ADVANTECH

Enabling an Intelligent Planet

TechTalks:

The Evolution of Edge Computing and AI

Steen Graham, General Manager, IoT Ecosystem & Channels, Intel Corporation

Dr. Jau Huang, Chairman & CEO, CyberLink

Stephen Huang, AVP of Embedded-IoT Group, Advantech

Paradigm Shift: Edge Computing and Edge AI

Cloud Computing

Edge Computing

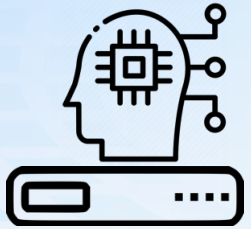
Edge Intelligence

$9 billion

Edge computing market by 2024
—MarketsandMarkets

Driving Forces:
Low Latency
Bandwidth
Data Security
Connectivity

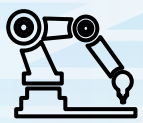
AI Inference Systems



1.5 billion

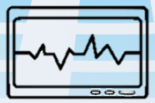
AI-optimized edge systems in 2023
—IDC report

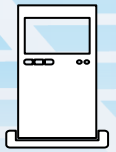
Devices


Robotics


IP CAM


Drones


Medical Equipment


KIOSK/POS


Digital Signage


Transportation

ADVANTECH

Edge Computing and Intelligence Solutions

ADVANTECH

WISE-PaaS

AIoT Solutions & Marketplace

Multi-Cloud Interoperability & Application Services

Equipment Mgmt.

Asset Mgmt.

Face ID Recognition

License Plate Recognition

Edge.SRP

- Edge.SRP Signage CMS
- Edge.SRP EdgeLink
- WebAccess SCADA
- WebAccess CNC

DeviceOn.App

- DeviceOn OTA
- DeviceOn E2I
- DeviceOn ePaper
- DeviceOn FaceView

3rd Party App

- McAfee
- Acronis
- Alleantia
- Azure

Wireless Gateways

Embedded Computers

Edge Intelligence Servers

Digital Signage Players

AI Inference Systems

CO2 / Temp,/ Vibration / pH Sensors

Machines/ Manufacturing/KIOSK

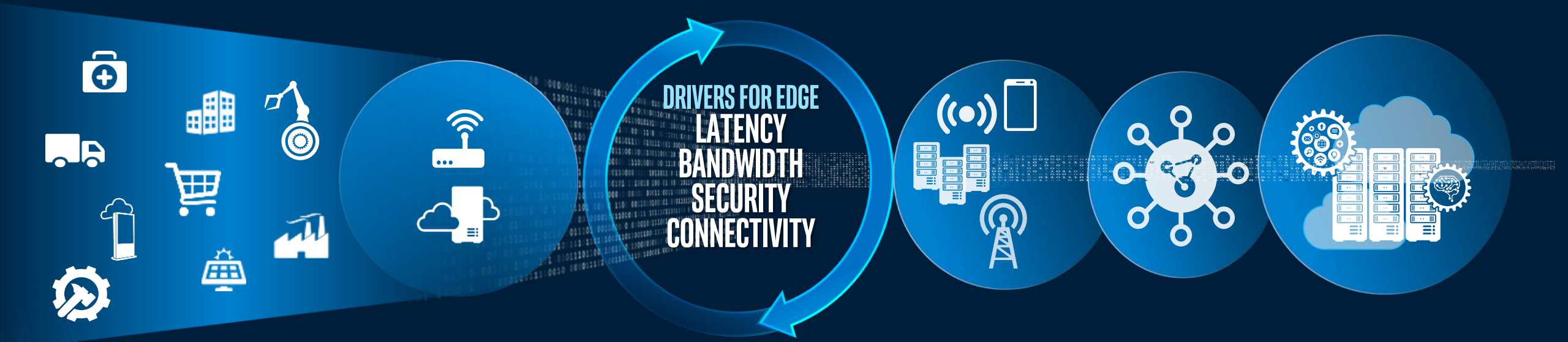
Air Compressor / Energy Storage/ Robotic

Display/ Signage

Camera

STEEN GRAHAM 葛雲龍
GENERAL MANAGER, IOT ECOSYSTEM & CHANNELS
INTERNET OF THINGS GROUP
INTEL CORPORATION

PARADIGM SHIFT TO EDGE COMPUTING



IOT & DEVICES | ON-PREMISE EDGE | NETWORK HUB OR REGIONAL DATA CENTER | CORE NETWORK | CLOUD DATA CENTER

75% of enterprise-generated data will be created and processed outside the a traditional centralized data center or cloud by 2025[1]

43% share of AI tasks taking place on edge devices (vs. cloud) in 2023[2]

15X growth in devices with edge AI capabilities by 2023[2]

1. Gartner; https://www.gartner.com/smarterwithgartner/what-edge-computing-means-for-infrastructure-and-operations-leaders
2. ABI Research: https://www.abiresearch.com/press/hardware-vendors-will-win-big-meeting-demand-edge-ai-hardware/

DEEP LEARNING WITH OPENVINO™ TOOLKIT

OpenVINO™

VISION PRODUCT OF THE YEAR 2019

WHAT'S NEW

- ✓ DEEP LEARNING WORKBENCH
- ✓ NETWORK LOAD OPTIMIZATION
- ✓ COMMAND LINE DEPLOYMENT MANAGER
- ✓ CUSTOM LAYERS
- ✓ PARALLEL & HETEROGENOUS INFERENCING
- ✓ SUPPORT 10TH GEN INTEL® CORE™ PROCESSORS

