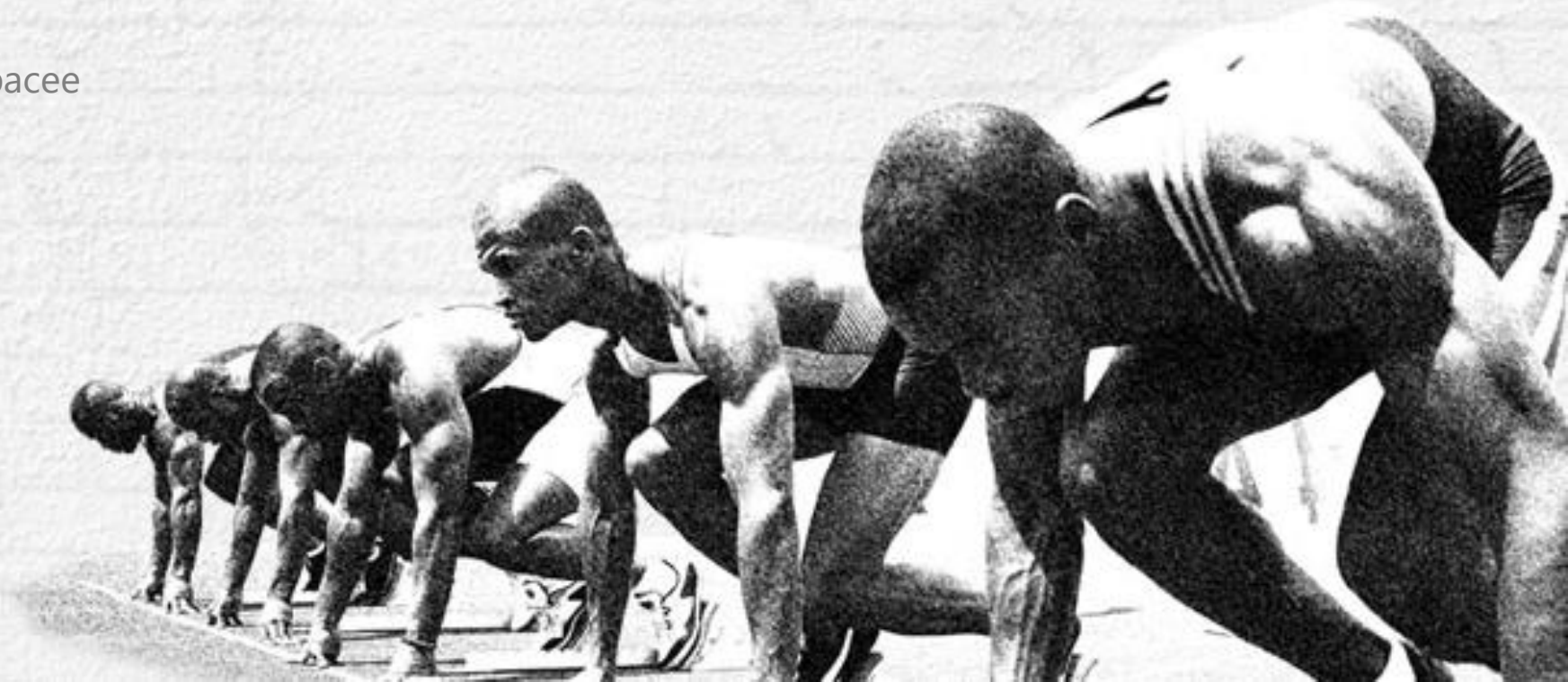
AI to the Edge

With Azure Percept

Ron Dagdag

Director of Software Engineering at Spacee

Microsoft AI and Windows MVP

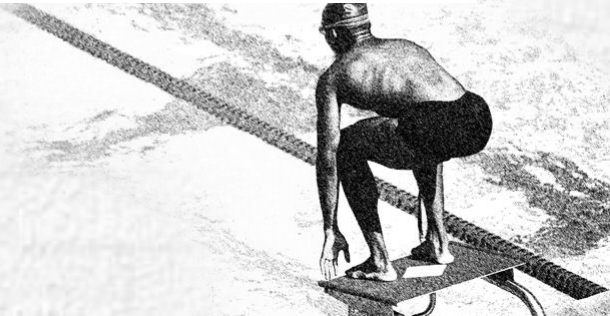


DATA PLATFORM VIRTUAL SUMMIT 2022

Diamond Knowledge Partner Microsoft

See no evil
Hear no evil
Speak no evil

Misaru
Kikasaru
Iwasaru

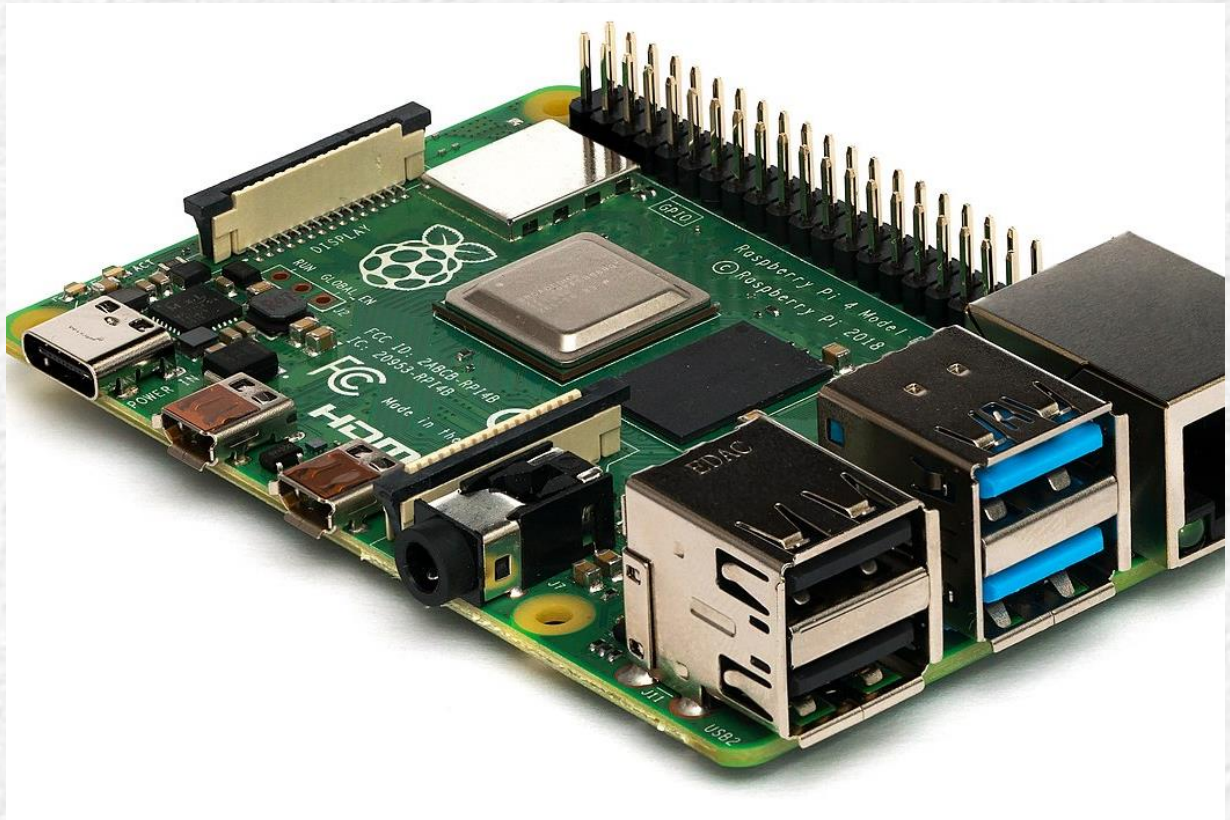


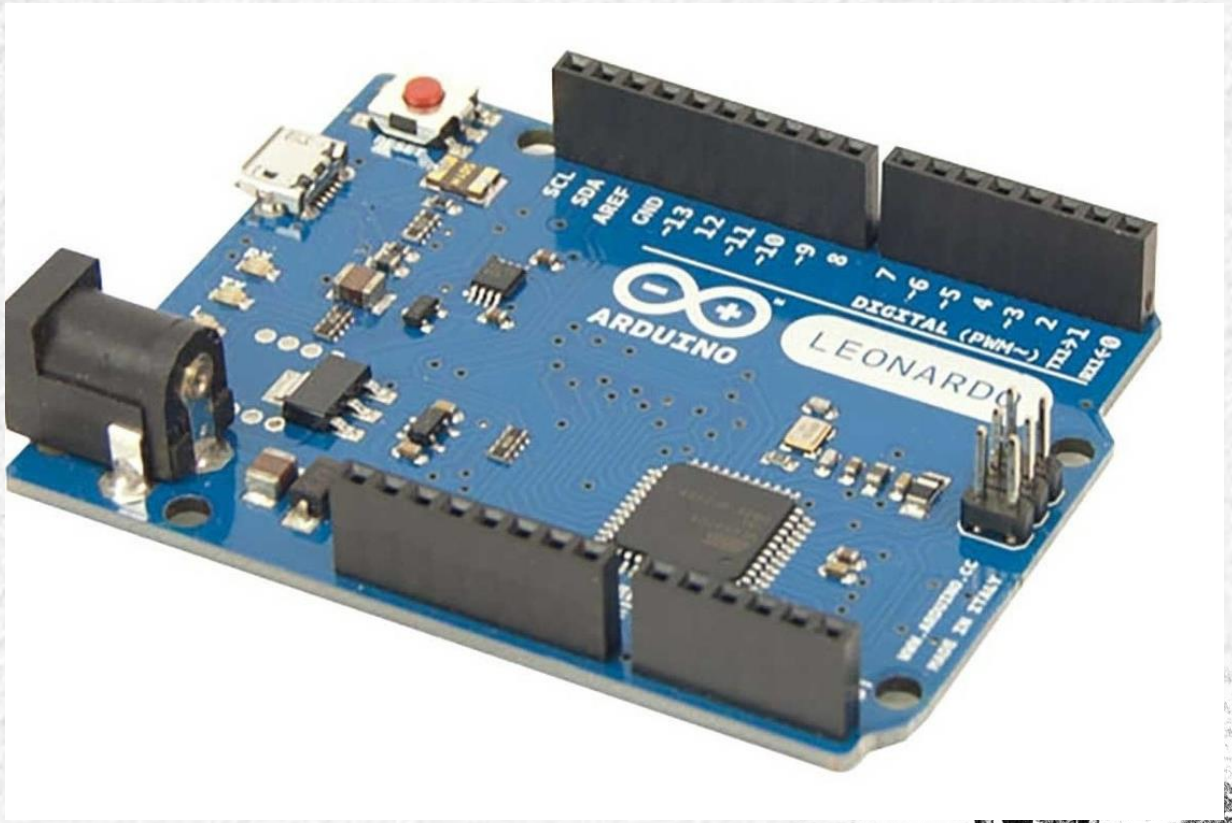
Tōshō-gū temple in Nikko, Japan

Agenda

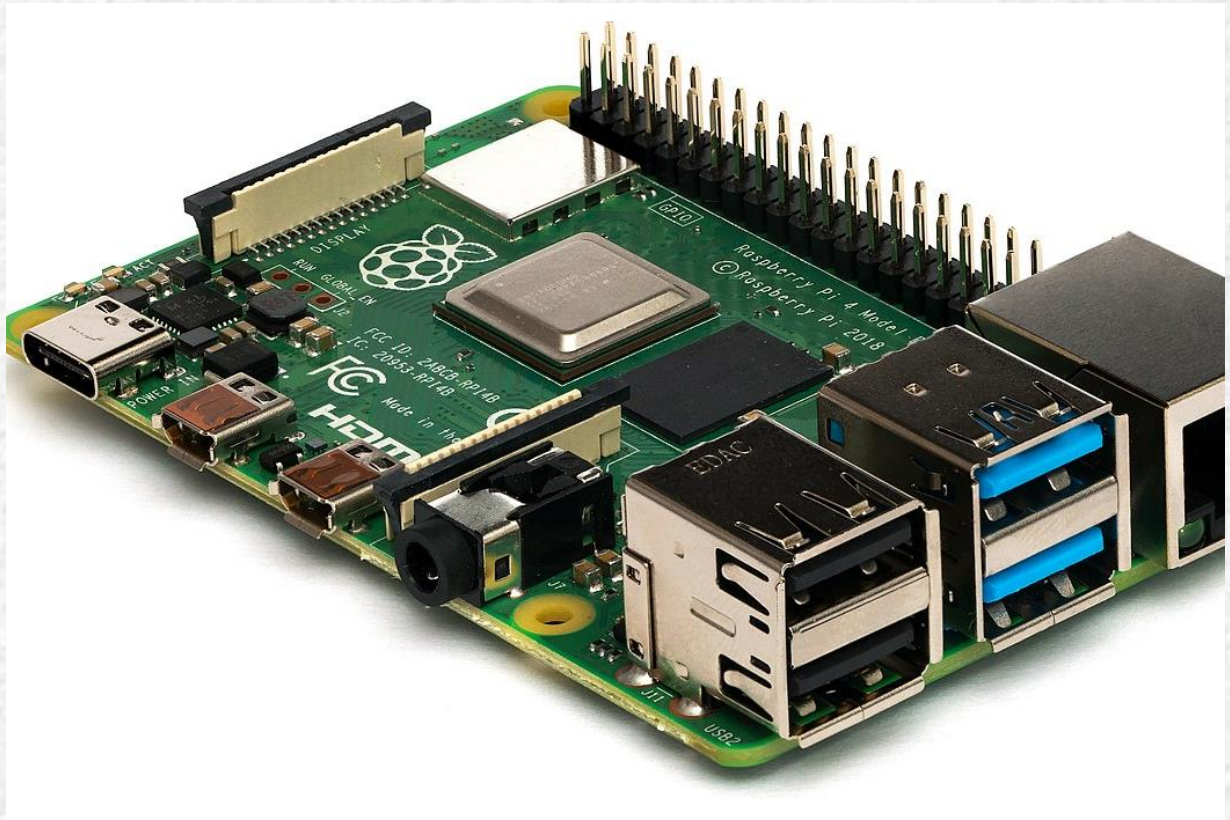
- What is AI enabled IOT?
- What is Azure Percept?
- Capabilities of Azure Percept
- Demo

