



Infuse machine learning into your .NET apps





HELLO!

I am Arafat Tehsin

Microsoft MVP – AI

Solution Architect – EY

 @arafattehsin  github.com/arafattehsin

 arafattehsin.com/blog



AGENDA

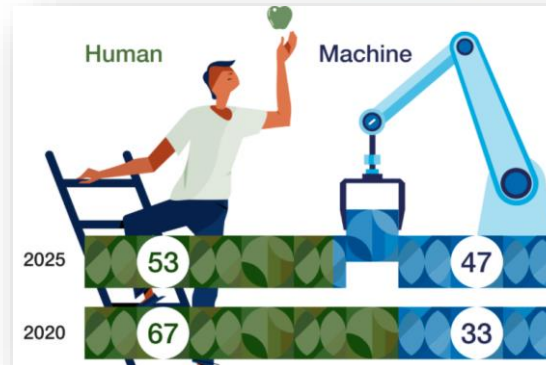
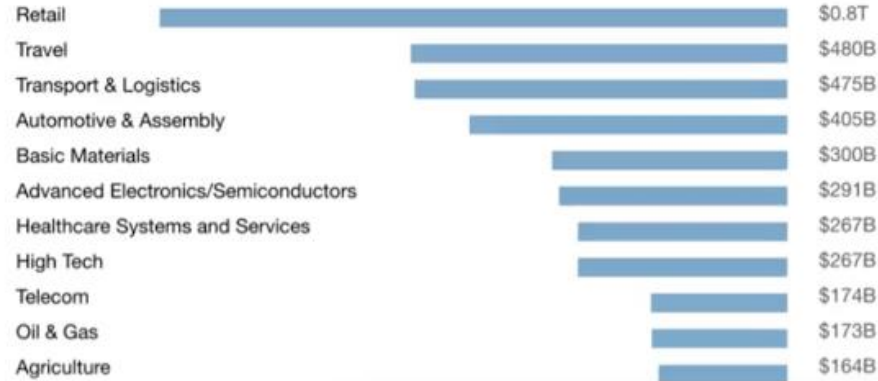
- Projection of AI
- The No-code/low-code AI Landscape
- ML.NET
 - Scenarios
 - CLI
 - Model Builder
- Demos



[illegible]

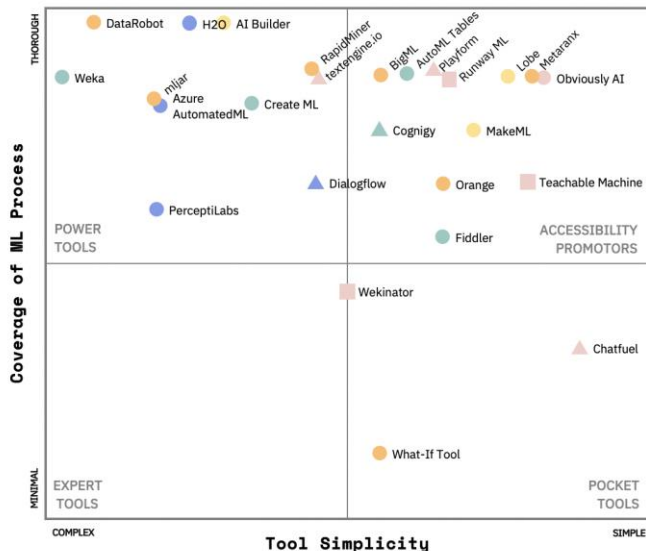
A collection of 30 hand-drawn icons representing various scientific fields. The icons include: a beaker with bubbles, a calculator, an atom with a central nucleus and three elliptical orbits, a cell with a nucleus, a microorganism with cilia, a line graph with a bell curve, a globe, a molecular structure with three spheres, a globe with a grid, a rocket ship, a globe with a grid, a test tube with a plant sprout, a lightbulb, a plug, an apple, a book with a graph on its cover, a pi symbol, a heartbeat line, a lightbulb, a star, a beaker with a drop, a planet with a ring, a brain, a DNA double helix, a water molecule (H2O), a magnet, a hexagonal molecular structure, a pi symbol, a lightbulb, a book with a graph on its cover, a pi symbol, an apple, a test tube with a plant sprout, a globe, a rocket ship, a molecular structure with three spheres, a globe with a grid, a cell with a nucleus, a microorganism with cilia, a line graph with a bell curve, an atom with a central nucleus and three elliptical orbits, a calculator, and a beaker with bubbles.