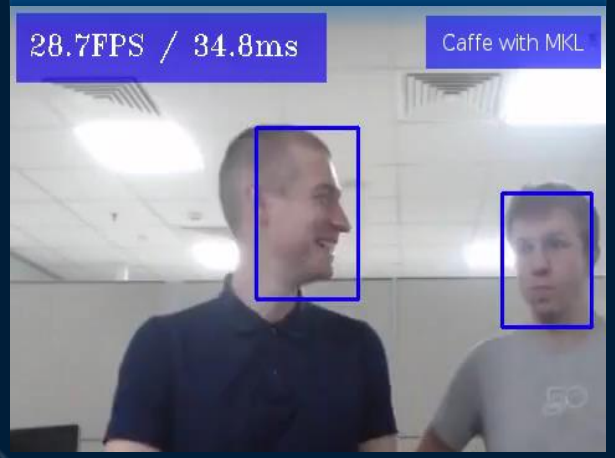
>40 PRE-TRAINED MODELS

FACTORY YIELD IMPROVEMENT

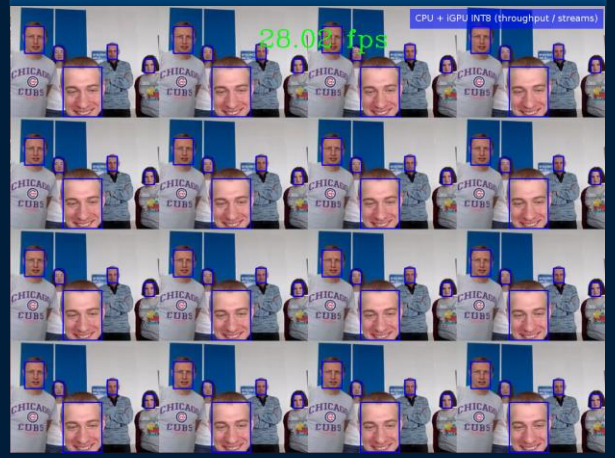
OpenVINO™ DELIVERING PERFORMANCE & SCALE

SAME HARDWARE, BETTER SOFTWARE

WITHOUT OPENVINO



WITH OPENVINO



SCALE WITH ACCELERATOR

OPENVINO + ACCELERATOR

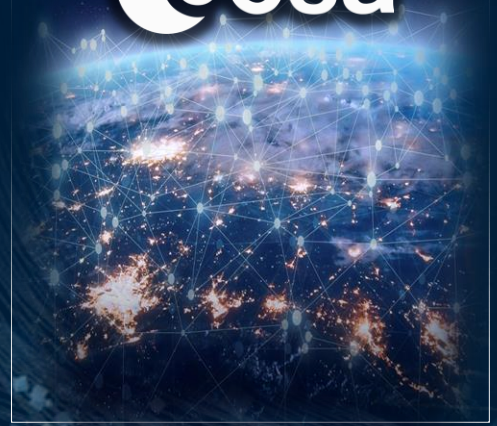
1 STREAM → 16 STREAMS → 49 STREAMS

For more information, visit www.intel.com/benchmarks. Performance results are based on testing as of August 07th,2019 and may not reflect all publicly available security updates. See configuration disclosure for detail end of the presentation. No product can be absolutely secure.

OpenVINO™ TOOLKIT DELIVERING AI IN PRODUCTION

SATELLITE STORM TRACKING & PREDICTION

esa

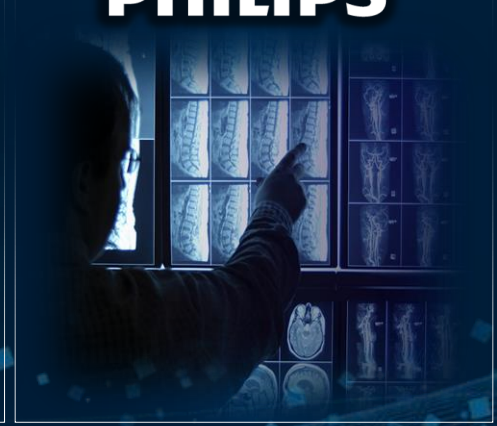


CORAL REEF RESTORATION

Sulubaaï Environmental Foundation

PRECISION MEDICAL DIAGNOSIS

PHILIPS



SMART CITIES TRANSPORTATION

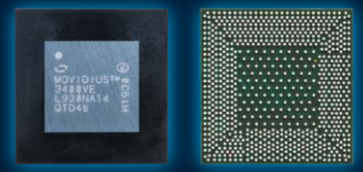
ADVANTECH

SMART BANKING & RETAIL

CyberLink

COMING IN 2020

NEXT GEN MOVIDIUS™ VPU



BUILD FOR EDGE AI

DEEP LEARNING | VISION | MEDIA

- ✓ LARGER MEMORY BANDWIDTH
- ✓ MULTI-NETWORK EXECUTION
- ✓ POWER EFFICIENCY WITH LOW COST
- ✓ ACCELRATED WITH OpenVINO™

HIGH EFFICIENCY

GROUNDBREAKING PERFROMANCE

4X NVIDIA TX2 **1.25X** ASCEND 310

THROUGHPUT (#IMAGES PER SECOND)

ON PAR NVIDIA XAVIER @ 1/5TH POWER

FLEXIBLE FORM FACTORS

FOR DIVERSE EDGE USE CASES

The above is preliminary performance data based on pre-production components. For more complete information about performance and benchmark results, visit www.intel.com/benchmarks. See backup for configuration details.
Comparison of Frames Per Second utilizing Resnet-50, Batch 1.

