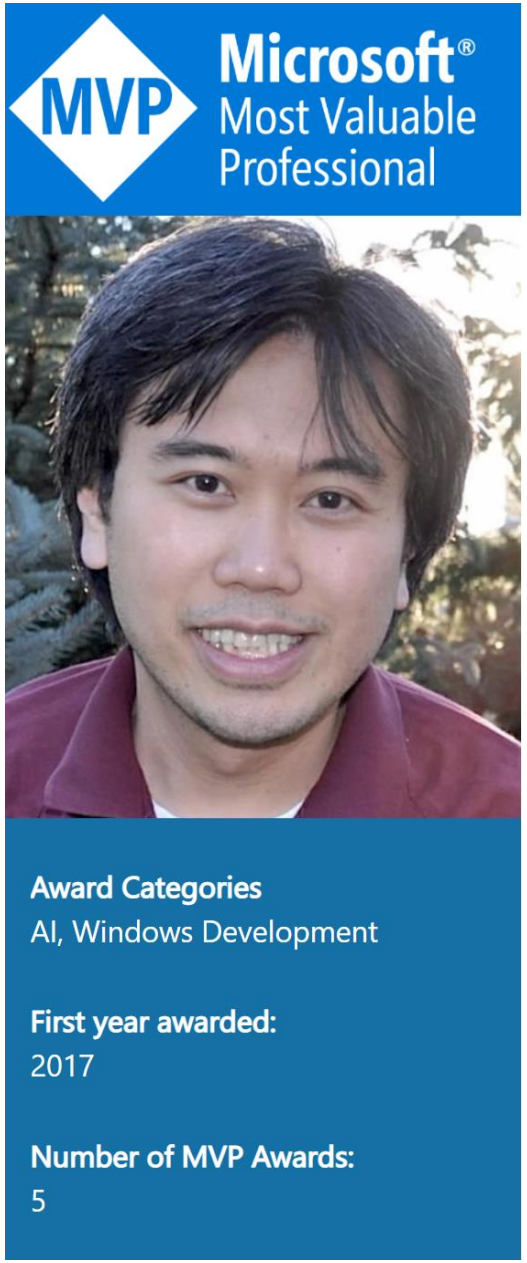
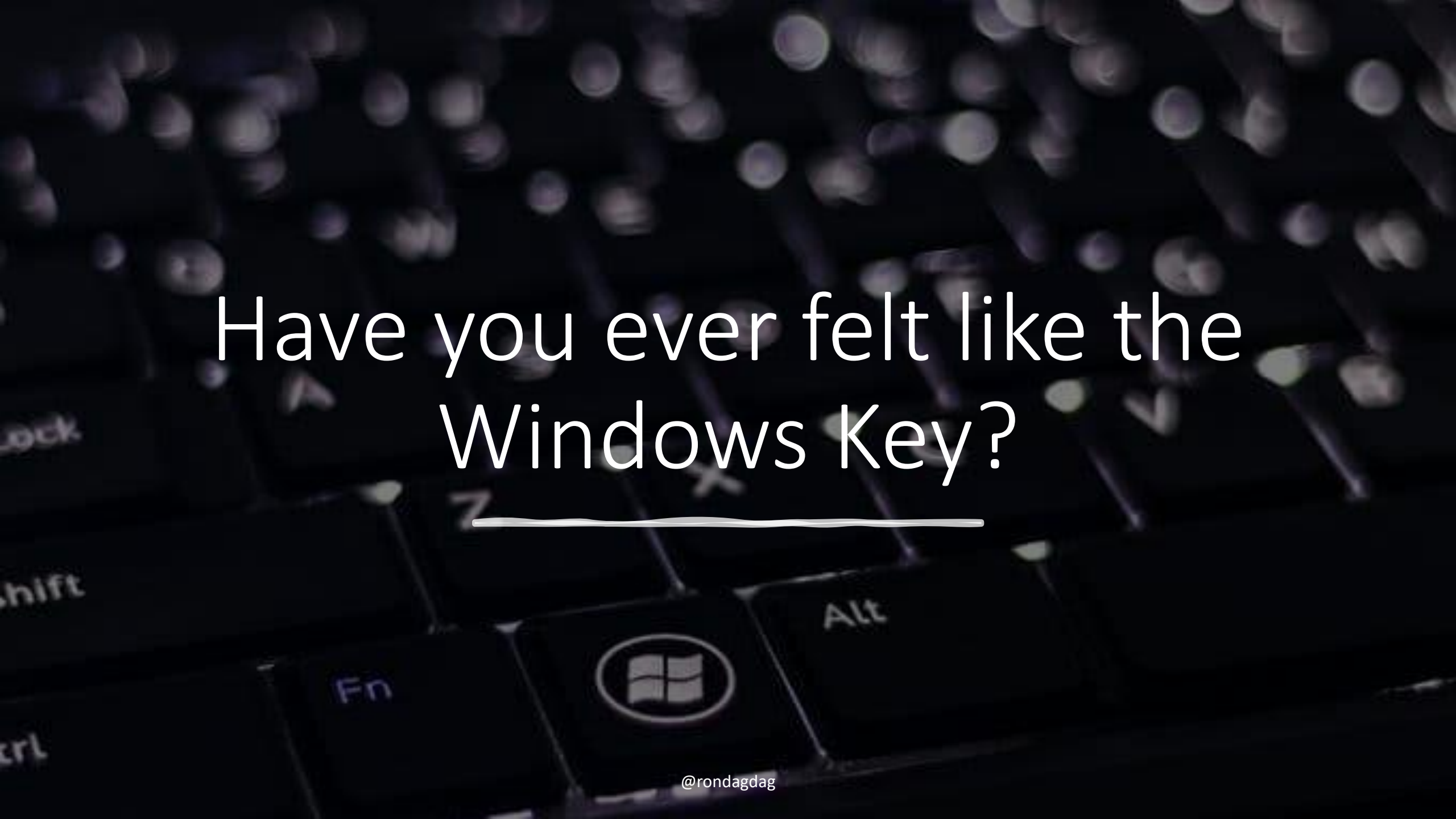
Build Intelligent apps with ML.NET and Windows Machine Learning

