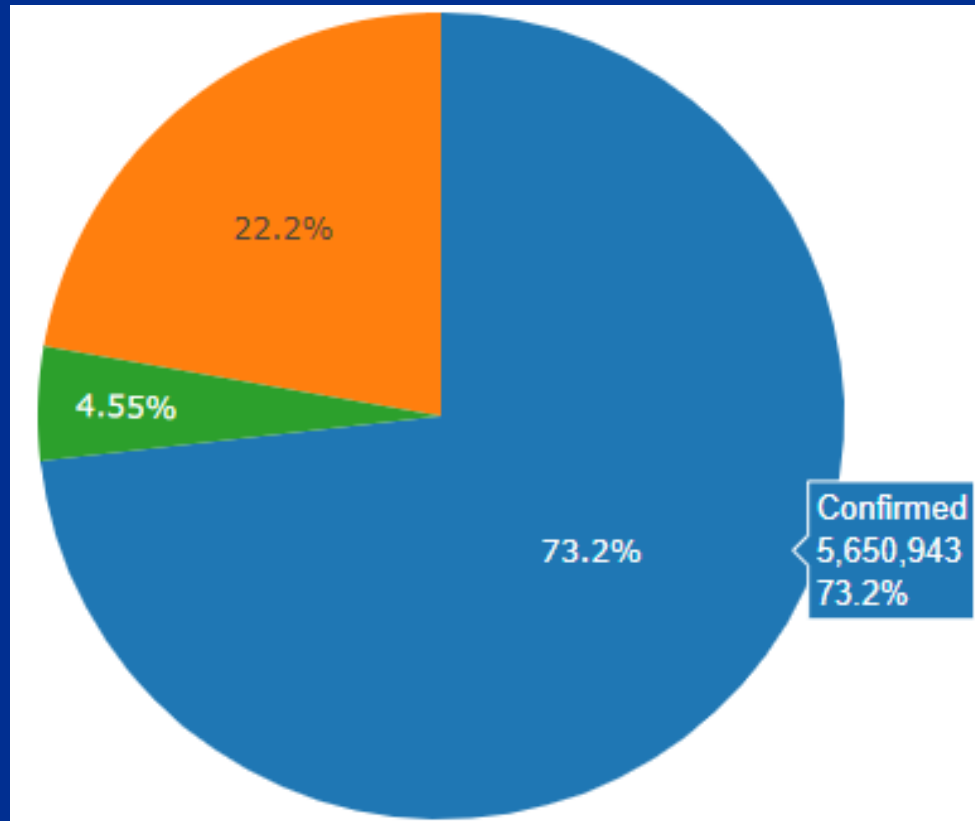
- Time Series
- Load Data – MLContext
- ML Pipeline
- Predict Confirmed cases in next 7 days.