**\$13
trillion**



NO-CODE / LOW-CODE AI LANDSCAPE

NO-CODE / LOW-CODE ML TOOLS ASSESSMENT

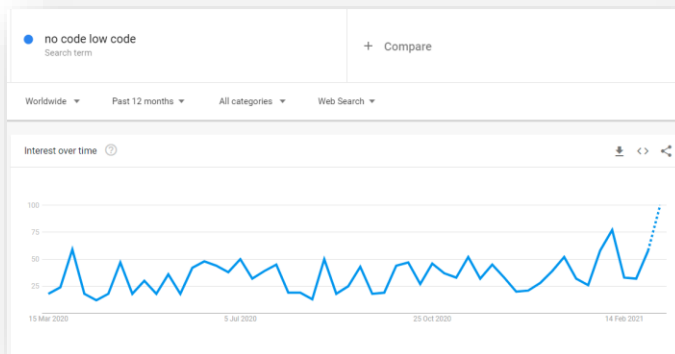


- Tool focus**
- Process building
 - ▲ Single use case
 - Multiple use cases

Scale of Data Science knowledge recommended

Beginner Intermediate Advanced

By 2023, over 50% of medium to large enterprises will have adopted an LCAP as one of their strategic application platforms.



MICROSOFT AI STACK

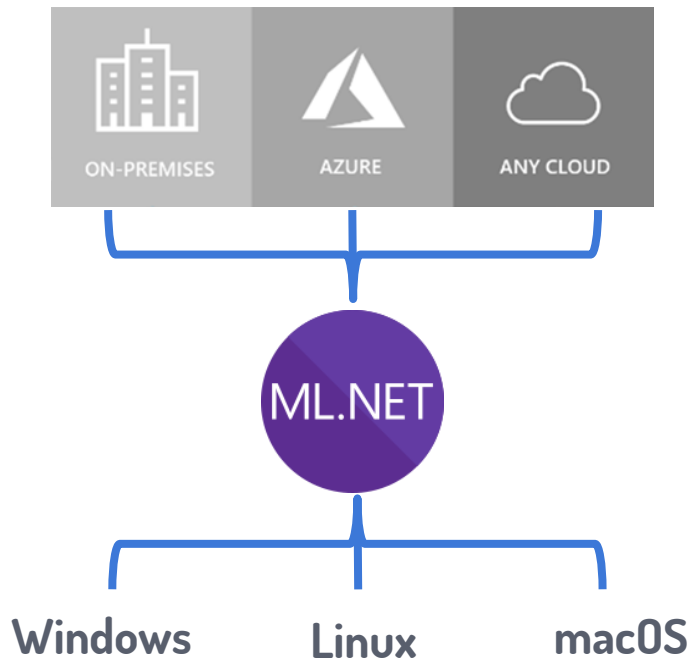


	Azure ML	ML.NET	Cognitive Services	Lobe	AI Builder	WinML
Create & Train Custom Models	Yes	Yes	Yes	Yes (Preview)	Yes	No
Model Consumption	Web API, ONNX	API, TensorFlow, ONNX, ML.NET	API / SDK	API (Local) / ONNX / TensorFlow / Core ML etc.	Power Platform	ONNX
Level of ML knowledge	Intermediate to Beginner	Beginner	Beginner to not required	Not required	Not required	Not required

PRO CODE → LOW CODE → NO CODE



WHAT IS ML.NET



An open source and cross-platform machine learning framework
for .NET



- You may want to use ML.NET when you...