ACCELERATE EDGE AI DEVELOPMENT TO DEPLOYMENT

intel market ready

EDGE AI SOLUTIONS

RETAIL
STORE INTELLIGENCE
ADVANTECH

CITIES
ROADSIDE CONDITION MONITORING
ADVANTECH

INDUSTRIAL
TEXTILE DEFECT DETECTION
ADVANTECH

DEVELOPER OFFERINGS

EDGE AI DEVELOPER KIT
ADVANTECH

EDGE AI SUITE
ADVANTECH + OpenVINO

CLOUD-EDGE DEVELOPER WORKFLOW INTEGRATION
Microsoft Azure
ONNX + OpenVINO

CORE TECHNOLOGIES

OpenVINO™ + ADVANTECH

Intel Atom inside · Intel Core inside · Intel Xeon inside · Intel Arria 10 inside · Intel Movidius inside

VISION ACCELERATOR DESIGN PRODUCTS

VEGA-320
With 1x Intel® Movidius™ Myriad™ X VPU

VEGA-330
With 2x Intel® Movidius™ Myriad™ X VPU

VEGA-340
With 4x Intel® Movidius™ Myriad™ X VPU

FUELING THE EDGE BUILDOUT

ADVANTECH

intel

DIVERSE
PRODUCT PORTFOLIO
WITH SEAMLESS SOFTWARE SCALABILITY

ROBUST
DEVELOPER TOOLS
FOR CHOICE OF EDGE USE CASES

VAST
ECOSYSTEM SCALE
FOR DIVERSE NEEDS AT THE EDGE


intel

DISCLAIMER

Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors.
Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products.
For more information go to www.intel.com/benchmarks. Performance results are based on testing as of Oct 31, 2019 and may not reflect all publicly available security updates. See configuration disclosure for details. No product or component can be absolutely secure.

Product	Intel Keem Bay VPU	NVIDIA Jetson TX2	Huawei Atlas 200 (Ascend 310)	NVIDIA Xavier AGX
Testing as of	10/31/2019	10/30/19	8/25/19	10/22/19
Precision	INT8	FP16	INT8	INT8
Batch Size	1	1	1	1
Sparsity	50% weight sparsity	N/A	N/A	N/A
Product Type	Keem Bay EA CRB Dev kit (preproduction)	Jetson Developer kit	Atlas 200 Developer kit	Jetson Developer kit
Mode	N/A	nvpmodel 0 Fixed Freq	N/A	nvpmodel 0 Fixed Freq
Memory	4GB	8GB	8GB	16GB
Processor	ARM* A53 x 4	ARM*v8 Processor rev 3 (v8l) × 4	ARM* A53 x 8	ARM*v8 Processor rev 0 (v8l) × 2
Graphics	N/A	NVIDIA Tegra X2 (nvgpu)/integrated	N/A	NVIDIA Tegra Xavier (nvgpu)/integrated
OS	Ubuntu 18.04 Kernel 1.18 (64-bit) on Host Yocto Linux 5.3.0 RC8 on KMB	Ubuntu 18.04 LTS (64-bit)	Ubuntu 16.04	Ubuntu 18.04 LTS (64-bit)
Hard Disk	N/A	32GB	32GB	32GB
Software	Performance demo firmware	JetPack: 4.2.2	MindSpore Studio, DDK B883	JetPack: 4.2.1
Listed TDP	N/A	10W	20W	30W

Intel technologies' features and benefits depend on system configuration and may require enabled hardware, software or service activation. Performance varies depending on system configuration. Check with your system manufacturer or retailer or learn more at www.intel.com.

DISCLAIMER

Results from Slide-4: Testing by Intel as of August 7th, 2019

Core™i7: (for all scenarios)
Platform: Intel(R) Core(TM) i7-8700T CPU @ 2.40GHz / 6 cores x 2 Threads, HT ON, Turbo ON, Total Memory 64GB DDR4-2400MHz. Model Name: Z370M-DS3H-CF. BIOS Version: F11. Ubuntu 16.04.6 LTS with kernel 4.15.0-55-generic.

Caffe* with MKL
Public distribution of Caffe with Intel® MKL optimizations enabled, for more information visit http://caffe.berkeleyvision.org
MKL - Math Library for Intel®-Based Systems for more information: https://software.intel.com/en-us/mkl

OpenVINO (Scenarios *Core™i7* + OpenVINO™)
Intel® Open Visual Inference & Neural Network Optimization software toolkit. For more information: https://software.intel.com/en-us/openvino-toolkit
OpenVINO™ Toolkit R2'2019 for Linux. Topology: face-detection-retail-0004/INT8. Scenarios (Core™i7+OpenVINO™, Core™i7+iGPU+OpenVINO™) Precision: mixed FP32+INT8. Scenario (Core™i7+iGPU+HDDL R8+OpenVINO™) Precision: FP16.

HDDL R8 (Scenarios *Core™i7* + HDDL R8 + OpenVINO™)
Intel® Vision Accelerator Design with Intel® Movidius™ VPU PCIe card (HDDL-R8).

Edge AI Solutions

Applications

License Plate Recognition | Vehicle Classification | Robot Vision | Facial Recognition | People Counting | Behavior Detection | Path Planning

Training

On-Premise Training

Training Server

Training & Modeling

intel Deep Learning Suite

NVIDIA CUDA | Kubeflow

Enterprise Services

kubernetes | docker

Cloud Training

Azure Machine Learning | WISE-PaaS/AFS

- Unified AI Platform
- Model Management
- Cross Clouds Support

Supported Frameworks: TensorFlow | Caffe | ONNX | mxnet

Inference

Model Deployment

Edge AI Suite | OpenVINO | Pretrained Model | Deployment Wizard | 3rd Party SDK

Device Management

WISE-PaaS/DeviceOn

Device Management | Monitor & Control | Update Management | Alert & Action

Docker Container(Ubuntu, Win10)