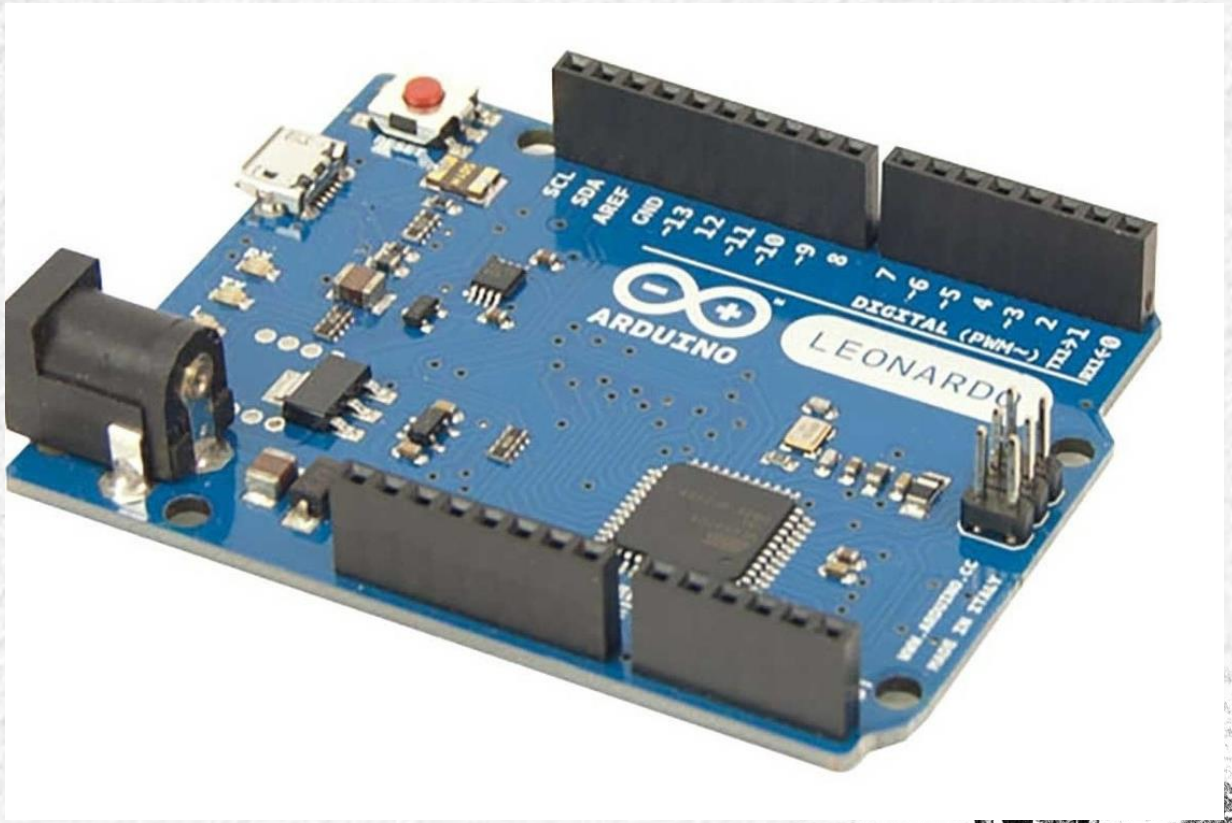
Internet Of Things



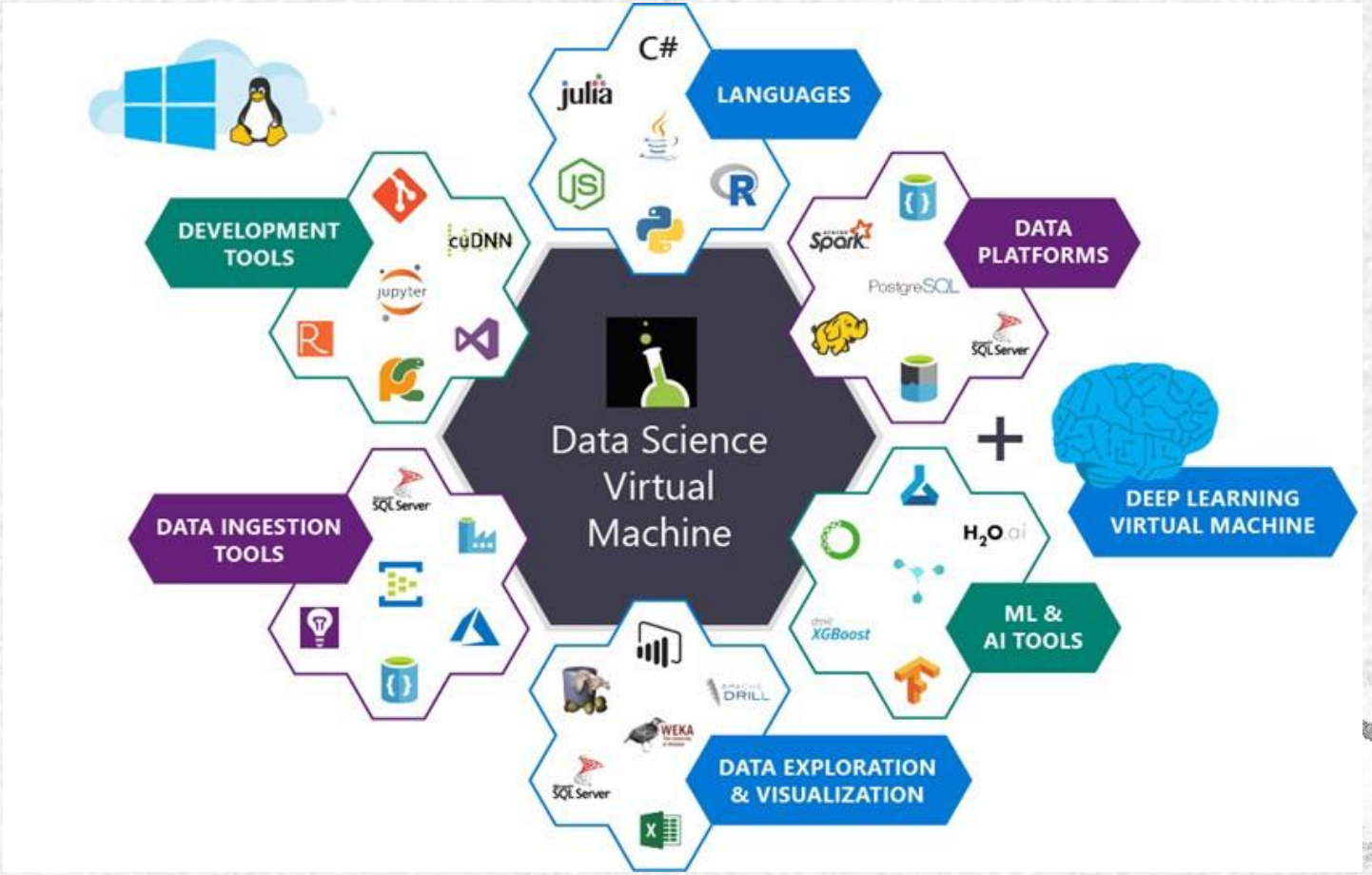


Internet Of Things





Computer Vision and Machine Learning



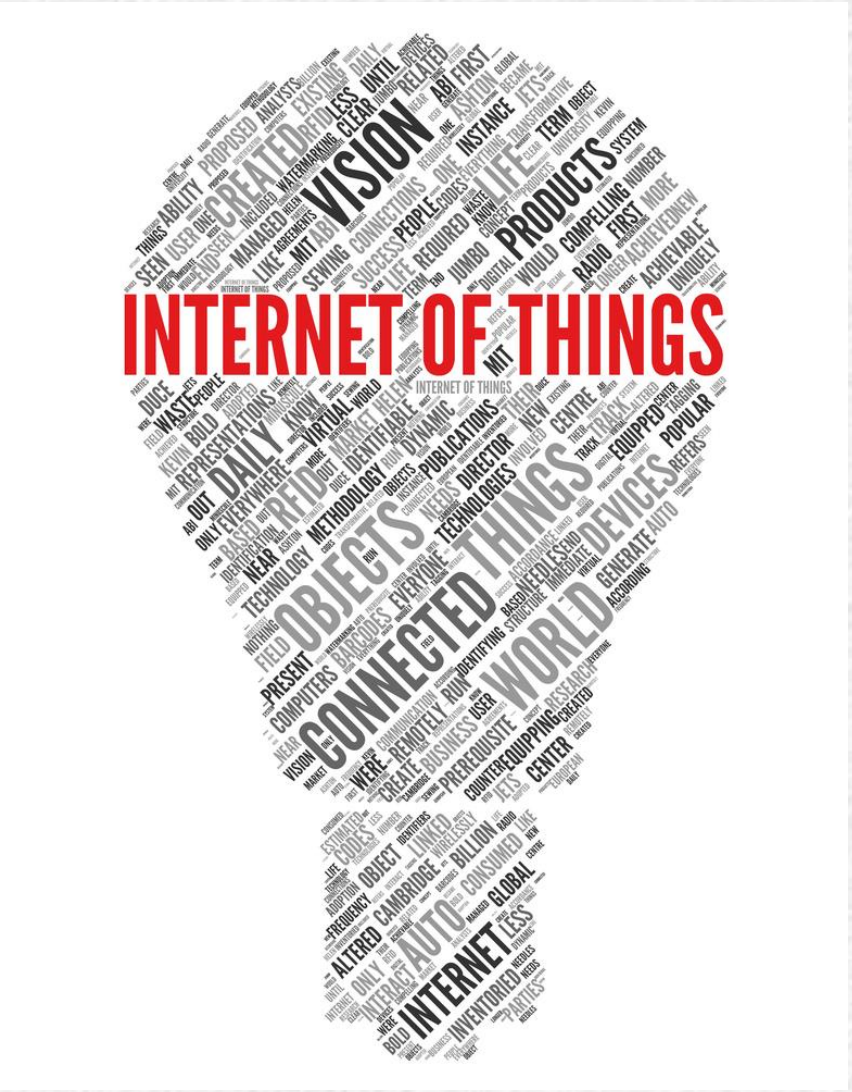
OpenCV

OpenVINO


@rondagdag

What is IOT?
Internet of Things