- Want to stay in .NET ecosystem
- Want to train a custom model without low-level complexities
- Want to consume a pre-trained model (ONNX runtime or TensorFlow)

POSSIBILITIES WITH ML.NET

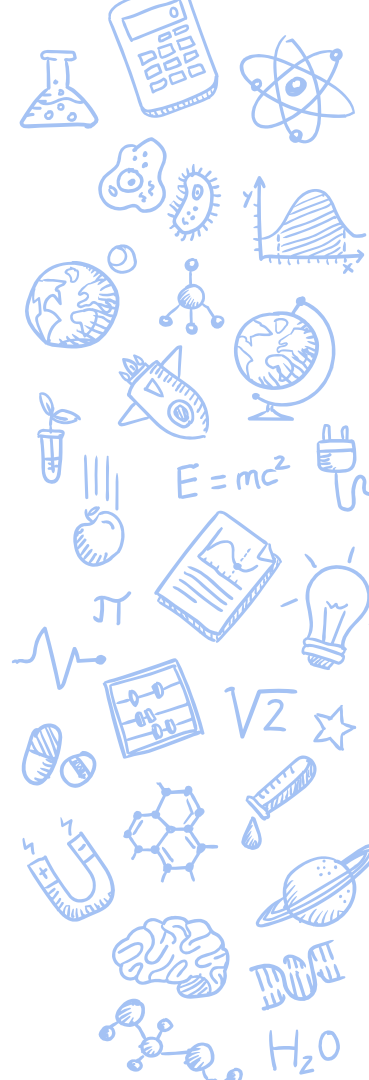
Classification



- Sentiment Analysis
- Eligibility or Non-eligibility
- Will customer buy or not?
- Which type of transaction is this?

- Predicting the price of fuel
- How many houses are going to go on rent this month?


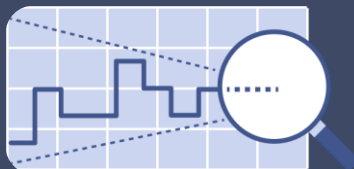
Regression



Forecasting

- Data center temperature
- Intrusion or fraud detection in the transactions

Anomaly detection

An icon for anomaly detection. It features a dark blue rounded square background. At the top, the text "Anomaly detection" is written in white. Below the text is a light blue grid. A dark blue step-line graph is plotted on the grid. Two dashed lines form a funnel shape, narrowing towards the right. A magnifying glass with a dark blue handle and frame is positioned over the right side of the grid, focusing on a dotted line that extends from the graph.

POSSIBILITIES WITH ML.NET

Recommendation



- List of the new retail products
- Smartphone applications
- Popular web services

- Search capabilities
- Automatic synonym implementation

Ranking



Image classification



The diagram illustrates the process of image classification. At the bottom, three input images are shown: a grid pattern, a striped square, and a circle. These images are fed into a neural network, represented by a stack of layers. The network processes the inputs and produces three output images at the top: a grid pattern, a striped square, and a circle. The entire process is labeled "Image classification".