Ron Dagdag



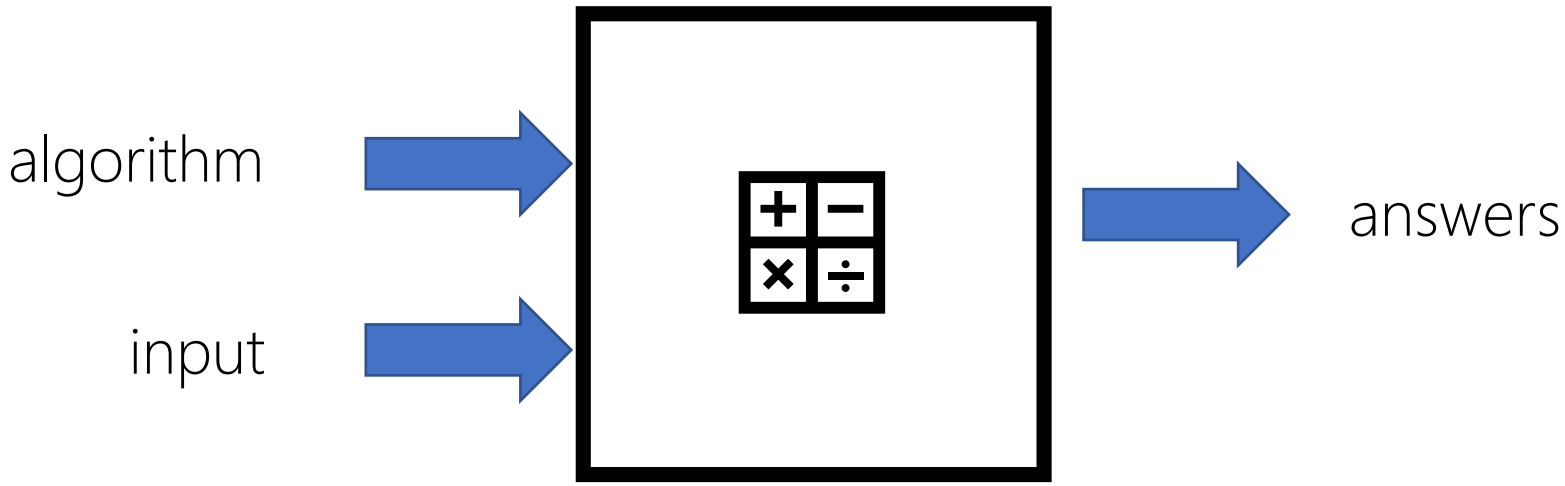

Have you ever felt like the Windows Key?
Alt
Fn
@rondagdag

- ⊞ Win + ⇧ Shift + S Opens Snip & Sketch tool to capture screen selection and puts into clipboard.
- ⊞ Win + Ctrl + ⇧ Shift + Alt Opens website https://www.office.com/?from=OfficeKey.
- ⊞ Win + Ctrl + ⇧ Shift + Alt + D Opens OneDrive.
- ⊞ Win + Ctrl + ⇧ Shift + Alt + L Opens website LinkedIn.
- ⊞ Win + Ctrl + ⇧ Shift + Alt + Y Opens website Yammer.
- ⊞ Win + Ctrl + ⇧ Shift + Alt + N Opens OneNote.
- ⊞ Win + Ctrl + ⇧ Shift + Alt + O Opens Outlook.
- ⊞ Win + Ctrl + ⇧ Shift + Alt + P Opens PowerPoint.
- ⊞ Win + Ctrl + ⇧ Shift + Alt + T Opens Teams.
- ⊞ Win + Ctrl + ⇧ Shift + Alt + W Opens Word.
- ⊞ Win + Ctrl + ⇧ Shift + Alt + X Opens Excel.