- connecting the Internet to the physical world via sensors
- Kevin Ashton in 1999
- any device that interacts with the physical world around it

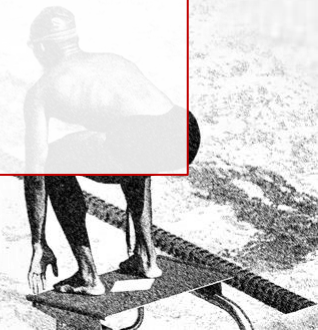


Remotely Monitor

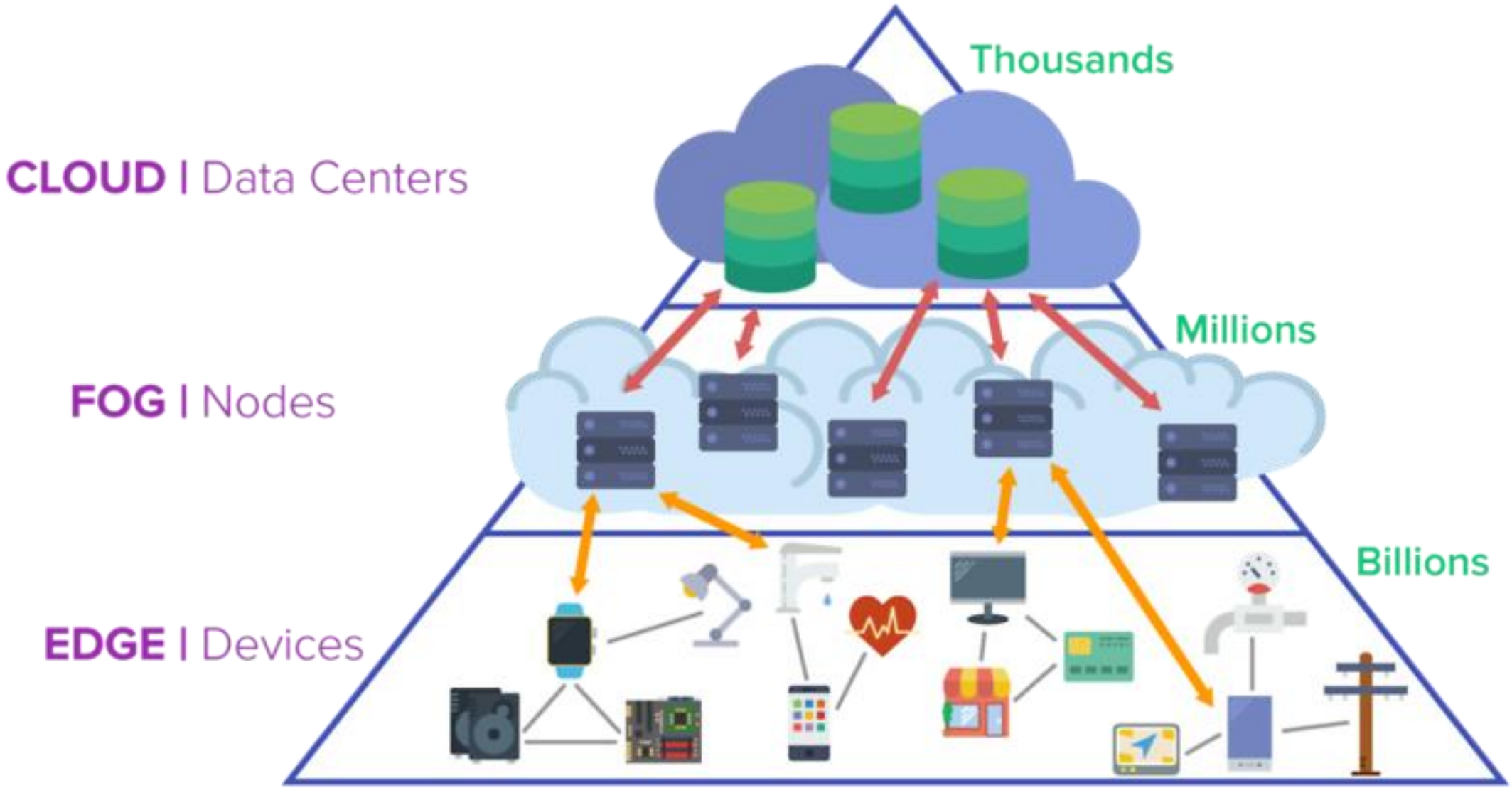
- Gather Data
- Edge Processing
- Device Status