intel IoT Solutions Alliance Premier

NVIDIA

Acceleration Modules

M.2+Ekey
VEGA-320

MiniPCIe
VEGA-330

PCIex4
VEGA-340

Inference Systems

4K Multi-display
AIR-100

Din-Rail
AIR-101

Rugged
AIR-200

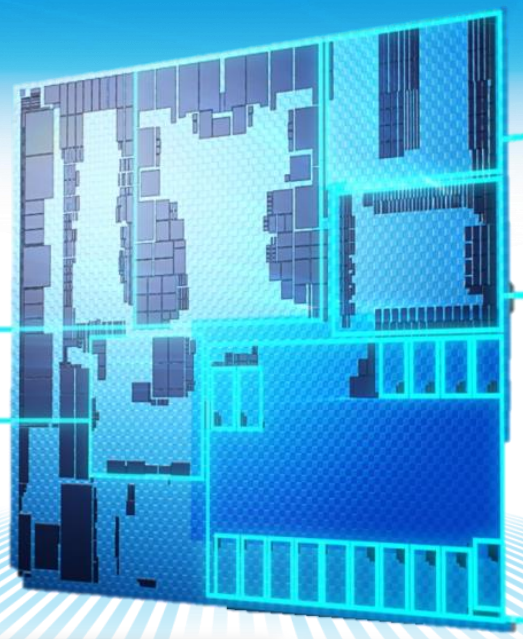
High Performance
AIR-300

Solutions

Facial Recognition

ADVANTECH

Edge AI Acceleration Modules

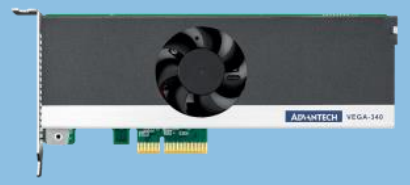
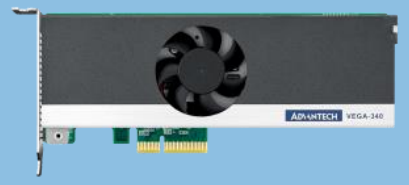


Neural Compute Engine

Vision Accelerators

Imagine Accelerators

CPUs

VEGA-320	VEGA-330	VEGA-340	VEGA-341
			
M.2 2230, One Intel Movidius X VPU on-board	miniPCIe, One/Two Intel Movidius X VPUs on-board	PCIe x 4, Four/Eight Intel Movidius X VPUs on-board	PCIe x 4, Intel Next Gen Movidius VPUs on-board

ADVANTECH

Edge Inference Systems

Enabling Real-time Intelligence

AIR-100

- ✓ Multi-4K display
- ✓ Cost sensitive

AIR-101

- ✓ Compact design
- ✓ Low power

AIR-200

- ✓ Extended temp.
- ✓ Multi-channel processing

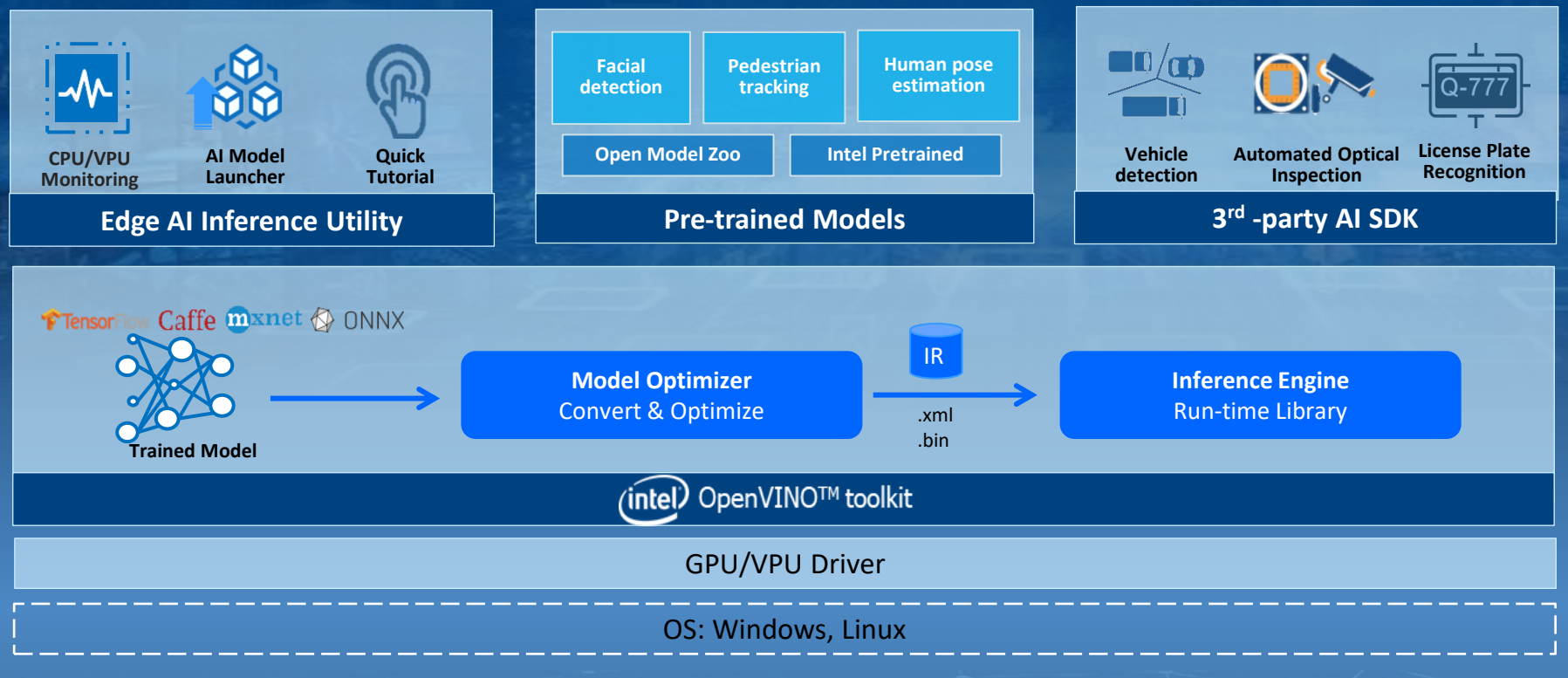
AIR-300

- ✓ High performance CPU
- ✓ High density image processing

Powered by: intel MOVIDIUS inside · Edge AI Suite · OpenVINO · NVIDIA

ADVANTECH

Edge AI Suite with OpenVINOR3



Advantech Edge AI Platforms

OpenVino R3 New Features:

- Model Loading Optimization
- Command Line Deployment
- Open Model Zoo Optimizations

ADVANTECH

EIoT Edge SRP & I.App

Manufacturing DFSI ▲ ▲ ▲ Smart City DFSI ▲ ▲ ▲ Domain DFSI ▲ ▲ ▲ ...