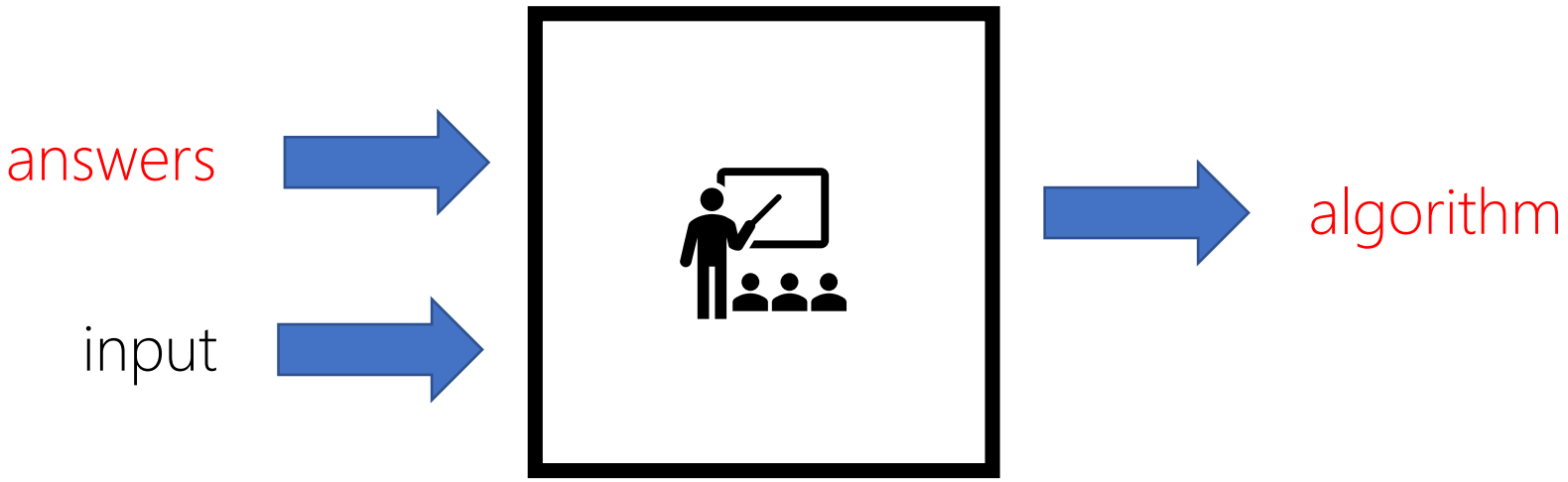
Agenda

- What is Machine Learning?
- Windows Machine Learning
- Open Neural Network Exchange (ONNX)
- ONNX Runtime
- Community Toolkit - Intelligent API
- ML.NET Model Builder
- Demo

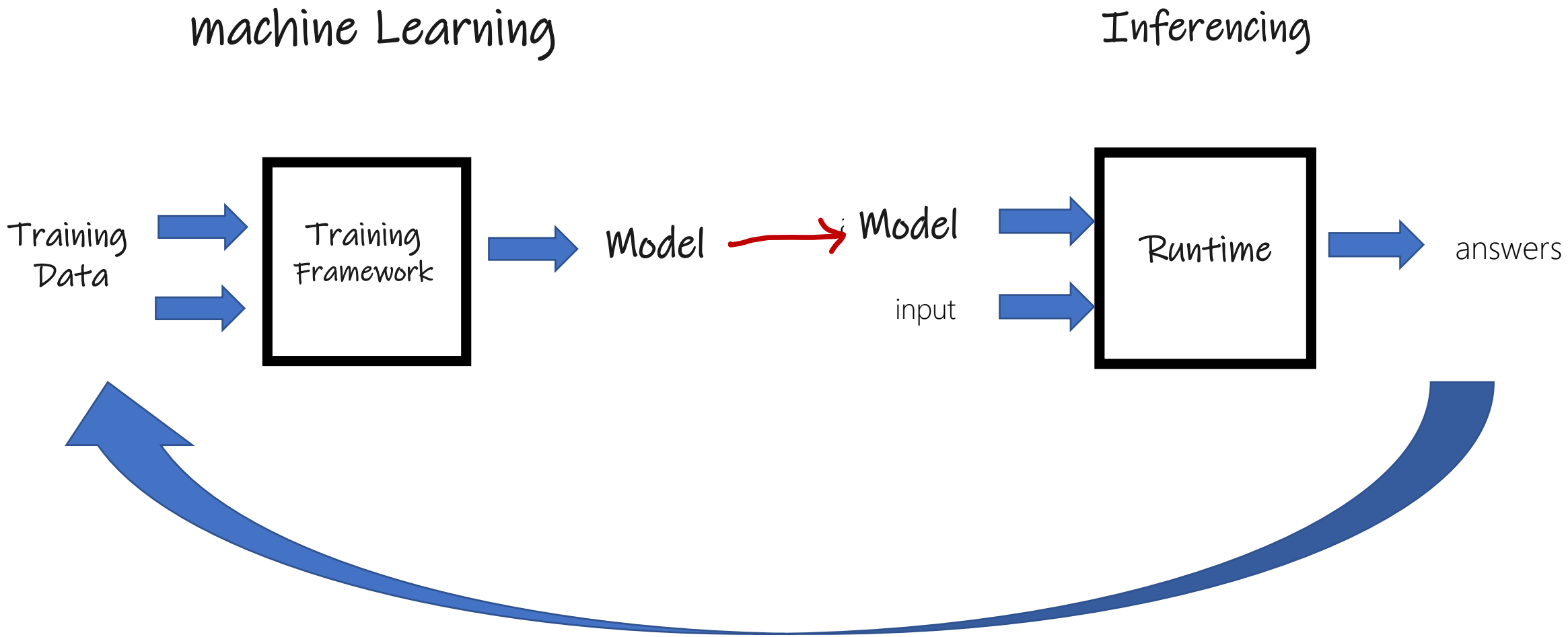
programming



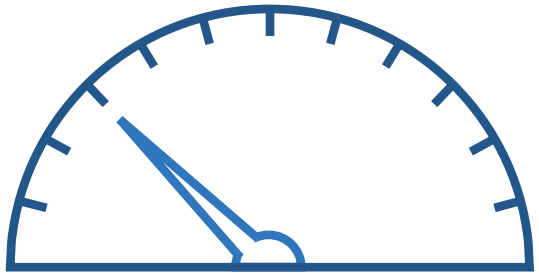
machine learning



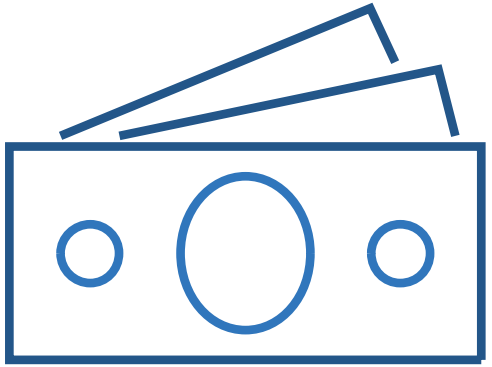
ML Primer


machine Learning
Inferencing
Training Data
Training Framework
Model
Model
input
Runtime
answers