Control Device

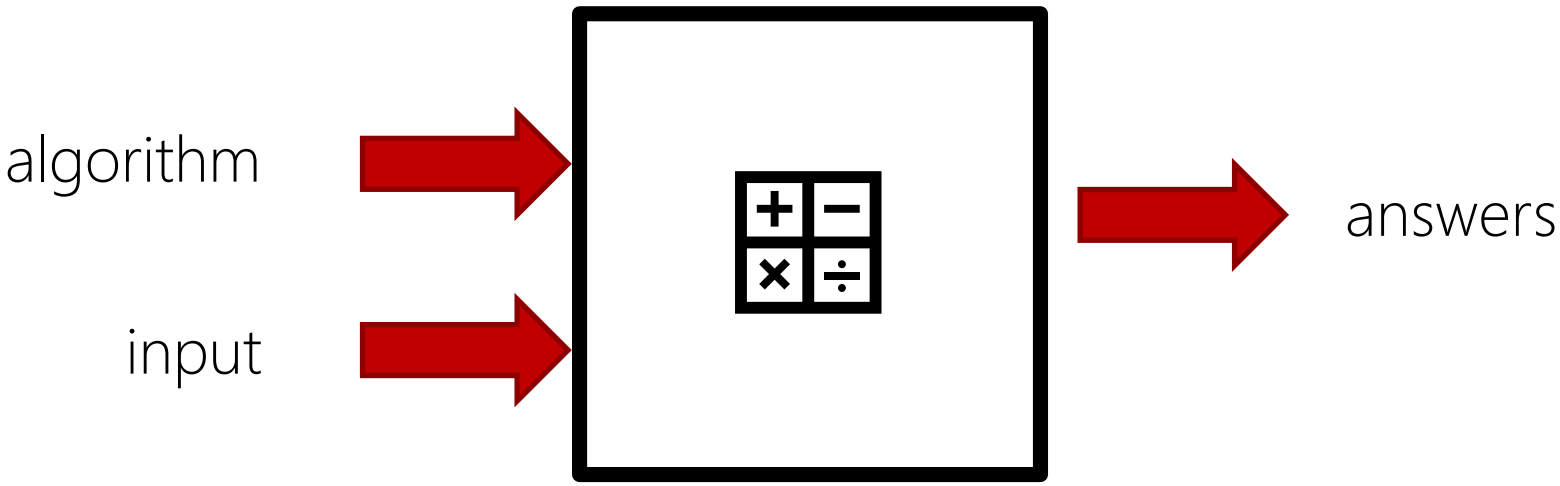
- Send Commands
- Set Device Properties



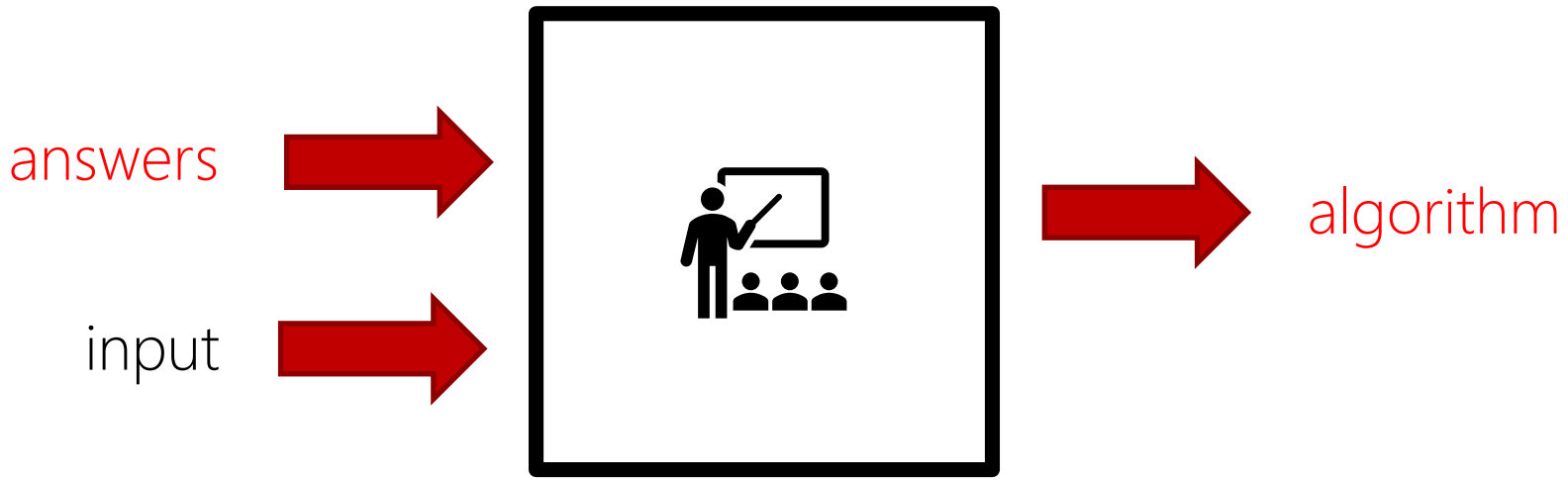
@rondagdag


CLOUD | Data Centers
Thousands
FOG | Nodes
Millions
EDGE | Devices
Billions

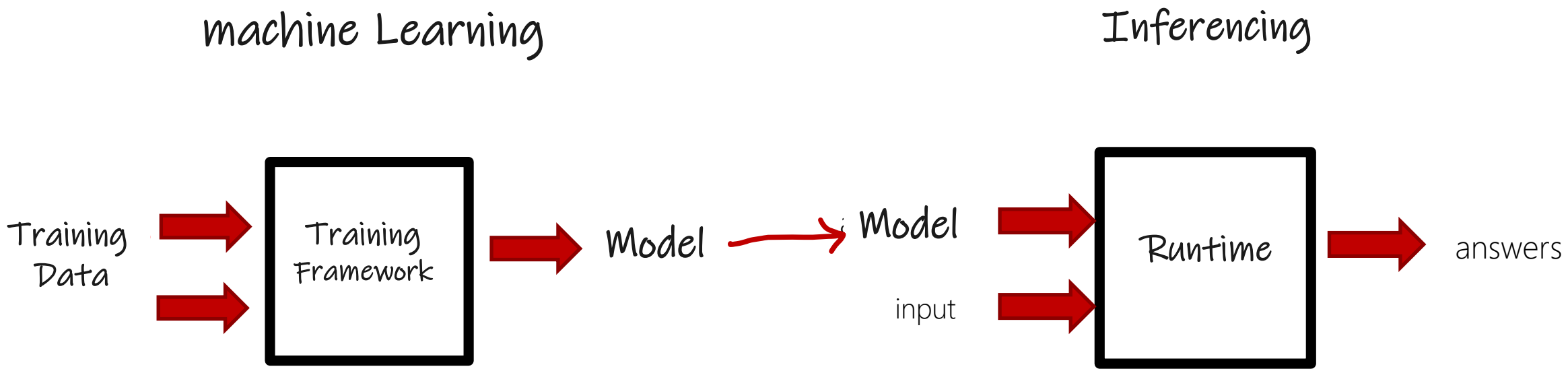
programming



machine learning



ML Primer


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

AZURE PERCEPT DEV KIT

@rondagdag


Azure Percept Dev Kit, Vision and Audio
Mics: x4 MEM mics Linear Array
CODEC: XMOS XUF208
Security: STM32L462CE
Audio: 16bit DAC
Buttons: 2x Momentary
LEDs: 3x RGB
Ports: USB Micro B
Azure Percept Audio
Azure Percept Vision
Processor: NXP iMX8m ARM
Memory: 4GB
Storage: 16GB
Security: TPM 2.0 Nuvoton NCPT750
Connectivity: WiFi & Bluetooth
Ports: 1xEthernet
1x USB C
2x USB A 3.0
Azure Percept Trust Module
VPU: Intel Movidius Myriad X (MA2085)
Memory: LPDDR4 2GB
Sensor: Sony IMX-219 (1.12 um) RGB
Security: STM32L462CE
Resolution: 8MP @ 30FPS
Ports: USB C & MIPI 4 Lane (up to 1.5 Gbps per lane)
Ports: USB Micro B

Always
Watching

Always
Recording

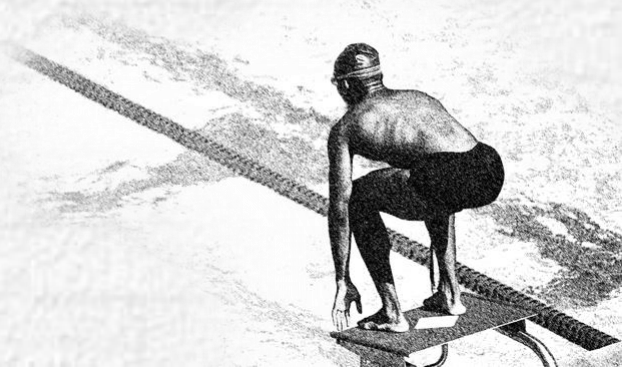
Process
Video Locally

Limited
Recording

Intelligent
Video Analytics

Azure Percept Vision

- Out-of-the-box AI recognition of common objects. No code required
- AI Acceleration
  - Intel Movidius Myriad X (MA2085) Vision Processing Unit (VPU) with Intel Camera ISP integrated, 0.7 TOPS
- Sensors and Visual Indicators
  - Sony IMX219 Camera sensor with 6P Lens
  - Resolution: 8MP at 30FPS, Distance: 50 cm – infinity
  - FoV: 120-degrees diagonal, Color: Wide Dynamic Range, Fixed Focus Rolling Shutter
- RGB Camera Support