- Front or back side of the ID
- Type of desserts
- Broken swings in park

Object detection



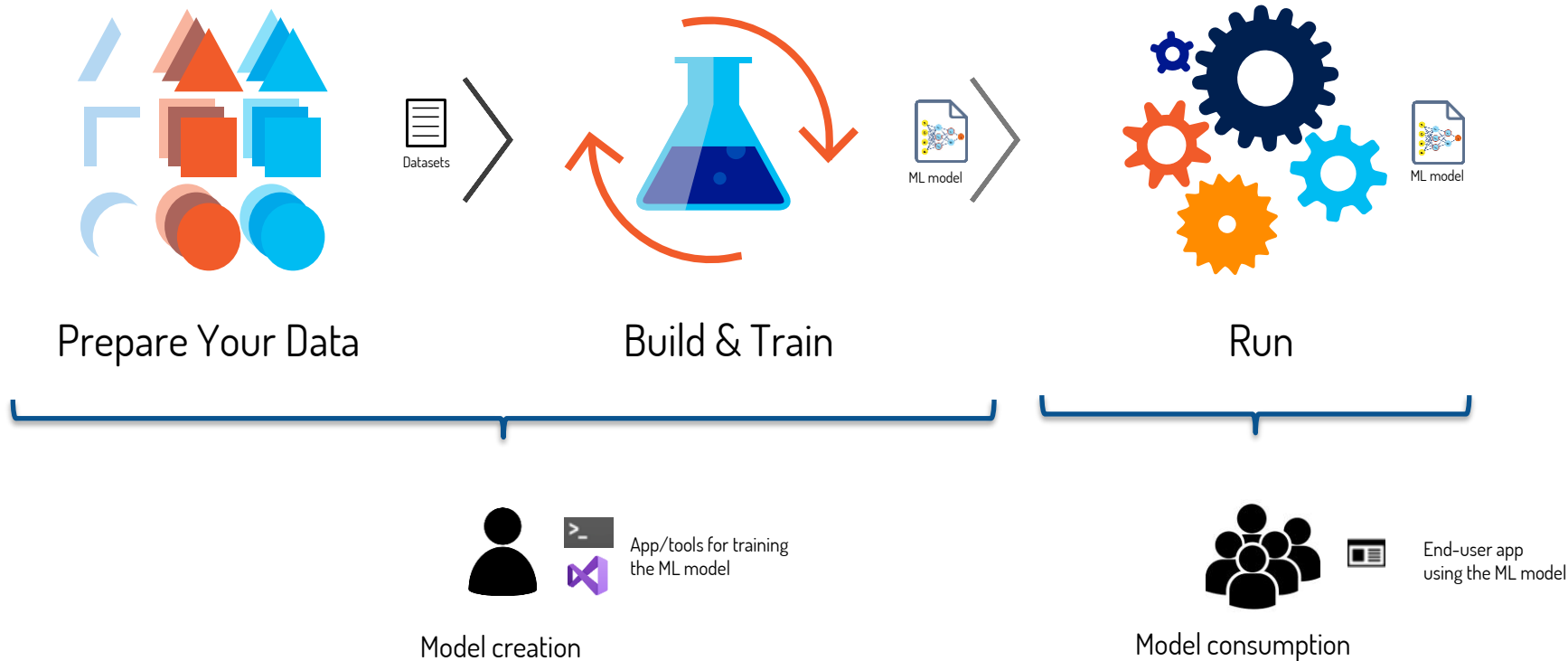
The diagram shows a dark blue background with several white clouds. Three airplanes are depicted: two blue and one yellow. Each airplane is enclosed within a dashed white rectangular bounding box, representing the output of an object detection algorithm. The blue airplanes are positioned on the left and center, while the yellow airplane is on the right.

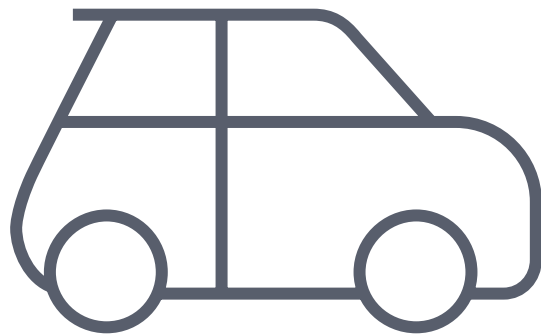
- Number of people in a café
- Types of flowers

WHAT TOOLS DO I HAVE?



MACHINE LEARNING WORKFLOW





How much is this car worth?

TYPICAL MODEL CREATION

Which features?

Mileage

Condition

Car brand

Year of make

Regulations

...

Gradient Boosted

Nearest Neighbors

SVM

Bayesian Regression

LGBM

...

Which algorithm?

Decision tree

Parameter 1

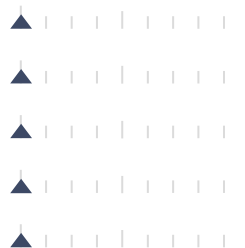
Parameter 2

Parameter 3

Parameter 4

Others

Which parameters?



30%

Model

TYPICAL MODEL CREATION

Which features?

Mileage

Condition

Car brand

Year of make

Regulations

...

Which algorithm?