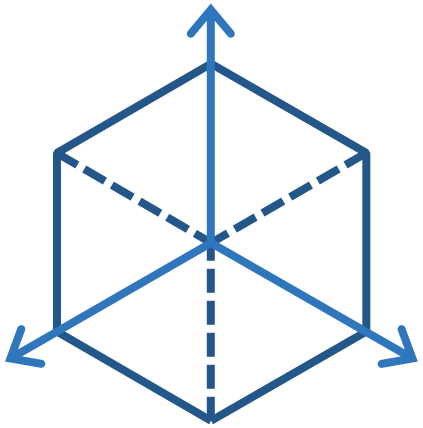
AI on apps



Low latency

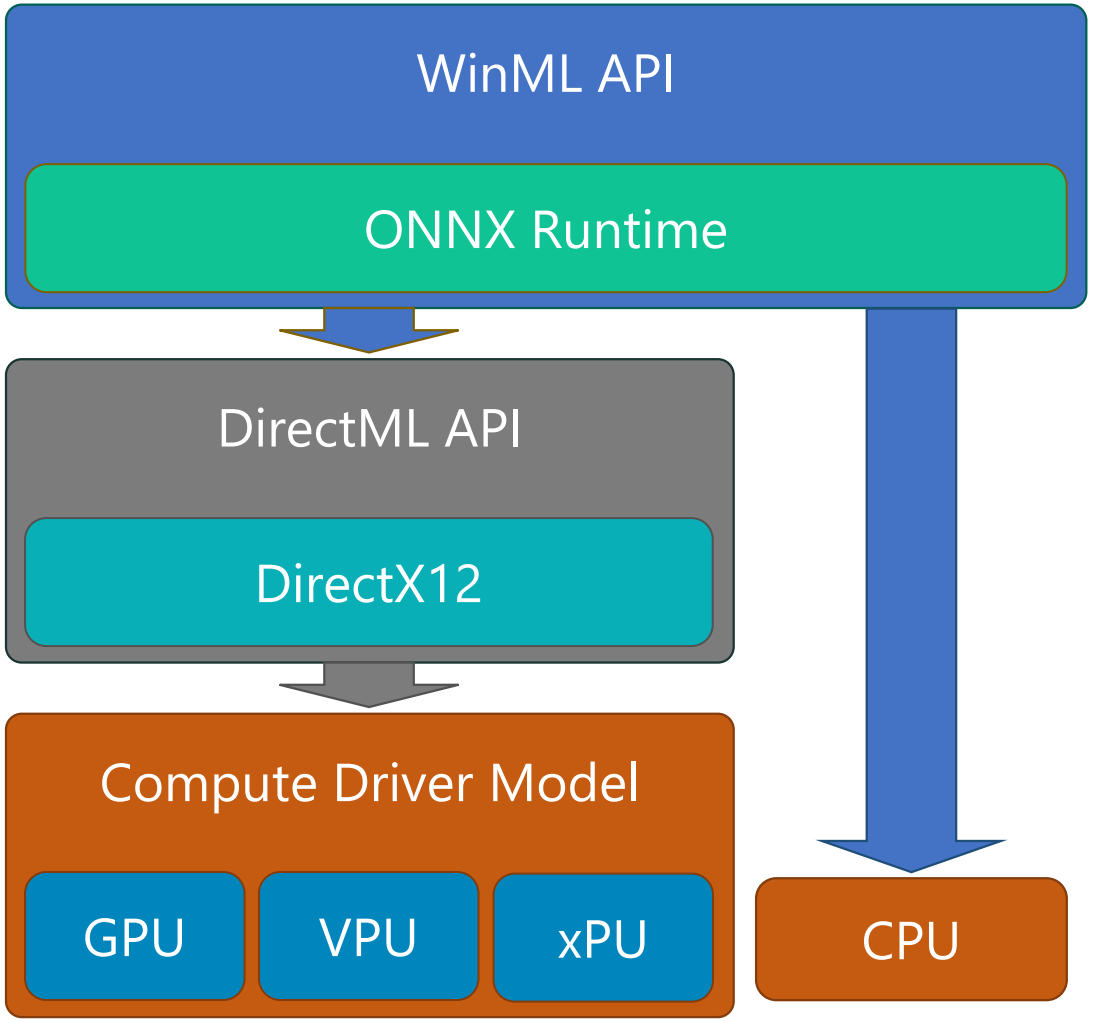


Scalability



Flexibility

Windows AI platform



- WinML
  - **Practical**, simple model-based API for ML inferencing on Windows
- DirectML
  - **Realtime, high control** ML operator API; part of DirectX family
- Compute Driver Model
  - Robust **hardware reach**/abstraction layer for compute and graphics silicon

Windows Machine Learning (WinML)

- Ease of development
- Abstract model-specific code away
- Broad hardware support
- Performs hardware optimizations
- Implement Machine Learning in Windows apps using Windows ML