Always Listening

Always Recording

Sound Processing at the edge

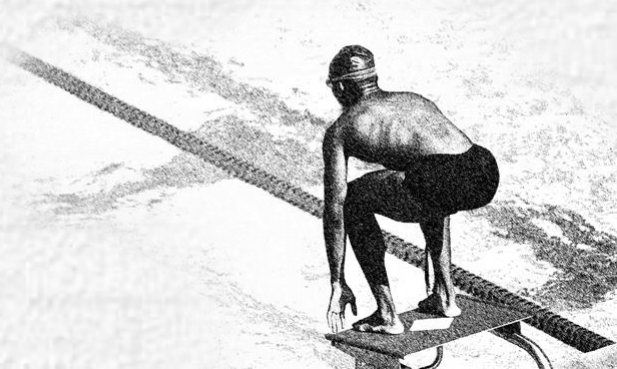
Limited Listening

Context Aware

Smart Assistants

Azure Percept Audio

- Performance
  - 180 Degrees Far-field at 4 m, 63 dB
- Sensors, Visual Indicators, and Components
  - 4x MEM Sensing Microsystems Microphones
  - 2x Buttons, USB Hub, DAC
  - 3x LEDs, LED Driver
- Ports
  - 1x USB 2.0 Type Micro B
  - 3.5 mm Audio Out



Always Broadcasting

Always Tracking

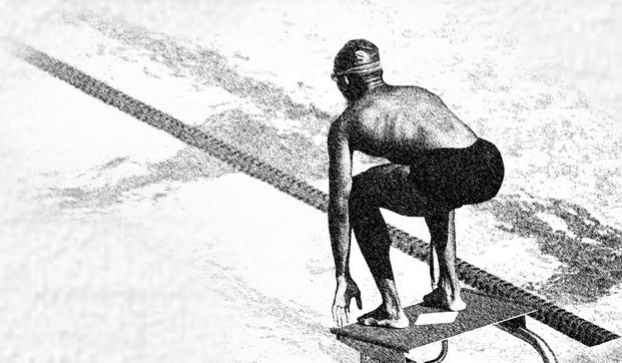
Data Processing at the Edge

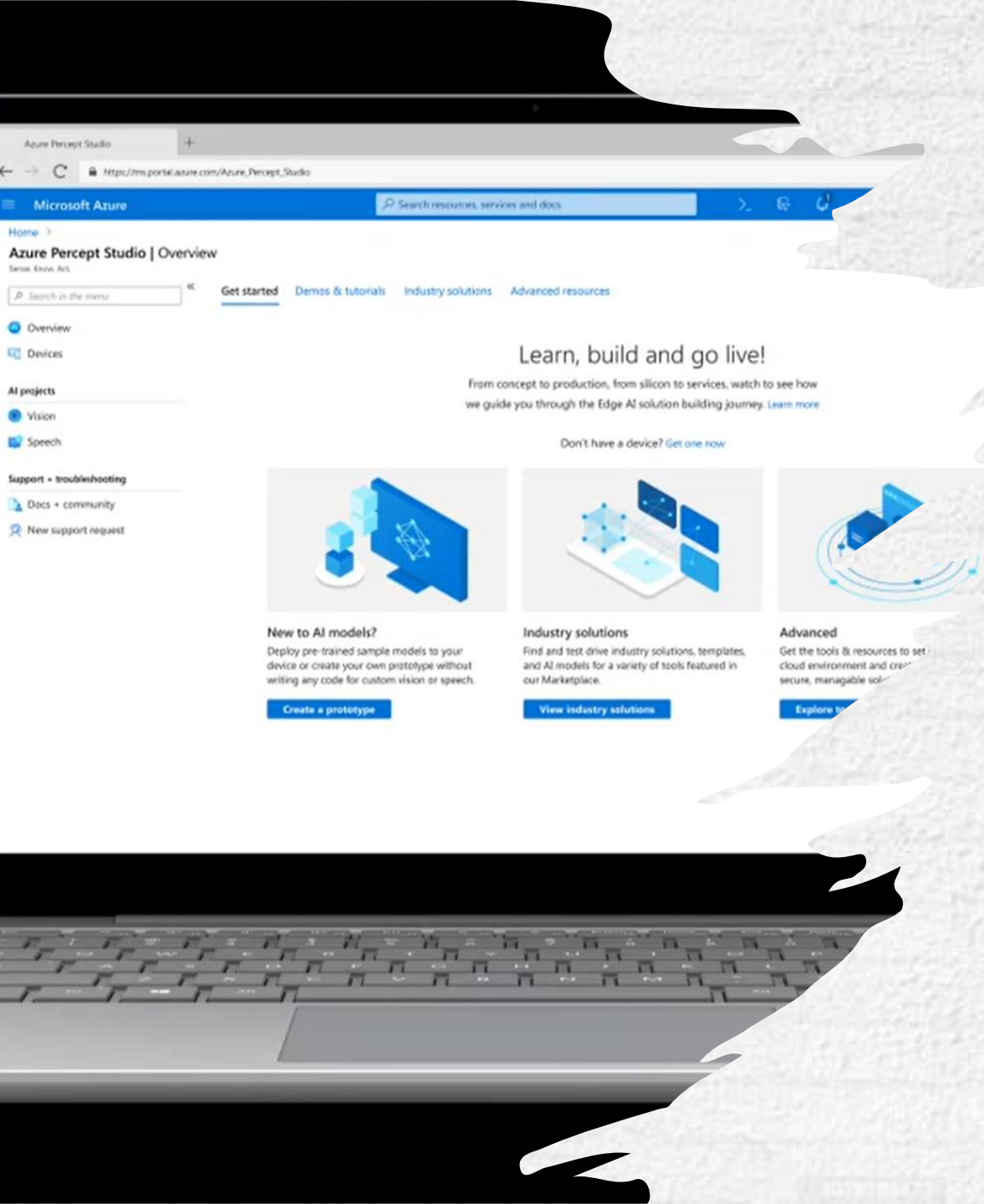
Limit information sent to the Cloud

Intelligent Edge

Azure Percept DK

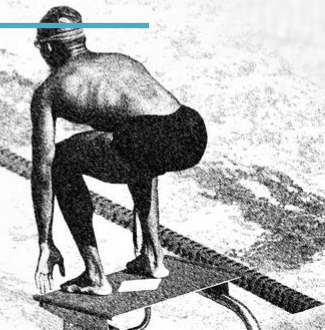
- Processor
  - NXP iMX8m
- Security
  - TPM 2.0 Nuvoton NCPT750
- Connectivity
  - Wi-Fi and Bluetooth via Realtek RTL882CE
- Ports
  - 1x Ethernet
    2x USB-A 3.0
    1x USB-C



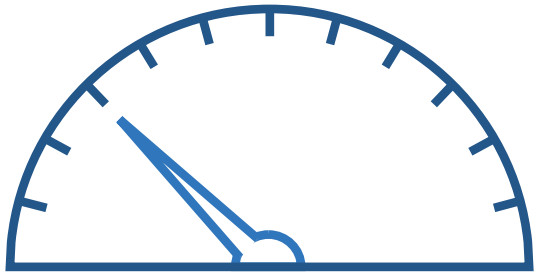


Azure Percept Studio

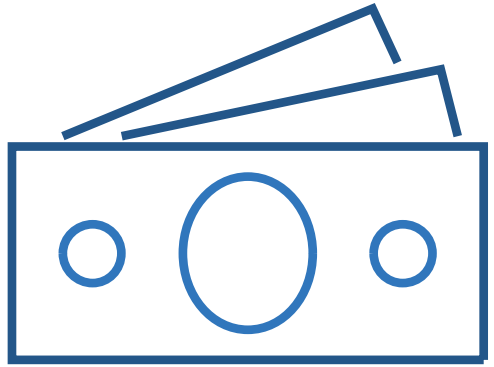
- Delightful onboarding
- Integrated experiences
- No code flow
- Advanced flow
- Prototype and deploy