# Visualizations

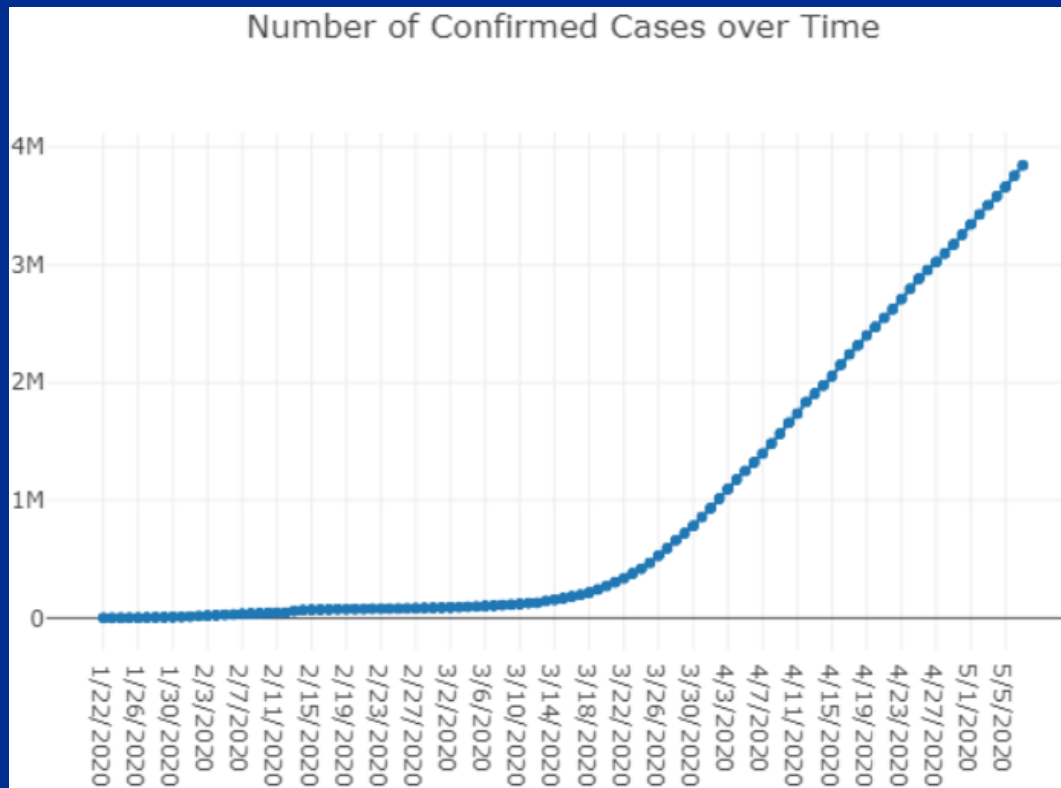
- Xplot – Plotly
- Bar
- Scatter
- Pie



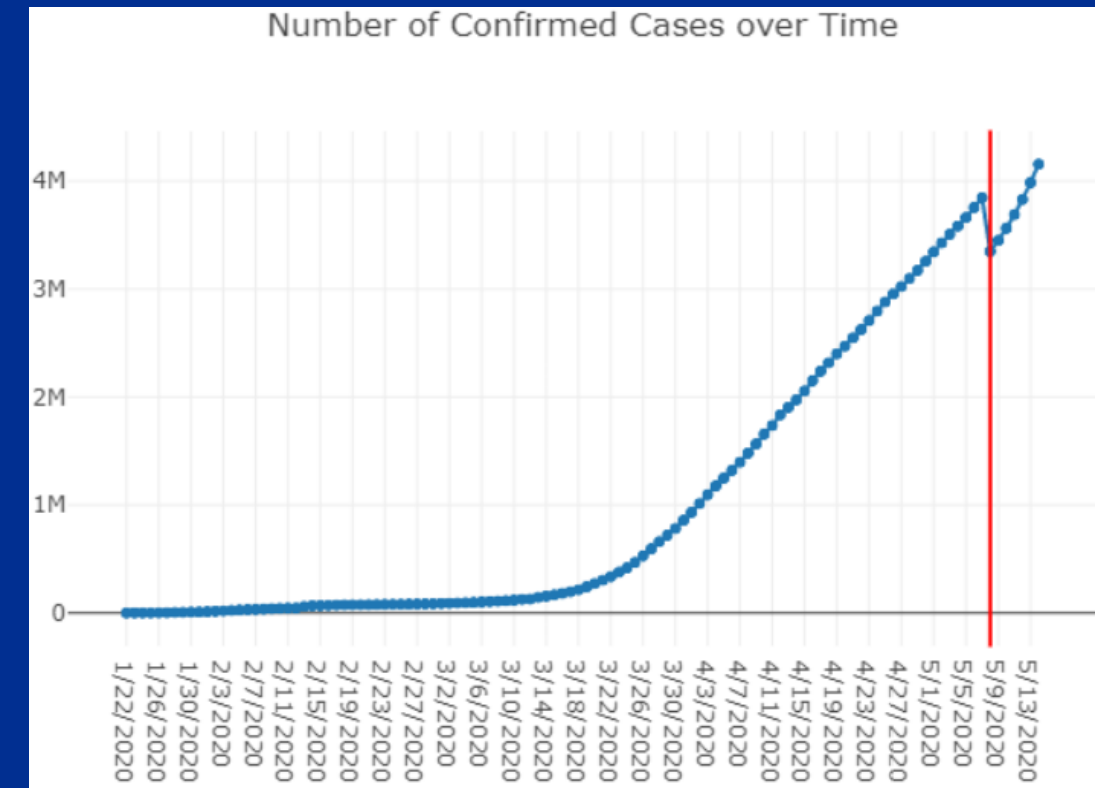
# Data Science – Data Frame



# Machine Learning : ML.Net – Prediction (7 days)



<i>index</i>	<i>value</i>
0	3348756
1	3450496
2	3563966
3	3690067
4	3830294
5	3985414
6	4156340





# Demo

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# ML.Net : Customer Stories



## Asgard Systems

Asgard Systems uses demand forecasting in grocery stores to reduce food waste and gas house emissions.

[Learn more >](#)



## Scancam

Scancam uses ML.NET to detect vehicles at fuel station pumps and provides alerts for known offenders who previously drove off without paying for their fuel.

[Learn more >](#)



## SigParser

SigParser converts e-mail signatures to contacts and eliminates manual data entry; it uses ML.NET to predict if an e-mail sender is human or an automated system.

[Learn more >](#)



## endjin

endjin uses ML.NET with AutoML to improve the process of classifying articles for their Azure newsletter and to revolutionize simple, everyday tasks.

[Learn more >](#)



## Microsoft Real Estate & Security

Microsoft Real Estate & Security uses ML.NET to detect and classify HVAC system faults on Microsoft's campus and convert them to work orders.