Windows Machine Learning (WinML)

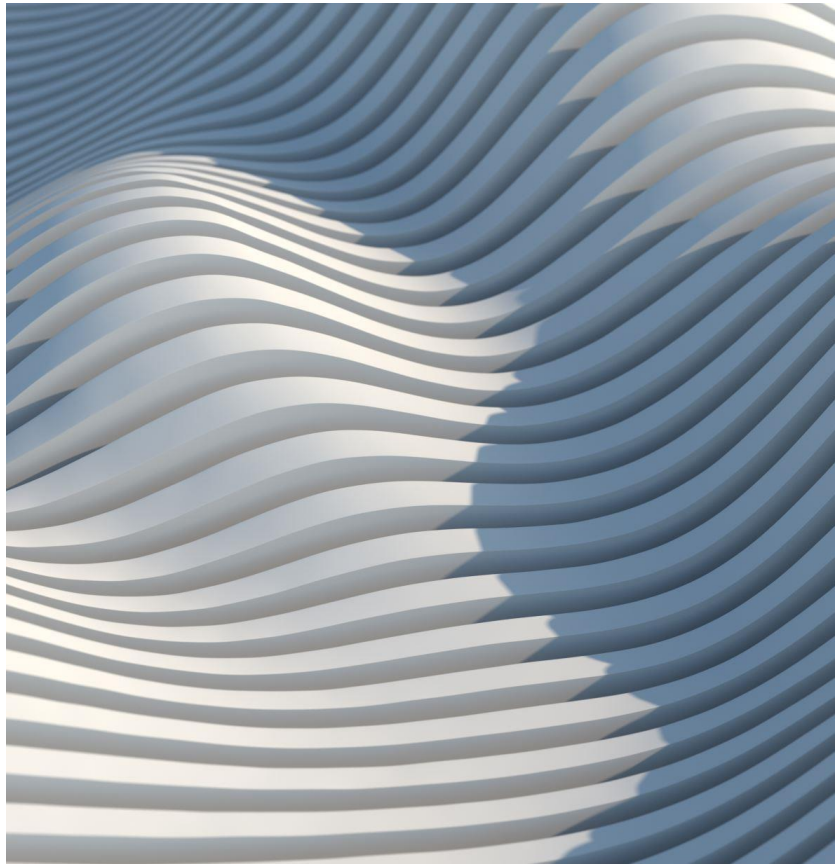
- Improve performance significantly on Windows
- high-performance
- Low latency, real-time results
- Increased flexibility
- Reduced operational costs
- Reliable API for deploying hardware-accelerated ML inferences on Windows devices

DEMO

Intelligent API

https://github.com/CommunityToolkit/Labs-IntelligentAPIs

- Machine learning tasks easier for devs
- No ML expertise need
- Reuse existing ML models
- Add Nuget package and calling a function
- Inferencing machine learning models on Windows
- Each APIs employs WinML



Intelligent API

https://github.com/CommunityToolkit/Labs-IntelligentAPIs

- Add a new nuget source with the feed URL

  https://pkgs.dev.azure.com/dotnet/CommunityToolkit/_packaging/CommunityToolkit-Labs/nuget/v3/index.json

- Add nuget package to application

  CommunityToolkit.Labs.Intelligent.ImageClassification

  CommunityToolkit.Labs.Intelligent.ObjectDetection

  CommunityToolkit.Labs.Intelligent.EmotionRecognition

Intelligent API

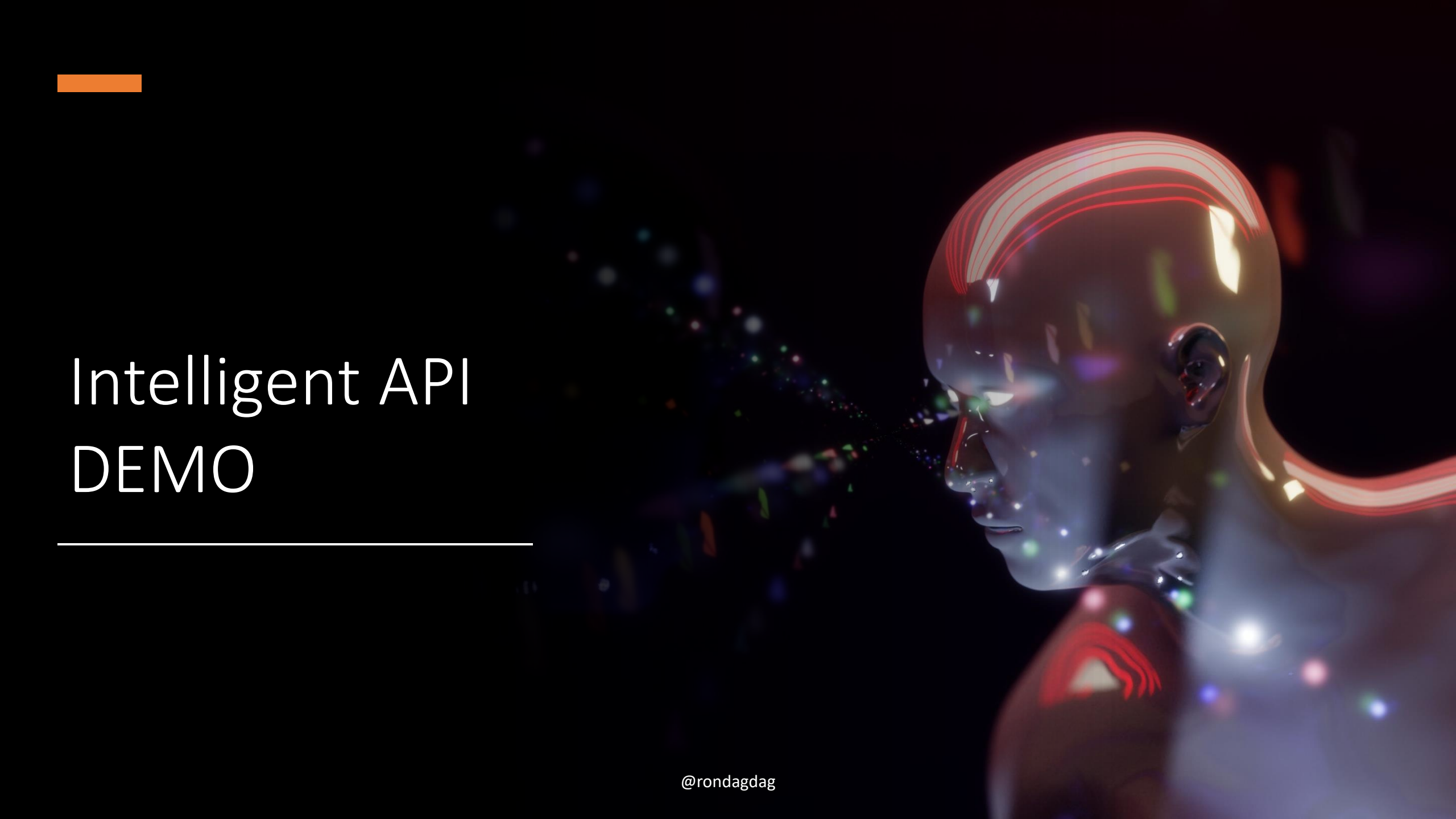
- Reference Library

  ```
  using CommunityToolkit.Labs.Intelligent.ImageClassification;
  ```