Gradient Boosted

Nearest Neighbors

SVM

Bayesian Regression

LGBM

...

Which parameters?

Neighbors

Weights

Max Samples Split

Min Samples Leaf

Others

| | | | | | | | | | ▲ | |

| | | ▲ | | | | | | |

| | | | | ▲ | | | | |

| | ▲ | | | | | | | |

| | | | | | | | | | ▲ | |

30%

Model

Iterate

TYPICAL MODEL CREATION

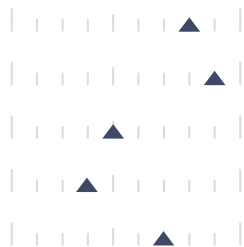
Which features?



Which algorithm?



Which parameters?



15%

30%

Iterate

AUTOML MODEL CREATION

Input

101010
010101
101010

Enter data

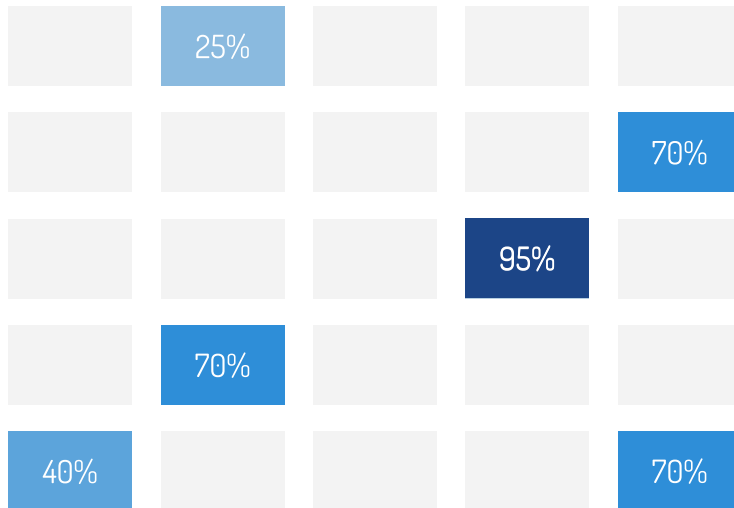


Define goals

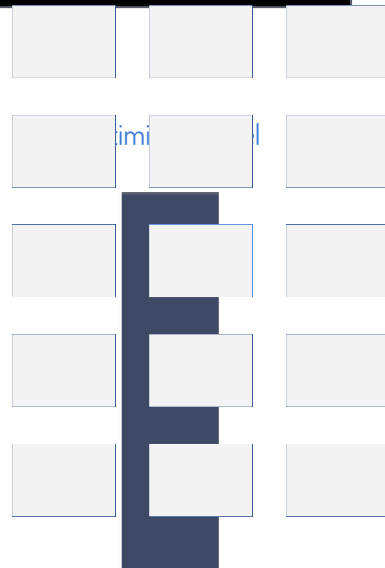


Apply constraints

Intelligently test multiple models in parallel

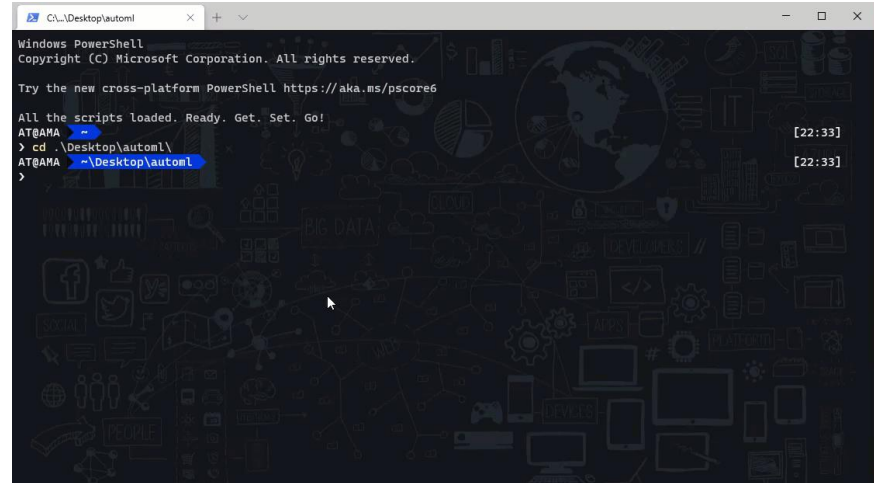


Output



ML.NET CLI

- Use the CLI to easily build custom ML models with Auto ML
- Removes the overhead of implementation, feature engineering and tweaking of hyperparameters