[Learn more >](#)

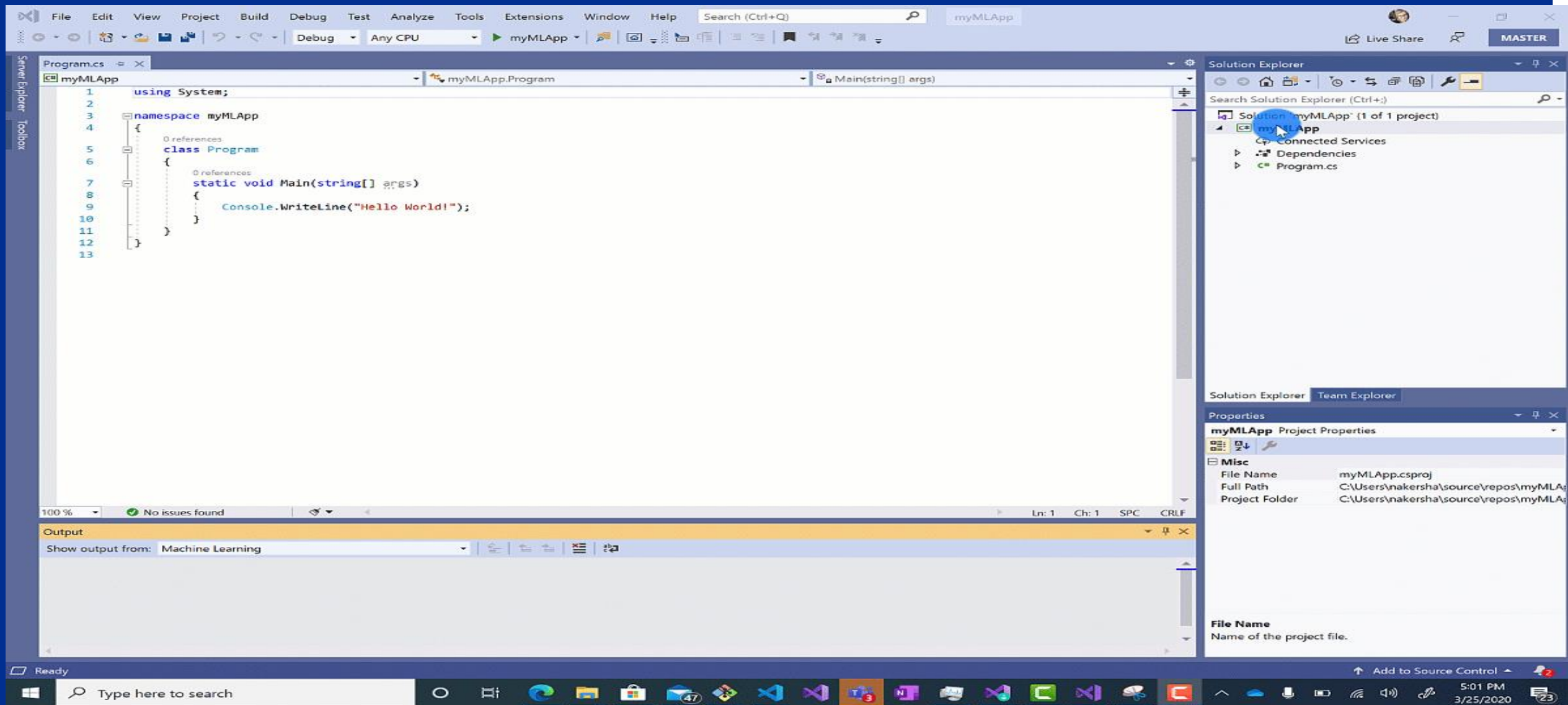


## Power BI

Power BI uses ML.NET to help users identify key influencers and customer segments so that they can understand the factors that drive their business metrics.

[Learn more >](#)

# ML.Net : Model Builder(AutoML)





# References

- ML.Net : <https://dotnet.microsoft.com/apps/machinelearning-ai/ml-dotnet>
- ML.Net: <https://devblogs.microsoft.com/cesardelatorre/what-is-ml-net-1-0-machine-learning-for-net/>
- ONNX : <https://onnx.ai/>
- Photo-Search (ONNX) : <https://github.com/Tak-Au/Photo-Search>
- Music Repair : <https://www.youtube.com/watch?v=nnV-1q-z9uE>
- ML Cookbook : <https://github.com/dotnet/machinelearning/blob/master/docs/code/MlNetCookBook.md>
- Deploy to Azure functions : <http://luisquintanilla.me/2018/08/21/serverless-machine-learning-mlnet-azure-functions/>
- <https://rubikscore.net/2019/02/18/ultimate-guide-to-machine-learning-with-ml-net/>
- <https://www.youtube.com/watch?v=dojO4zEL9sg>
- <https://www.youtube.com/watch?v=zy7Y9CHji2k>



# Resource

- Github: <https://github.com/praveenraghuvanshi/tech-sessions/tree/master/21102022-AI-ML-using-ml-dotnet-azconf-2022>
- Dev.to : <https://dev.to/praveenraghuvanshi/covid-19-eda-and-prediction-using-net-dataframe-and-ml-net-c-introduction-nlb>

# Platinum Partner



# Gold Partner



# Silver Partner



# Q & A



# Applying Data Science and Machine Learning using Microsoft .Net

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