- Call Classify Image

  ```
  List<ClassificationResult> list = await
  SqueezeNetImageClassifier.ClassifyImage(selectedStorageFile, 3);
  ```

Intelligent API DEMO

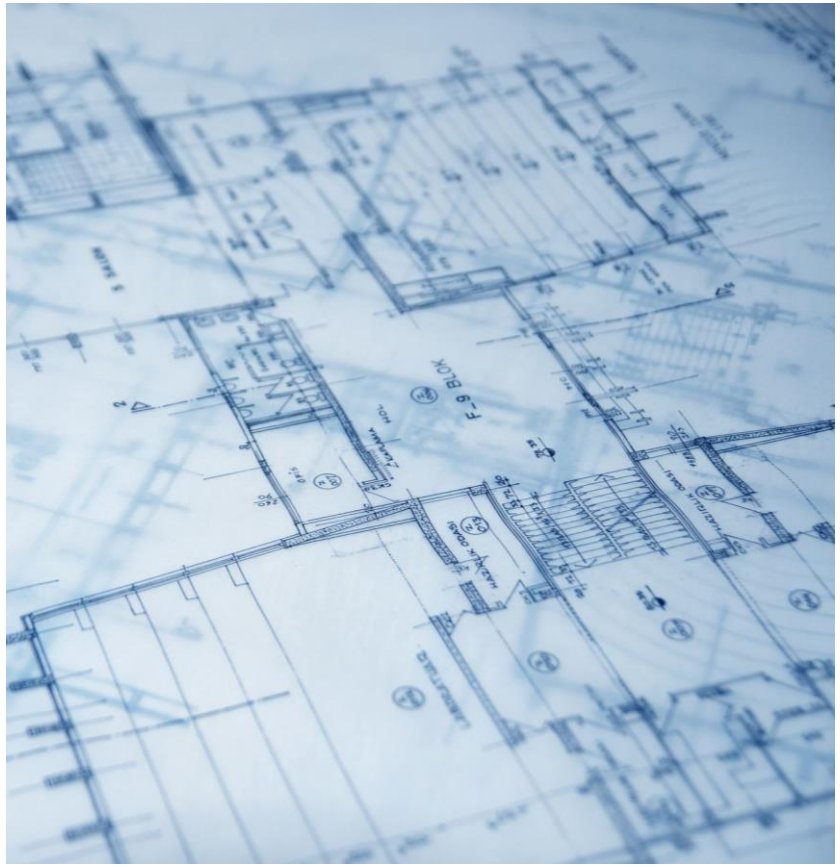


ML.NET

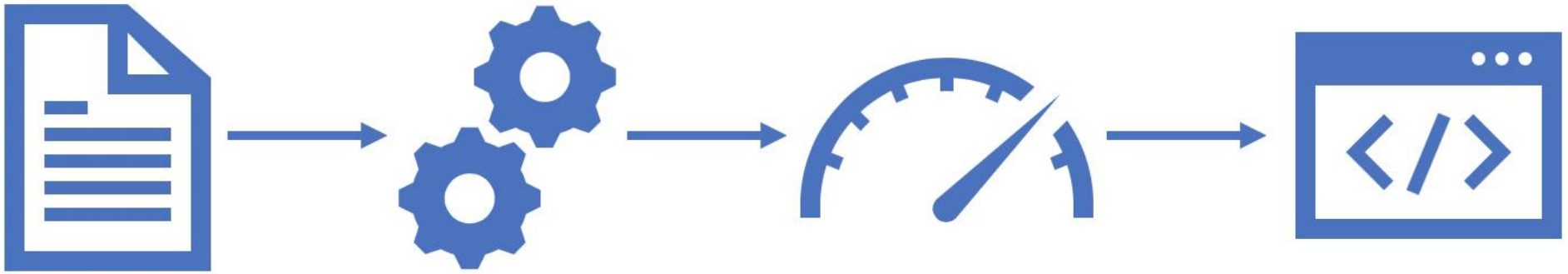
- machine learning to .NET applications
- Add automatic predictions to apps
- online or offline
- ML.NET can generate machine learning **model**.
- model - steps to transform input data into a prediction
- import pre-trained TensorFlow and ONNX models
- Supports Windows, Linux, and macOS