- Cross platform (Windows, Linux, MacOS)
- Generate code for training & consumption



```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Try the new cross-platform PowerShell https://aka.ms/powershell

All the scripts loaded. Ready. Get. Set. Go!
AT@AMA ~
> cd .\Desktop\automl\
AT@AMA ~\Desktop\automl\
>
```



SentimentAnalyzer 1.2.2
7300+ downloads
BotBuilderCommunity and many more..



ML.NET CLI

CROSS PLATFORM WITH AUTOML

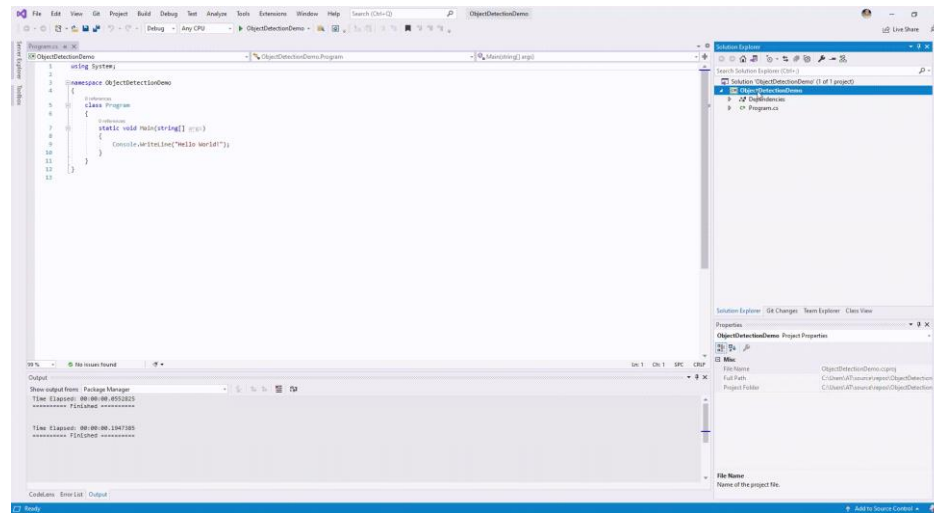
/demo

**Sentiment Analysis is not the end of the
world. There's so much beyond that.**

– A friend

MODEL BUILDER

- No-code way to build custom ML models with AutoML
- Config based training with generated code-behind files
- Load from files and databases
- .mbconfig solves many problems
- Utilizes Azure ML Studio Experiments for resource intensive operations