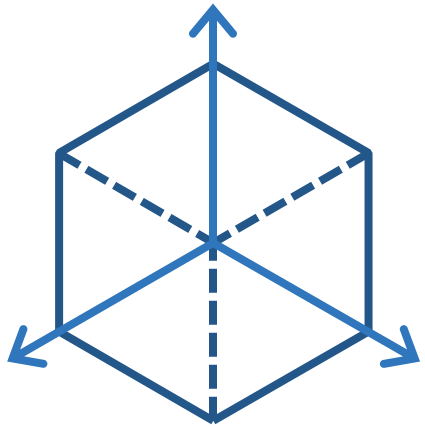
AI on the edge



Low latency

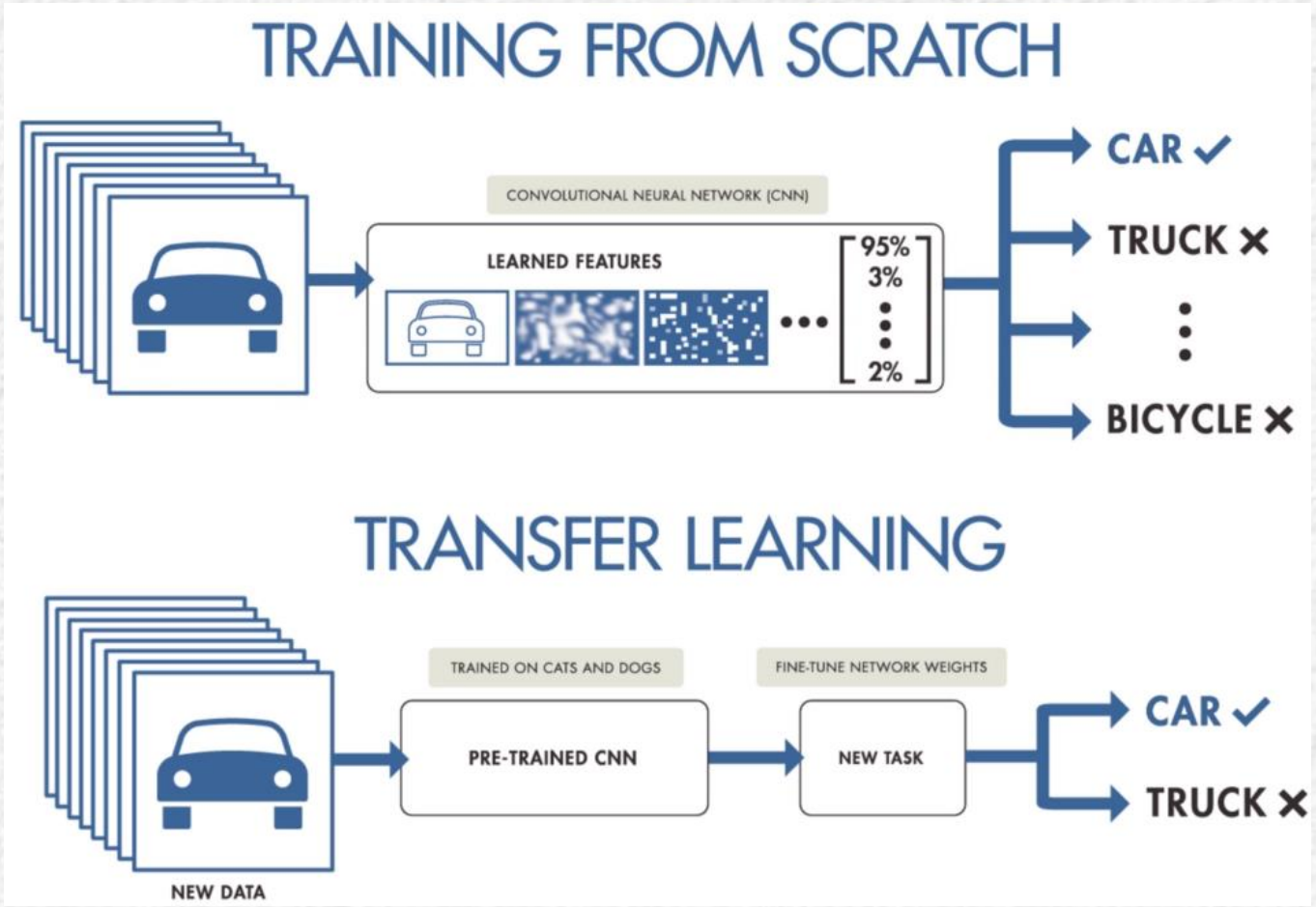


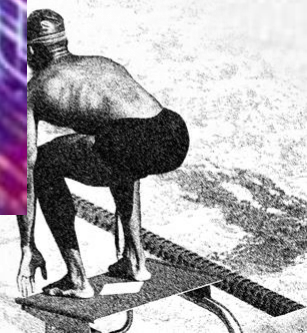
Scalability



Flexibility

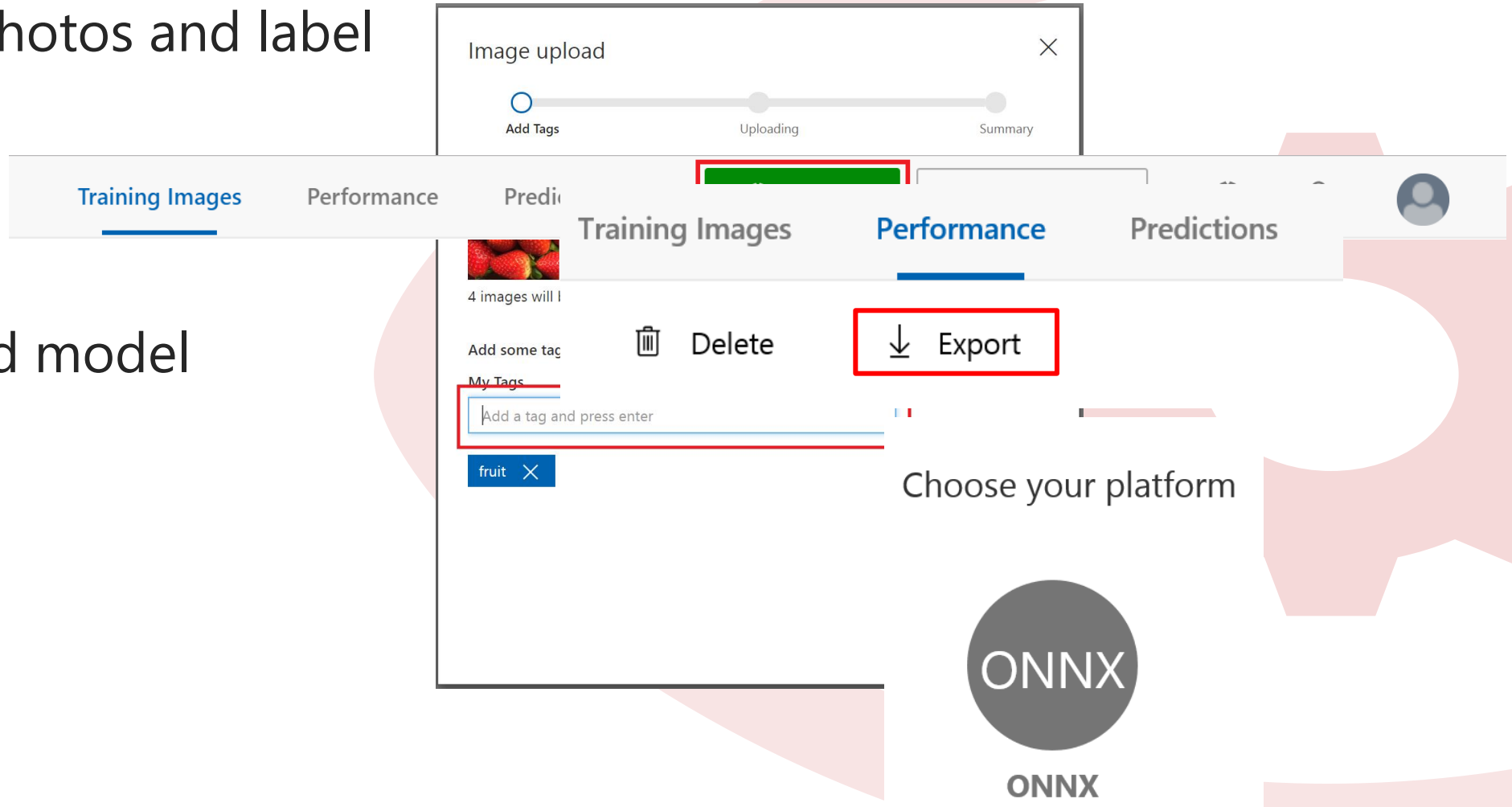
What is Transfer Learning?