ML.NET Model Builder

- Simple UI tool in Visual Studio
- Runs locally to build, train and ship ML projects
- build/train in Azure
- Generates Custom ML models



Model Builder



Model Builder

Model Builder supports the following environment options:

Scenario	Local CPU	Local GPU	Azure GPU
Data classification	✓	✗	✗
Value prediction	✓	✗	✗
Image classification	✓	✓	✓
Recommendation	✓	✗	✗
Object detection	✗	✗	✓

Model Builder

Dataset size	Average time to train
0 - 10 MB	10 sec
10 - 100 MB	10 min
100 - 500 MB	30 min
500 - 1 GB	60 min
1 GB+	3+ hours

These numbers are a guide only. The exact length of training is dependent on:

- the number of features (columns) being used to as input to the model
- the type of columns
- the ML task
- the CPU, disk, and memory performance of the machine used for training

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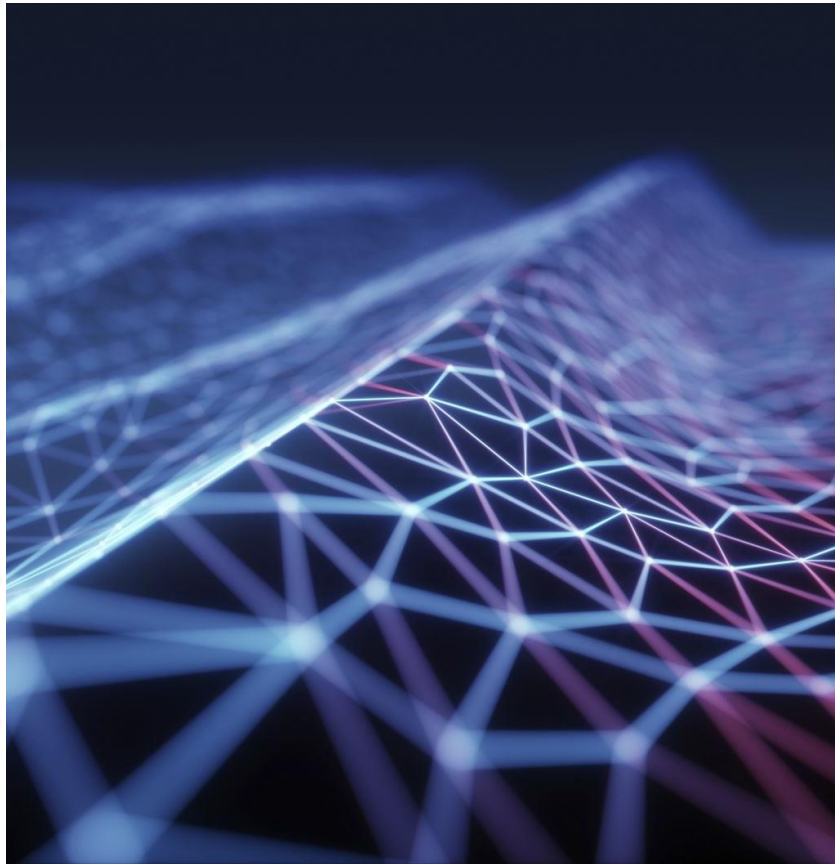
Open and Interoperable AI

When to use ONNX?

- Trained in Python - deploy into a C#/Java/Javascript app
- High Inferencing latency for production use
- Model to run resource on IoT/edge devices
- Model to run on different OS or Hardware
- Combine models created from different frameworks
- Training takes too long (transformer models)