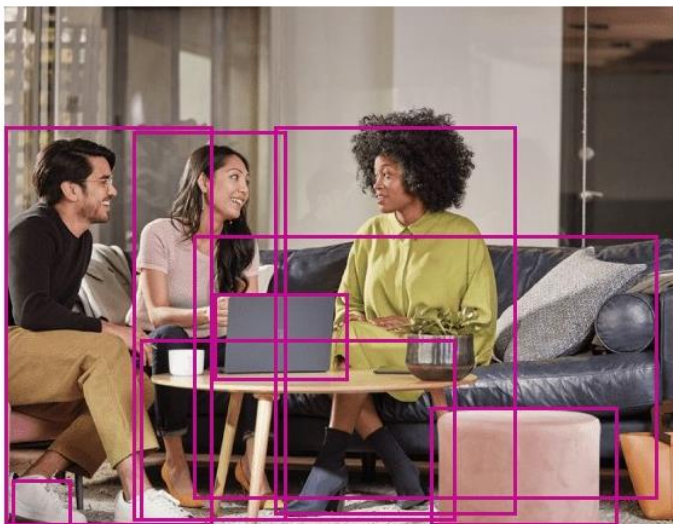


OBJECT DETECTION WITH ML.NET

- Computer Vision problem to locate and categorizes object in images / frames



{Person} – Image Classification



{Footwear, Person, Laptop, Plant} – Object Detection



OBJECT DETECTION WITH ML.NET

- Addresses all the common scenarios

Scenario

Environment

Data

Train


Evaluate

Consume

Next steps


Select a scenario

Train with your data
The following scenarios use Automated ML to train and pick the best model for your data.
[Learn more about training with your own data in Model Builder.](#)



Text classification
Classify text data into 2+ categories, e.g. predict if comments are positive or negative sentiments.

Local ML



Value prediction
Predict a numeric value from your data (regression), e.g. predict the price of a house based on features like size, location, etc.

Local ML






Image classification
Classify images into 2+ categories, e.g. predict whether an image is of a dog or a cat.

Azure ML Local ML



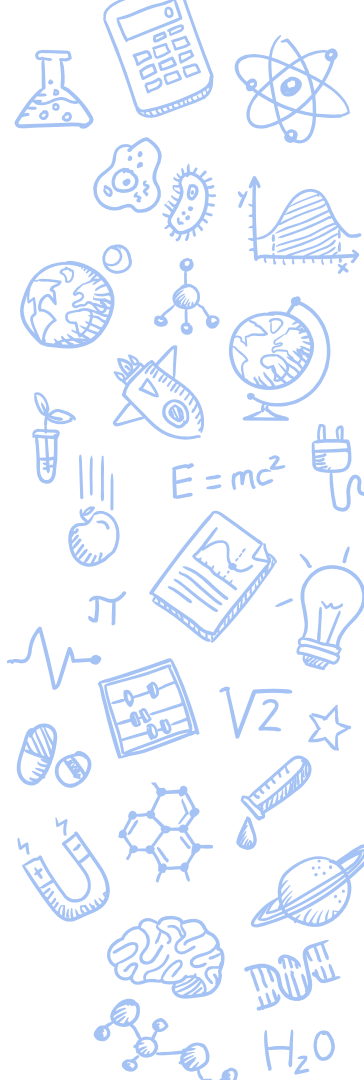
Recommendation
Produce a list of suggested items for a particular user, e.g. recommend products.

Local ML



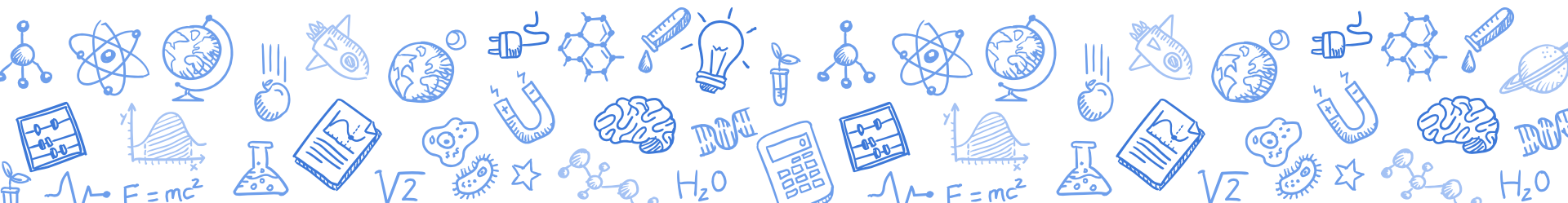
Object detection
Detect and identify objects in images, e.g. detect cars in an image and draw bounding boxes around each car.