General I.APP

WISE-PaaS Marketplace

OTA

DeviceOn OTA

- Software, firmware & configuration updates
- Advantech BIOS updates

FaceView

DeviceOn FaceView

- Facial recognition
- Customer behavior analytics
- VIP/Watchlist mgt

E2I

DeviceOn E2I

- Protocol conversion
- Edge intelligence
- Real-time virtualization

ePaper

DeviceOn ePaper

- EPD device auto-discover
- Fast transmission
- Device association

IoT - PaaS

Compute Resource Management

CLOUD FOUNDRY, kubernetes

IoT Device Connecting

RabbitMQ

Data & Storages Services

PostgreSQL, mongoDB

WISE-PaaS/ EnSaaS

kubernetes

Azure AKS

- Azure Automated ML
- Azure Digital Twin

IaaS

Public Cloud — Microsoft Azure

Private Cloud — WISE-STACK/ Data Service Server

Edge.SRP (HW+SW)

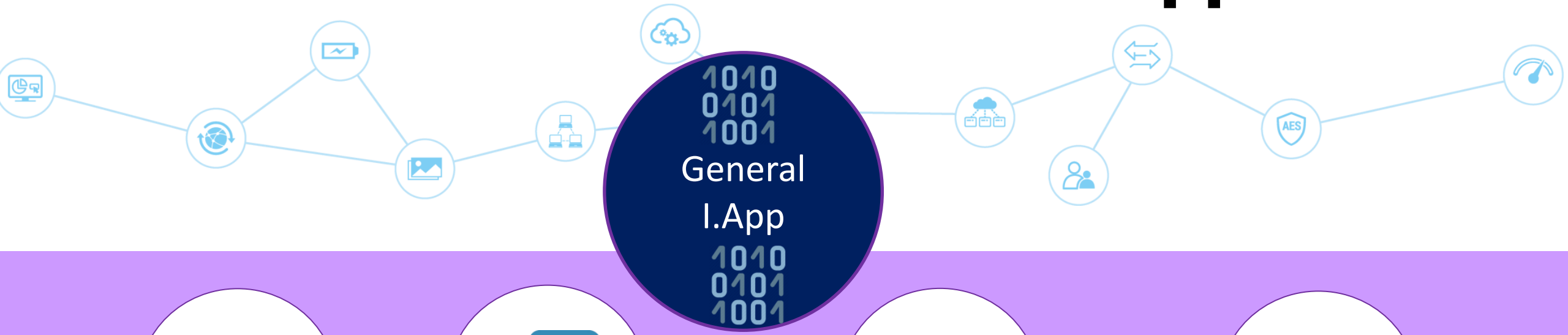
McAfee Security | Acronis Backup | DeviceOn | OpenVINO SDK | Edge AI Suite | 3rd Party AI.Inference ...