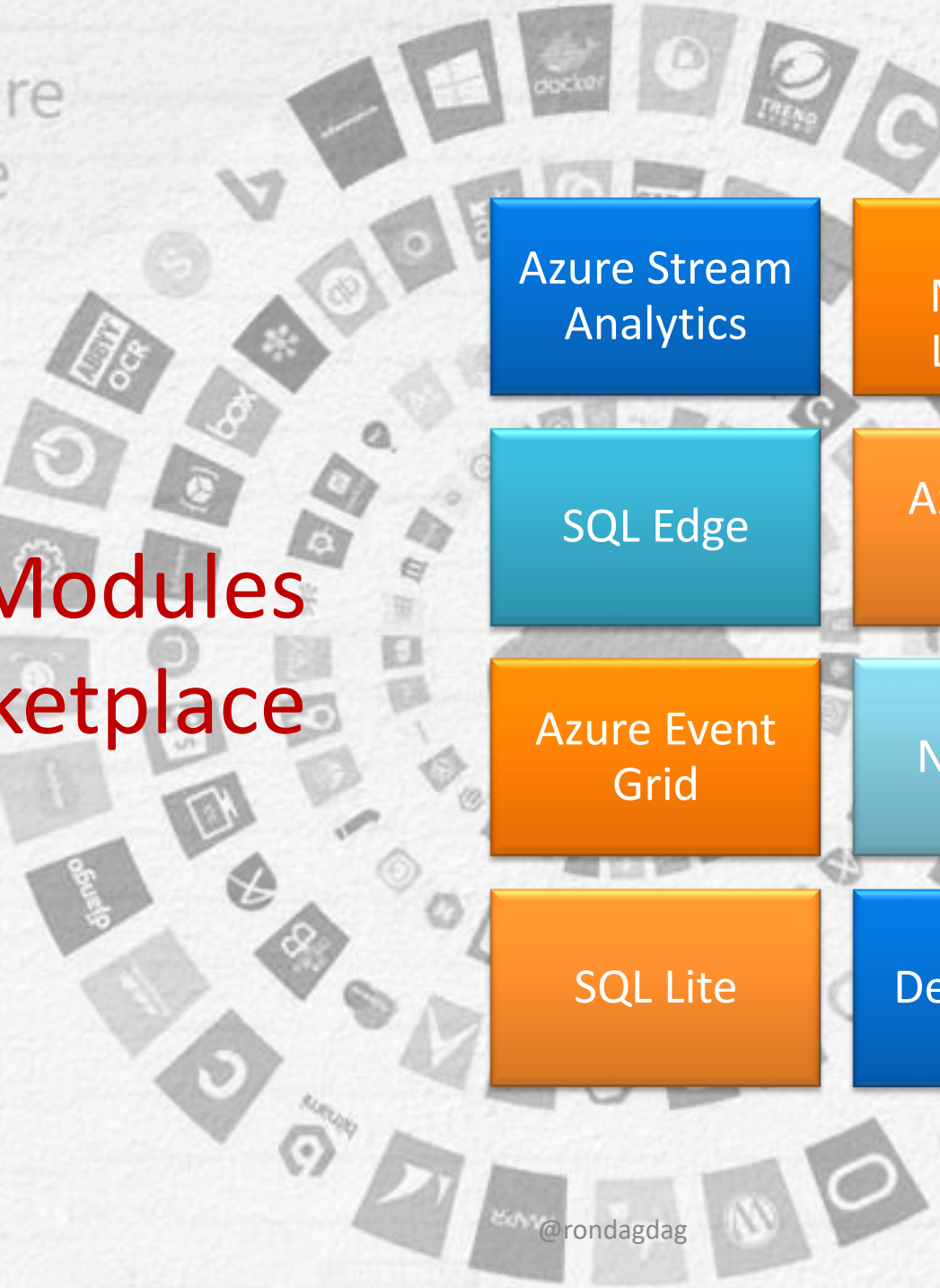
Custom Vision Service: customvision.ai

1. Upload photos and label
2. Train
3. Download model



Microsoft Azure Marketplace

IoT Edge Modules Azure Marketplace



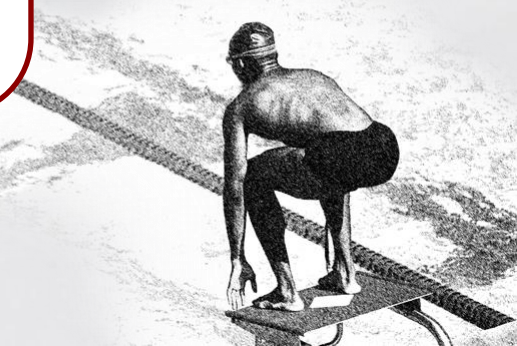
- Azure Stream Analytics
- Azure Machine Learning
- Custom Vision
- SQL Edge
- Azure Blob Storage
- Anomaly Detector
- Azure Event Grid
- Node-Red
- Redis-Edge
- SQL Lite
- Nvidia Deepstream SDK
- Live Video Analytics

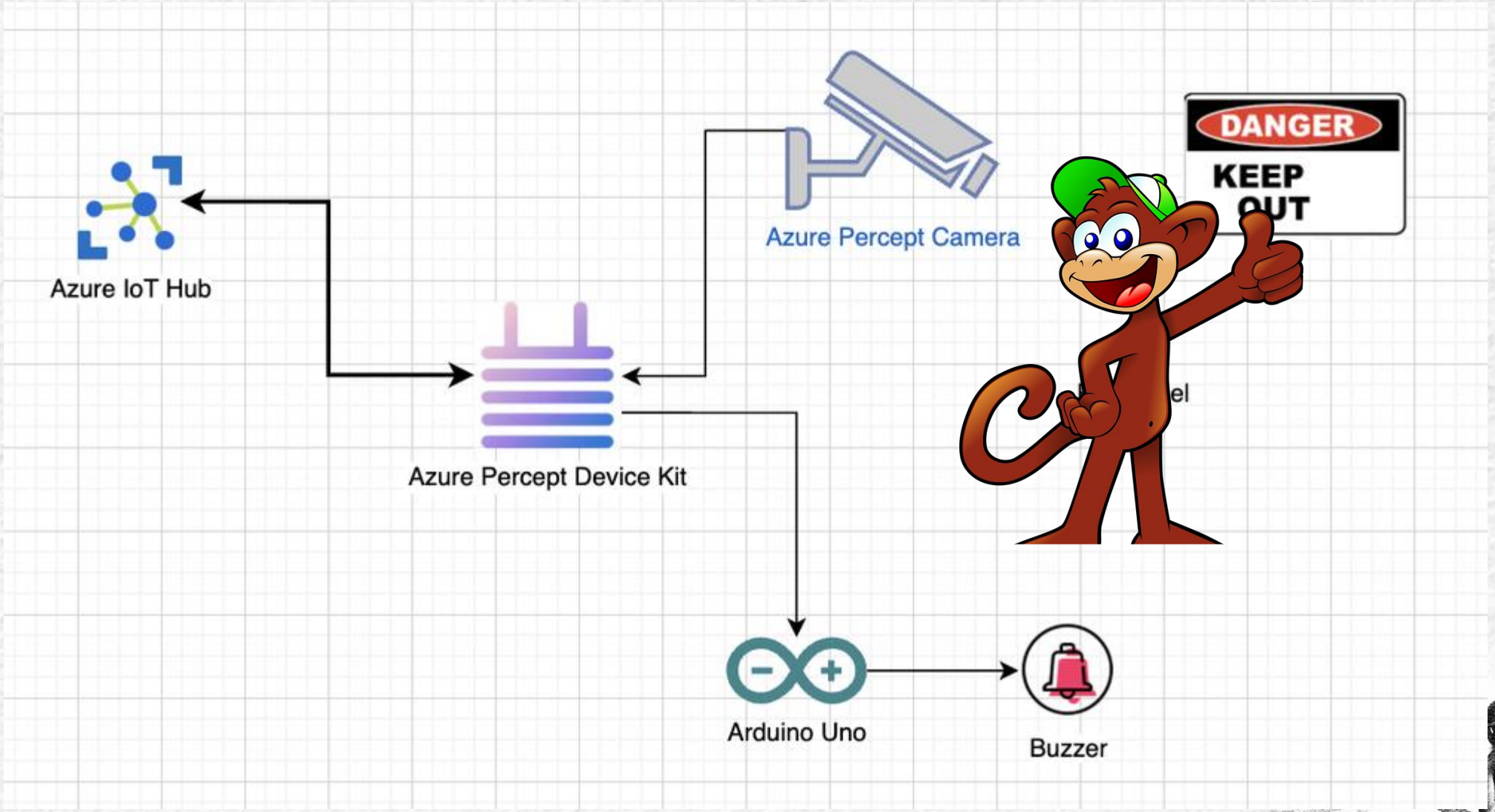
Demo

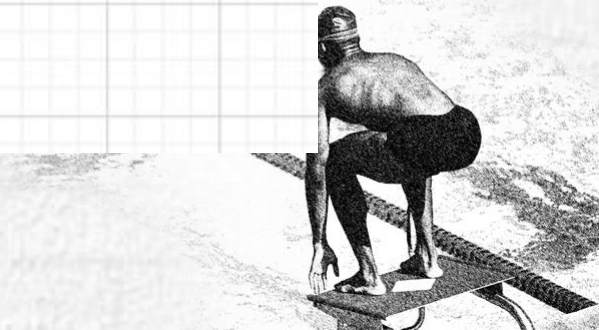
Azure Percept Studio

- Azure Percept DK
- Azure IoT Hub
- Azure Custom Vision
- ONNX Runtime
- OpenVINO
- Azure Percept Eye Module

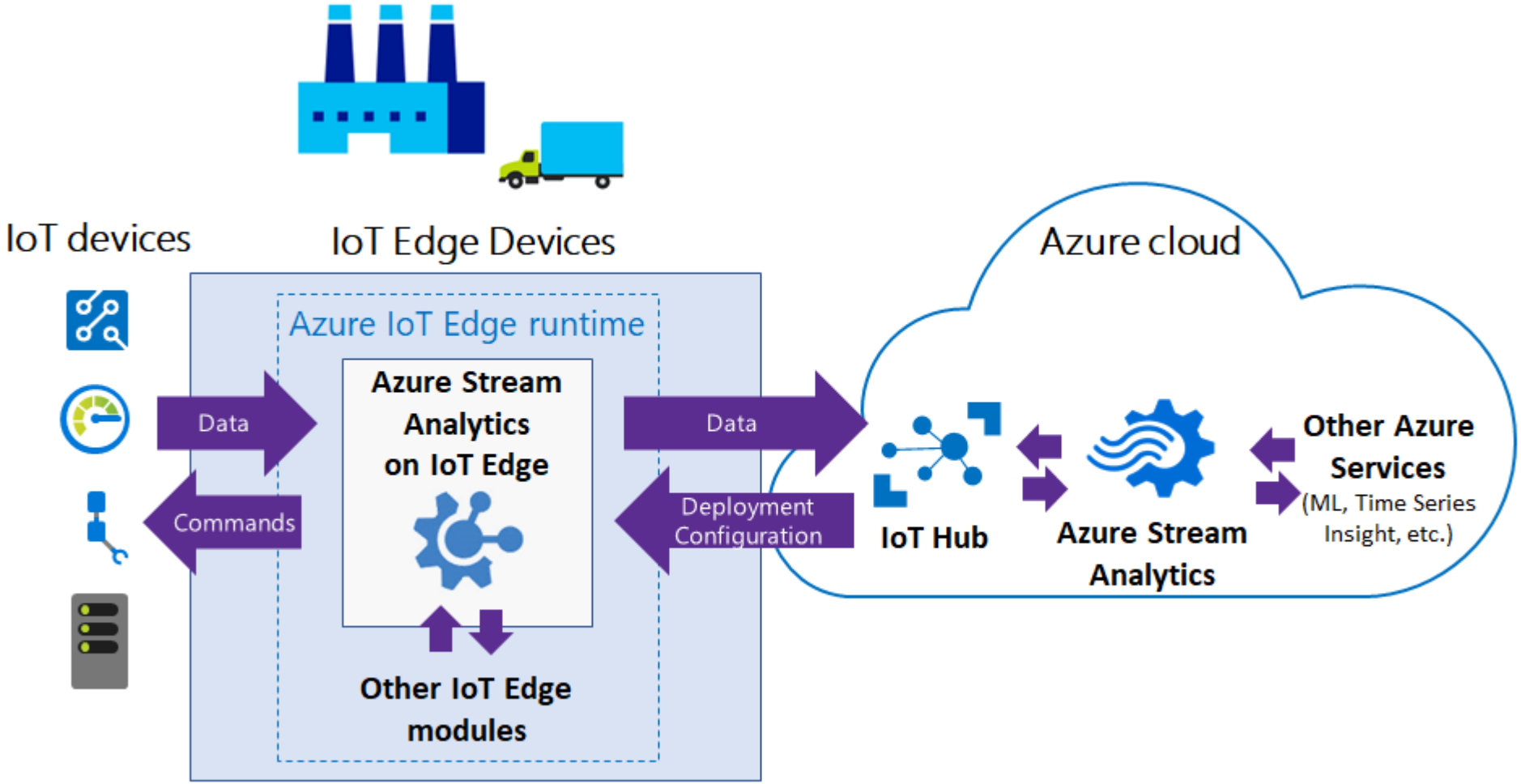
https://github.com/rondagdag/azurepercept-to-see-hear-speak-noevil