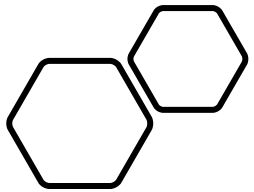


ONNX Runtime

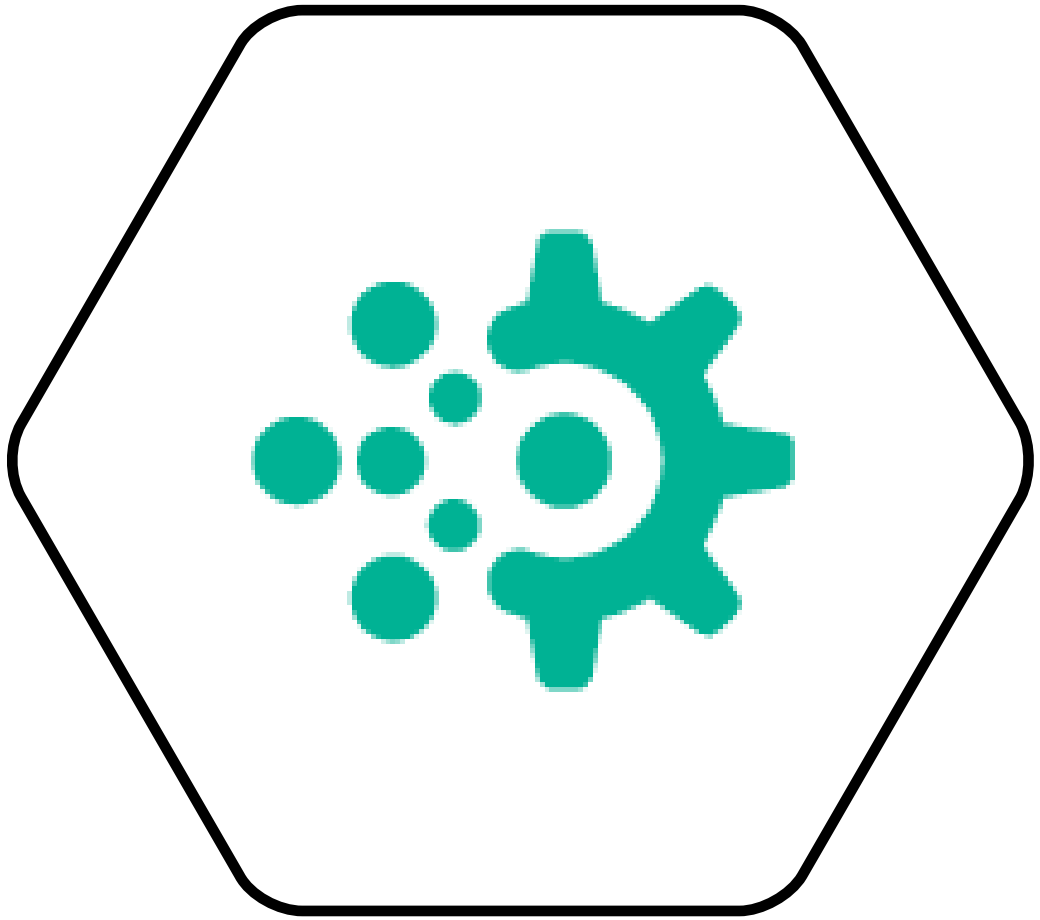
onnxruntime.ai

Optimize Inferencing | Optimize Training

Platform	**Windows**	Linux	Mac	Android	iOS	Web Browser (Preview)	
API	Python	C++	**C#**	C	Java	JS	Obj-C	WinRT
Architecture	**X64**	X86	ARM64	ARM32	IBM Power		
Hardware Acceleration	Default CPU	CoreML	CUDA	**DirectML**	oneDNN		
	OpenVINO	TensorRT	NNAPI	ACL (Preview)	ArmNN (Preview)		
	MIGraphX (Preview)	TVM (Preview)	Rockchip NPU (Preview)	Vitis AI (Preview)			
Installation Instructions	Install Nuget package **Microsoft.ML.OnnxRuntime.DirectML**						



Model Builder DEMO



Summary

- What is Machine Learning?
  - training and inferencing
- Windows Machine Learning
  - Implement ML in Windows apps
- Open Neural Network Exchange (ONNX)
  - ML Model file like pdf

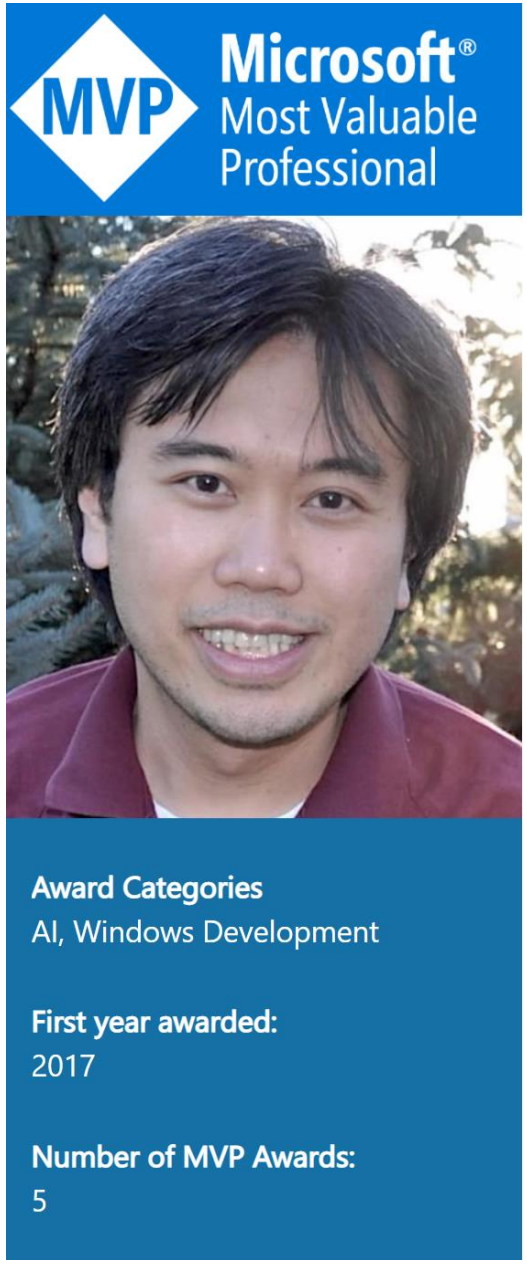
Summary

- ONNX Runtime
  - API to use onnx models into apps
- Community Toolkit - Intelligent API
  - Nuget package to add computer vision models to win apps
- ML.NET Model Builder
  - Generates Custom ML models in Visual Studio

https://github.com/rondagdag/mlnet-modelbuilder-talk

About Me

Ron Dagdag



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