Edge Intelligence Servers

Edge AI AIR Series

ADVANTECH

Data Driven General I.App



Easy to Use

- User Friendly UI
- Easy to Connect & Configure

Integrable & Scalable

- Easy for DFSI to Integrate
- Large-scale Duplication

Decoupled

- Function Decoupled
- Available on MarketPlace

Edge SRP Bundled

- Optimized for Edge SRP
- AIoT Applications Oriented

ADVANTECH

FaceView I.App

Empowering AI Facial Recognition

High Precision Engine

- 98.5% accuracy rate
- 10E-6 error rate

Real-time Identification & Notification

- Face identity & labeling
- VPU/GPU acceleration

FaceView

Customer Behavior Analytics

- Dashboard for decision makers

Customer Management

- Easy enrollment
- VIP/Watchlist management

Corporate

Retail

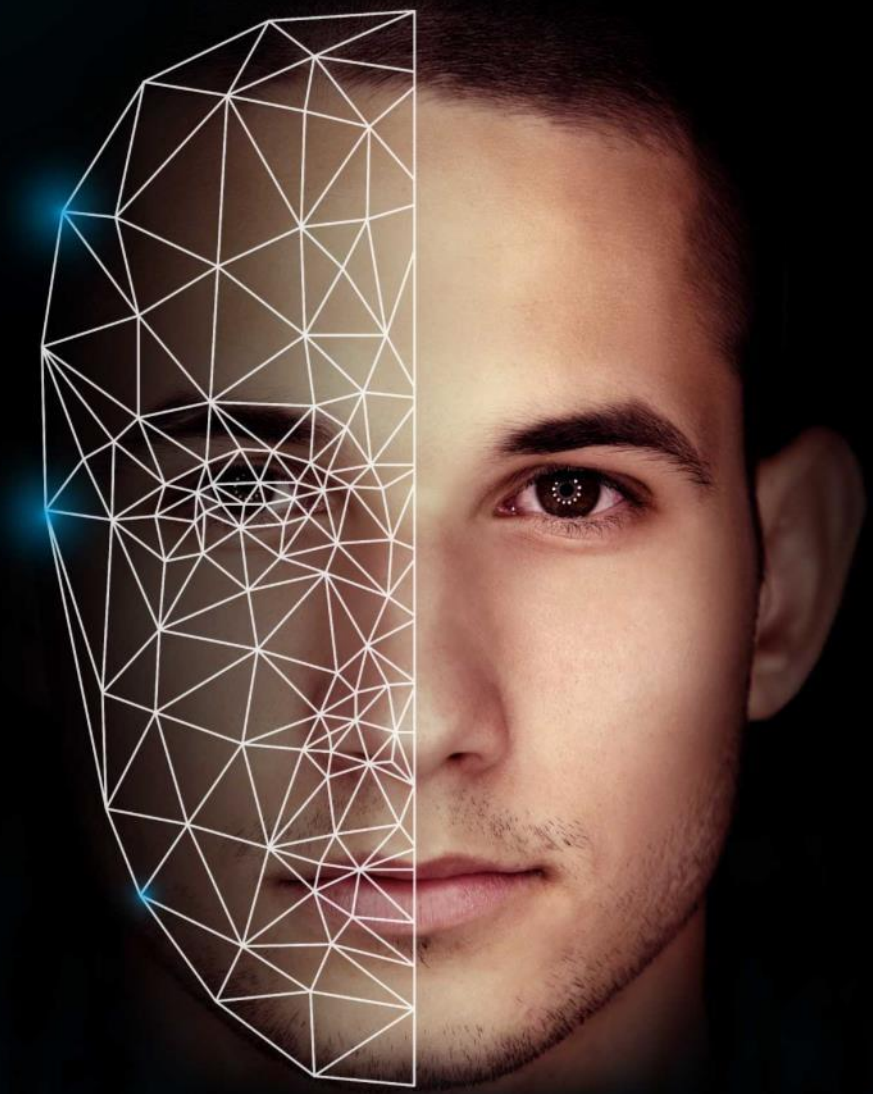
Hospitality

Bank/Government

ADVANTECH

AI-driven IoT at the Edge

Dr. Jau Huang
Chairman and CEO



FaceMe®

AI Facial Recognition by CyberLink

About CyberLink

World's Top Multimedia & AI Software Company

- A 20-year public company since **2000**
- Market leader in multimedia; **over 3 billion** software shipped to date
- From **#1 media player**, **PowerDVD** to cutting-edge

AI Facial Recognition solutions

PowerDVD, used to be on 80% of all PC

PowerDirector 18

(10 PC Mag Editors' Choices in a row, from v9 to v18)

2010 2011 2012 2013 2014 2015 2016 2017 2018 2019

PC MAGAZINE EDITORS' CHOICE

CyberLink FaceMe®

The World's Top Cross-Platform AI Facial Recognition Engine

99.5%
ACCURACY RATE

OPTIMIZED FOR
EDGE IoT
& Server

CROSS PLATFORM
Windows | Linux
iOS | Android

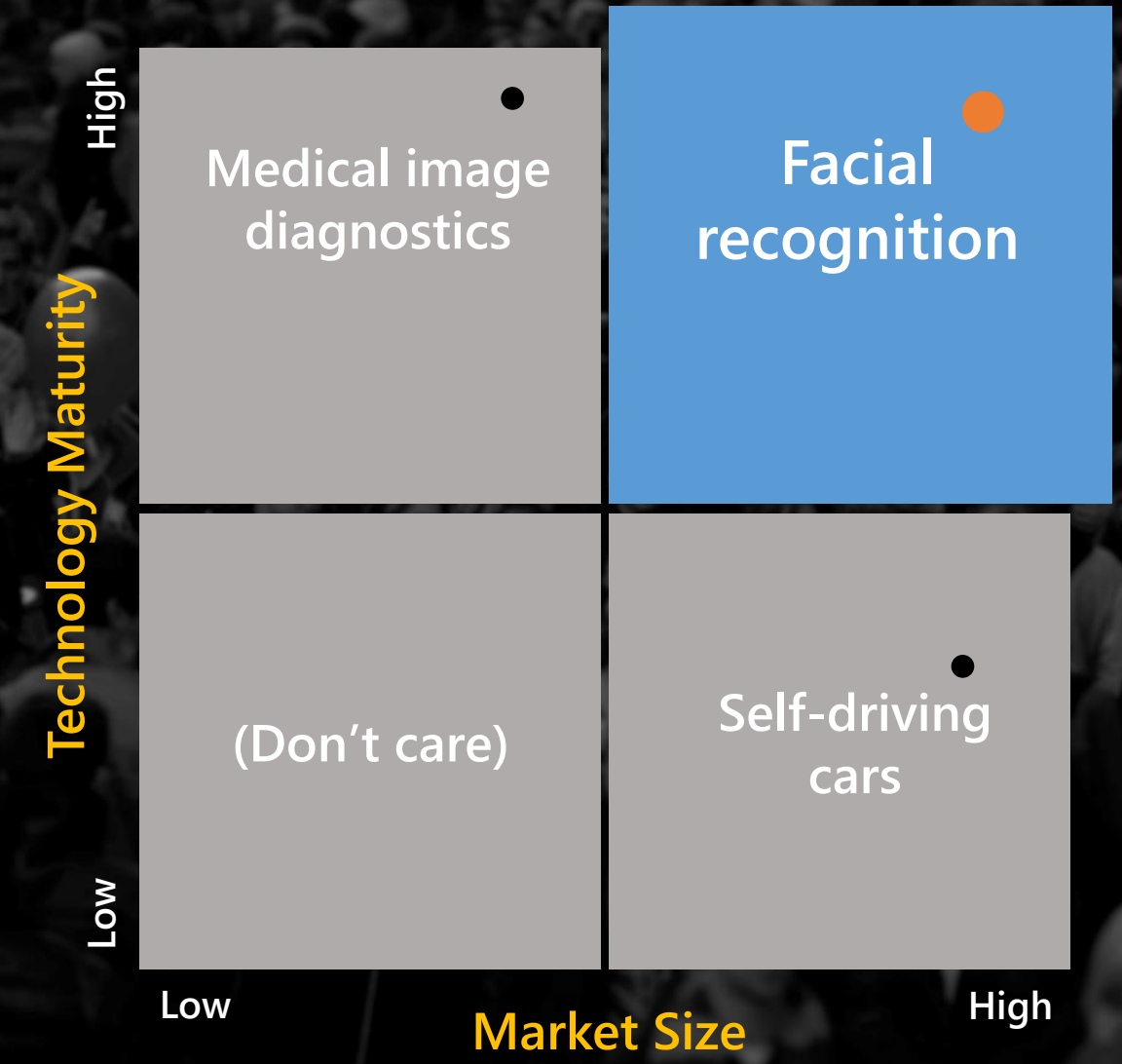
Top Ranking by NIST (WILD, 1E-4)