Azure ML



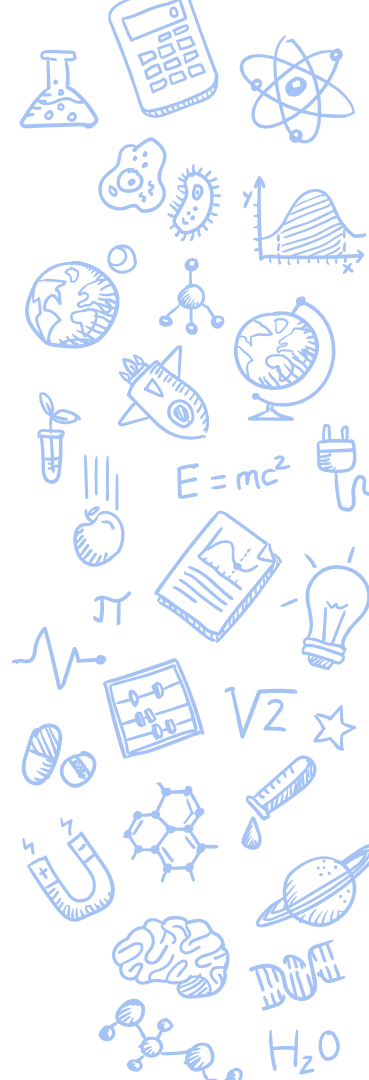
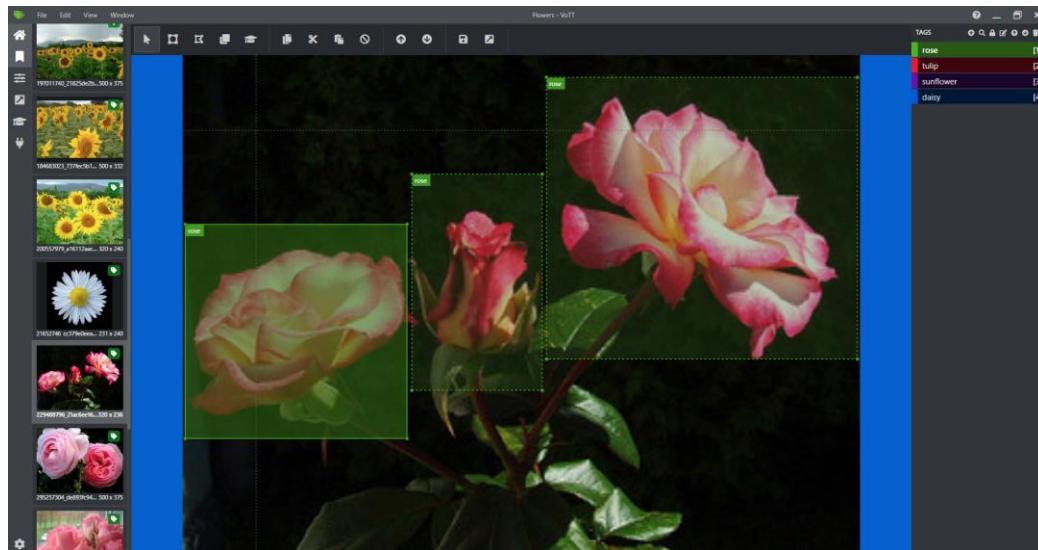
But first..

Let's talk about Tagging!



VoTT (Visual Object Tagging Tool)

- An opensource image / video tagging tool
- Developed by Microsoft CSE team
- Multiple export provider options
- Works for web / local





ML.NET Model Builder

CROSS PLATFORM WITH AUTOML

/demo

- ML.NET Videos - <https://channel9.msdn.com/Series/MLNET/MLNET-Machine-Learning-Introduction-1-of-8>
- ML.NET Docs - <https://docs.microsoft.com/en-us/dotnet/machine-learning/>
- ML.NET Model Builder Updates - <https://devblogs.microsoft.com/dotnet/ml-net-and-model-builder-march-updates/>
- SentimentAnalyzer repo - <https://github.com/arafattehsin/CognitiveRocket/tree/master/Cognitive-Library/SentimentAnalyzer>
- Blog Post - <https://www.arafattehsin.com/beyond-sentiment-analysis-object-detection-with-ml-net/>
- Object Detection with ML.NET (Docs) - <https://docs.microsoft.com/en-us/dotnet/machine-learning/tutorials/object-detection-model-builder>



THANKS!

Any questions?

You can find me at

 @arafattehsin

 arafat@outlook.com