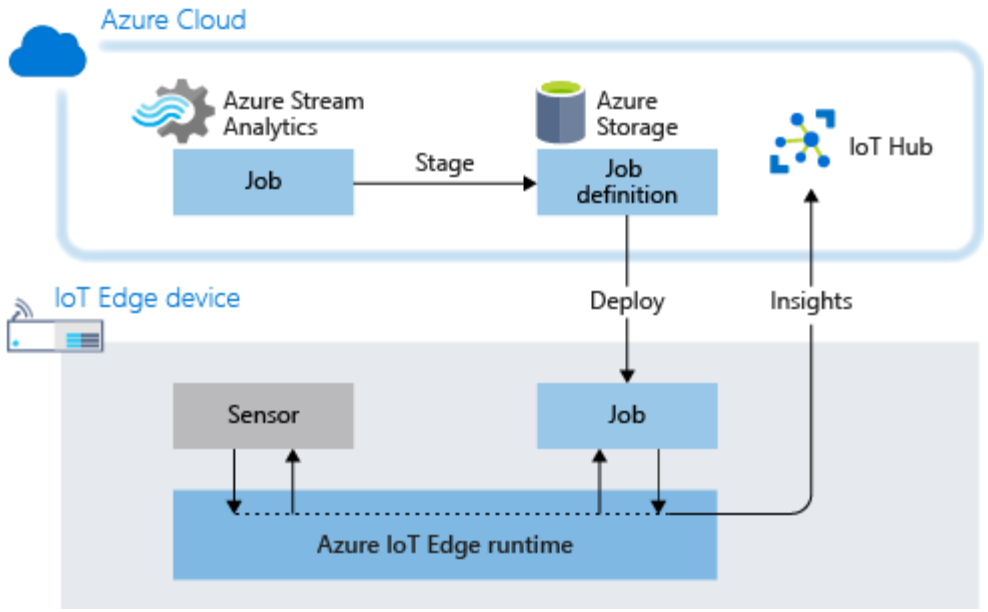

Azure IoT Hub
Azure Percept Camera
DANGER
KEEP
OUT
Azure Percept Device Kit
Arduino Uno
Buzzer



Azure Stream Analytics on Percept



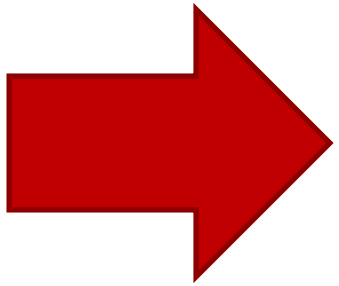
Azure Stream Analytics on Azure Percept



@rondagdag

Data Coming out of Azure Eye Module


```
[{
    "body": {
      "NEURAL_NETWORK": [
        {
          "bbox": [
            0.32,
            0,
            0.592,
            0.834
          ],
          "label": "person",
          "confidence": "0.970703",
          "timestamp": "1633275502757261752"
        }
      ]
    },
    "enqueuedTime": "2021-10-03T15:38:24.365Z"
  },
  {
    "body": {
      "NEURAL_NETWORK": [
        {
          "bbox": [
            0.343,
            0.002,
            0.593,
            0.847
          ],
          "label": "person",
          "confidence": "0.980957",
          "timestamp": "1633275501674003741"
        }
      ]
    },
    "enqueuedTime": "2021-10-03T15:38:23.272Z"
  },
```

Data Coming out of ASA Edge Module


```
"body": {
    "Label": "speak",
    "Count": 14
}
```

```
WITH ReaderQuery AS (
  SELECT
  CAST(Data.arrayvalue.label AS NVARCHAR(MAX)) as Label,
  CAST(Data.arrayvalue.timestamp as BIGINT) as UNIXtimestamp

FROM
  iotinput
  Cross apply GetArrayElements(NEURAL_NETWORK) as Data
WHERE
    CAST(Data.arrayvalue.confidence as Float) > 0.6
)
SELECT
    Label,
    Count(*)
INTO alert
FROM ReaderQuery
GROUP BY Label, TumblingWindow(second, 15)
```

https://docs.microsoft.com/en-us/azure/iot-edge/tutorial-deploy-stream-analytics

Demo

Azure Stream Analytics

- IoT Edge
- Deployment

https://github.com/rondagdag/azurepercept-to-see-hear-speak-noevil

Recap

✓ What is AI enabled IOT?

AI – Learn from data

IOT - Monitor and Control devices

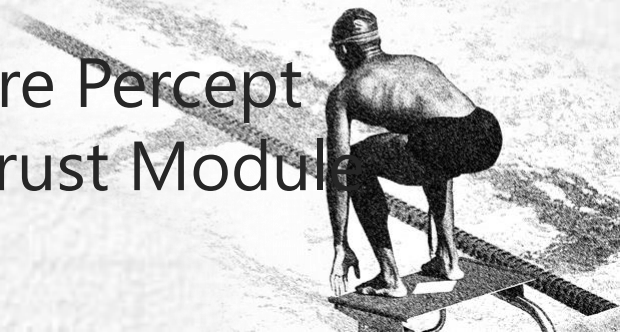
Process AI workload at the Edge

✓ What is Azure Percept?

Easy way to prototype and deploy AI to the Edge

✓ Capabilities of Azure Percept

Vision, Audio, Trust Module



Ron Dagdag

Director of Software Engineering / AI Edge Specialist

6th year Microsoft MVP awardee

Email: ron@dagdag.net
Twitter @rondagdag https://linktr.ee/rondagdag

Linked In
www.linkedin.com/in/rondagdag/

Thanks for geeking out with me about Monkeys and Azure Percept

Special Thanks To

Microsoft

for supporting

DataPlatformGeeks & SQLServerGeeks

Community Initiatives

SQLServerGeeks

Data Platform Summit

DataPlatformGeeks

Thank You

Three Ways to Win Prizes

Post your selfie with hash tag **#DPS2022**

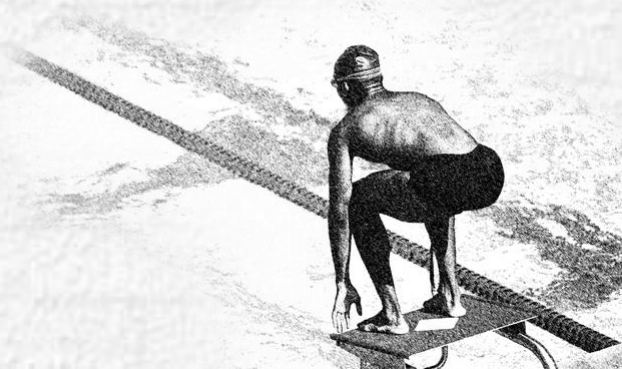
Give Session & Conference Feedback

Visit our Sponsors & Exhibitors

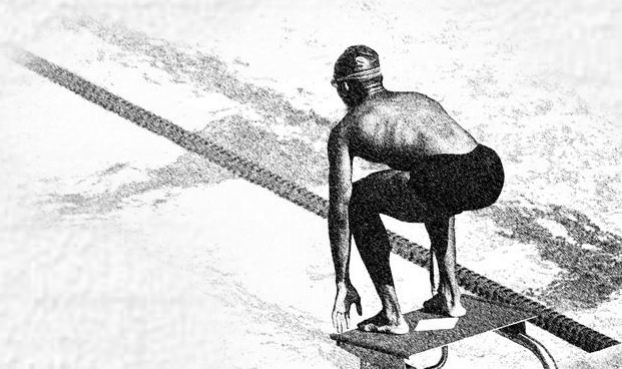
Follow us on Twitter **@TheDataGeeks @DataAISummit**

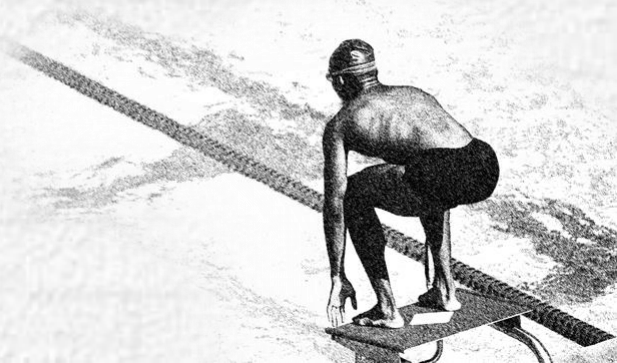
DATA PLATFORM
VIRTUAL SUMMIT 2022

Diamond Knowledge Partner Microsoft




@rondagdag






@rondagdas