Vendor Ranking	Company	FNMR	Country/ Region
1	Hikvision	2.71%	China
2	N-Tech Lab	2.75%	Russia
3	Imperial College London	2.76%	UK
4	DeepGlint	2.78%	China
5	Ever AI	2.78%	US
6	Vocord	2.80%	Russia
7	Toshiba	2.82%	Japan
8	VisionLabs	2.85%	Netherlands
9	Camvi Technologies	2.88%	US
10	Anke Investments	2.88%	China
11	Panasonic R+D Center Singapore	2.95%	Japan
12	CyberLink FaceMe	2.98%	Taiwan
13	Innovatrics	3.01%	Sloak
14	Hengrui AI Technology Ltd	3.03%	China
15	Neurotechnology	3.03%	Lithuania
16	KanKan Ai	3.04%	China
17	Vigilant Solutions	3.06%	US
18	Saffe Ltd	3.08%	Germany
19	Idemia	3.09%	France
20	Tech5 SA	3.10%	South Africa

only 0.27%

Source: NIST FVRT 1:1 2019.07.03 Top 20 vendor ranking, each vendor may submit up to 2 algorithms.

Killer Apps for IoT



AI on Video Goes to the Edge

(Bandwidth & Computation, Cost/Performance, advantages)

Edge-IoT

Billions
Detection & recognition

Edge-Workstations

Gateways
Data & analytics

Cloud Server

Data center
AI training & inference

Market Demand for Facial Recognition

(a few examples)

Smart Retail

Security & Surveillance

Access Control

on many things, from doors to cabinets

AIoT USE CASE

Smart Kiosk Using Facial Recognition

- Customer demographics, e.g., gender, age, emotions
- Personalized offering
- Authentication

AIoT USE CASE

Medicine Cabinet Access with Facial Recognition

- Fingerprint does not work for 2 reasons
- Light-weight AI engine (inference engine) required

FaceMe® - Built for AIoT

Optimized for Edge Computing

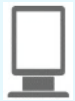
Edge Device


Embedded System


Mobile Device


POS


Kiosk


Digital Signage


Door Security


VMS

OS

android

NVIDIA JetPack

iOS

Inference Engine

OPENVINO™ M


TensorFlow™


ncnn

CPU

ARM

NVIDIA JETSON

Intel Neural Compute Stick

FaceMe® - Optimized for both Cloud & AIoT

False Acceptance Rate (FAR) 1E-6

	UH Model	VH Model	H Model
True Acceptance Rate (TAR)	98.89%	97.99%	94.98%
Execution time (on Celeron)	68.0 ms	6.9 ms	4.7 ms
Deep Learning Model	250MB	17MB	4MB

- VH Model runs nearly 10X faster & 15X smaller by only sacrificing 0.9% accuracy.
- H Model can even run on Snapdragon 410 chip (very low computation power).
- Both VH and H Models are ideal for AIoT devices.

An Example on Hardware Optimization

FaceMe on Intel® Movidius™ VPU

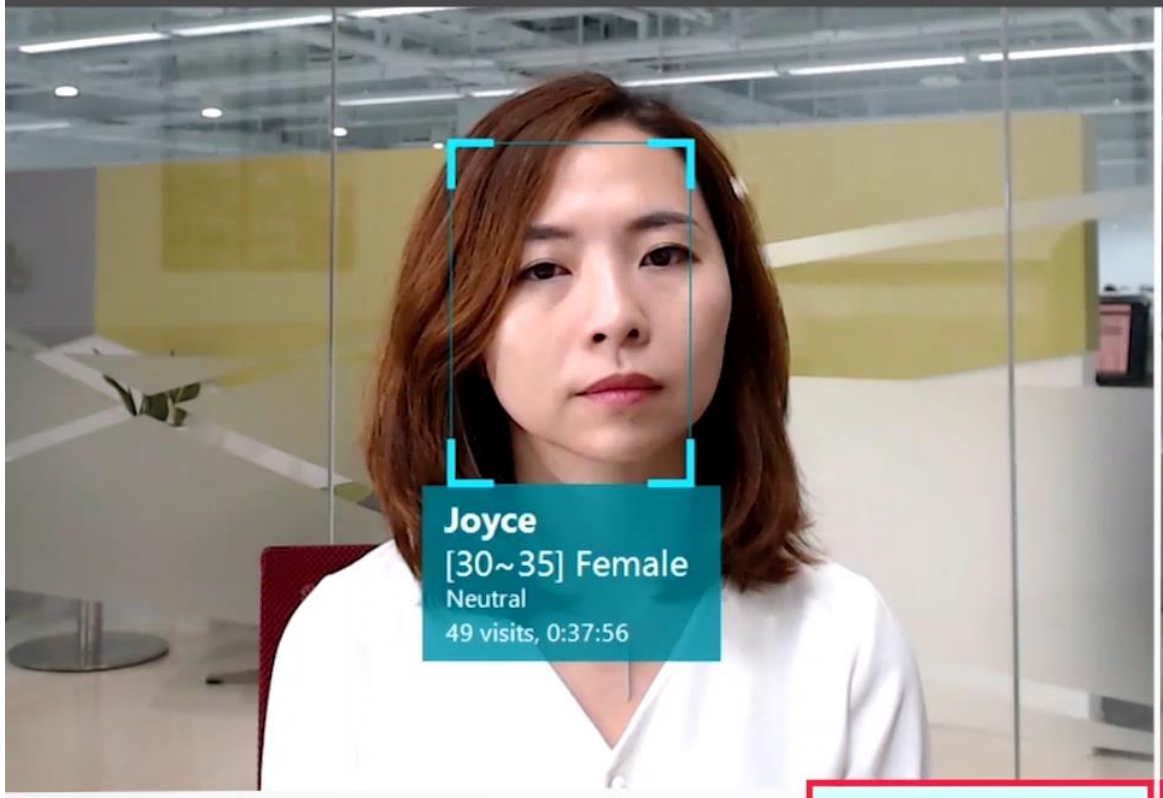
Intel Movidius VPU (Vision Processing Chip) aims to run AI models in small factor devices with very low power

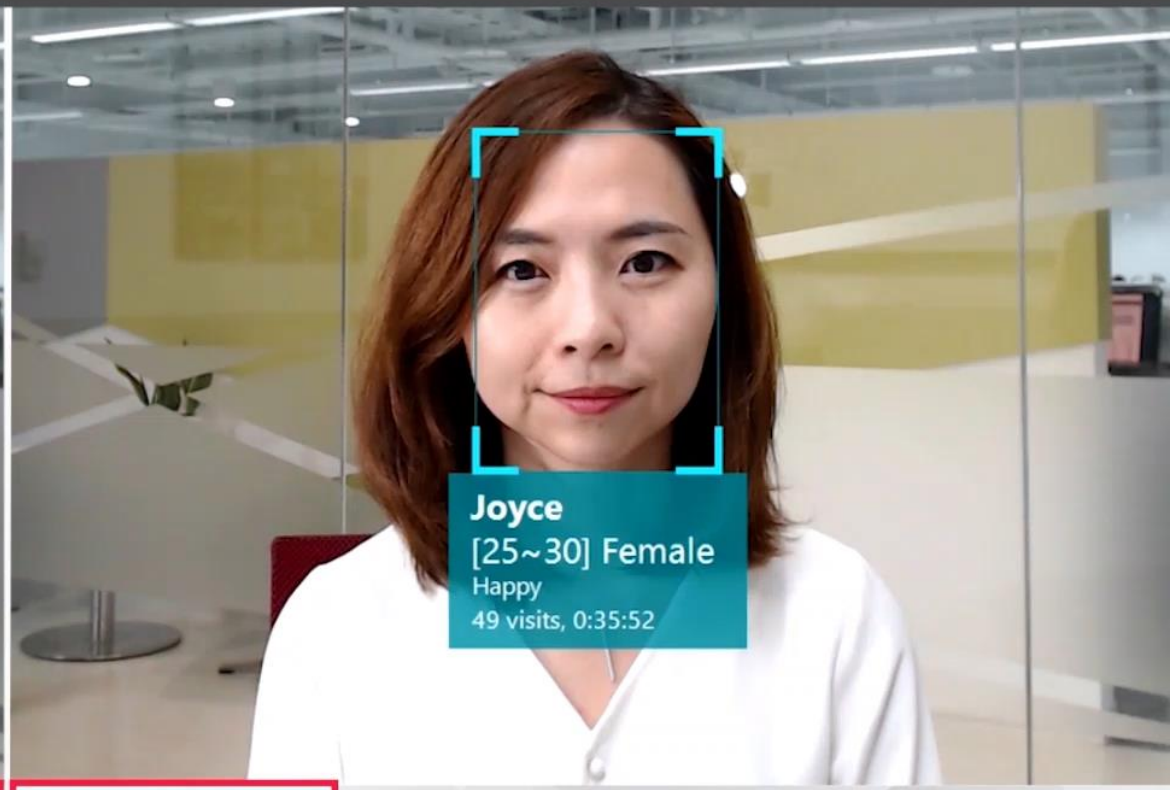
Advantech AIR Inference System

Intel next-gen Movidius VPU, codenamed Keem Bay

20X Performance Speedup on "Face Recognition"

FaceMe | Face Recognition w/Ultra High Model





Celeron CPU

3868.7ms | **195.1ms**

Movidius VPU

Time required for Face Recognition (Smaller is faster)

Conclusion: FaceMe is Designed for ...

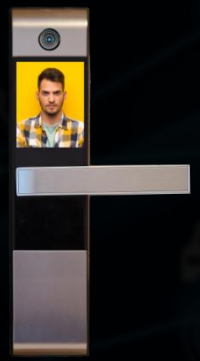
AIoT Device Partners

Door Security

Industrial PC

KIOSK

Smart Lock



Digital Signage

POS

System Integration Partners

Public Safety & Surveillance

Retail, CRM & Events

Security & Access Control

Best Partnership in IoT Ecosystem

Dr. Jau Huang
Chairman and CEO

For more details
CyberLink.com/FaceMe

CyberLink

Edge AI Solutions

OpenVINO

Pretrained Models

Deployment Wizard

SDK

3rd Party SDK

intel IoT Solutions Alliance Premier

NVIDIA

Acceleration Modules

VEGA-320
M.2, 1 VPU

VEGA-330
MiniPCIe, 1/2 VPUs

VEGA-340
PCIex4, 4/8 VPUs

Inference Systems

AIR-100
Quad 4K Displays

AIR-101
Din Rail

AIR-200
Ruggedized

AIR-300
High performance

Solutions

Facial Recognition

ADVANTECH

Co-Creating the Future of the IoT World