

# Empowering AI on the Edge:

## Acceleration Modules, Inference Systems & Software Integration

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# Edge Computing and Intelligence Solutions



IoT Solutions & Marketplace

Multi-Cloud Interoperability &  
Application Services



Equipment  
Mgmt.



Asset  
Mgmt.



Face ID  
Recognition



License Plate  
Recognition

Edge.SRP



3<sup>rd</sup> Party App



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

# Edge AI Solutions

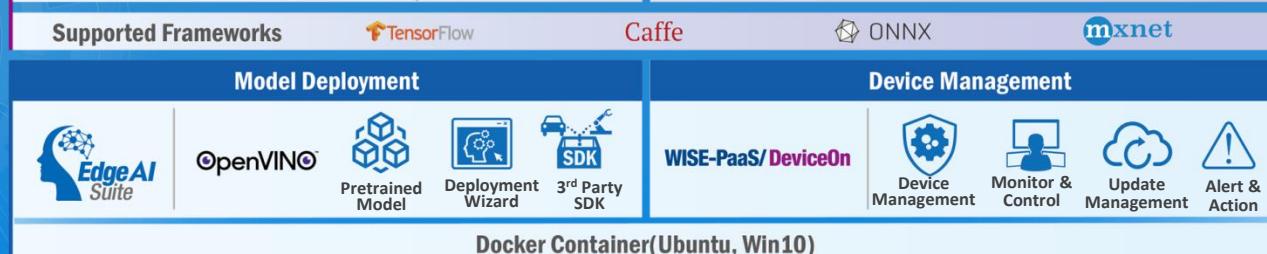
## Applications

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

## Training



## Inference



### Acceleration Modules



M.2+Ekey  
VEGA-320

MiniPCIe  
VEGA-330

PClex4  
VEGA-340

### Inference Systems



4K Multi-display  
AIR-100

Din-Rail  
AIR-101

Rugged  
AIR-200

High Performance  
AIR-300

### Solutions



Facial Recognition

# EIoT AI-Product & Solution Roadmap

Vertical  
Solution

Software

Inference  
Systems

Edge AI  
Modules



FaceView I.APP



Edge AI Suite  
V1.2



AIR- 100

4 displays, with  
VEGA-320, retail



AIR- 101

APL with VEGA-330,  
industrial



AIR- 200

Core i5, with  
VEGA-330



AIR -300

Xeon, PCIe x 16  
for GPU card



VEGA-320

M.2, Intel Movidius X



VEGA-330

mPCIe, Intel Movidius X



VEGA-340

PCIe x 4,  
4/8 Intel Movidius X



VEGA-341

PCIe x 4, next gen. Movidius VPU



MP

2020 1H

2020 2H

ADVANTECH

# Edge AI Acceleration Modules

The diagram illustrates the internal architecture of an Edge AI Acceleration Module. It features a central processing unit with various components highlighted by cyan lines:

- Neural Compute Engine**: Located at the top right.
- Vision Accelerators**: Located on the right side.
- Imagine Accelerators**: Located on the left side.
- CPUs**: Located at the bottom left.

Intel Movidius Inside logo

Imagine Accelerators

CPUs

Neural Compute Engine

Vision Accelerators

**VEGA-320**

M.2 2230, One Intel Movidius X VPU on-board

**VEGA-330**

miniPCIe, One/Two Intel Movidius X VPUs on-board

**VEGA-340**

PCIe x 4, Four/Eight Intel Movidius X VPUs on-board

**VEGA-341**

PCIe x 4, Intel Next gen. Movidius VPUs on-board

# Fast Integration into Current Applications



# Performance Benchmark I

Throughput (FPS), higher is better

	1 x MA 2485	8 x MA2485	Core i3 8100T	Core i7 8700T	Xeon Gold 5218
mobilenet-ssd	57	452	290	352	1842
inception-resnet-v2	7	59	22	41	253
googlenet-v1	89	716	147	283	1515
resnet-50	35	268	85	158	993

Value(FPS/\$), higher is better

	1 x MA 2485	8 x MA2485	i3 8100T	i7 8700T	Xeon gold 5218
mobilenet-ssd	0.83	0.7	1.6	1.16	0.72
inception-resnet-v2	0.11	0.09	0.18	0.14	0.1
googlenet-v1	1.29	1.1	1.26	0.93	0.59
resnet-50	0.51	0.41	0.73	0.52	0.39

# Performance Benchmark II



FaceView, 1080P, VPU v.s. CPU

	Time Required for Recognition
MA2485 VPU	82.78ms
Celeron J3355 CPU	3,868.7ms

FaceView, 1080P

	Average Time for recognition
1 VPU	82.78ms
4 VPU	23.28ms
8 VPU	13.38ms



Multi-Head SSD Object Detection Running on AIR-200

	Detection Performance
MA2485 VPU	21 fps
Core i7 6822EQ CPU	50 fps

# Topology Supported In Myriad/HDDL Plugins

Supported network  
Performance optimized network

## CaffeNet

GoogLeNet v1, v2, v3, v4

Inception v1, v2, v3, v4

LSTM: CTPN

MobileNet v1, v2

MobileNet SSD

MTCNN-o, -p, -r

ResNet-18, -50, -101, -152

ResNet v2-50, -101, -152

SqueezeNet v1.1

SSD MobileNet v1, v2

SSD Inception v2

U-Net

YoVGG16, VGG19

YoloTiny v1, v2 v3

Yolo v2, v3



## AlexNet

DenseNet-121, -161, -169, -201

GoogLeNet v1, v2, v4

MobileNet v1, v2

MobileNet SSD

MTCNN-o, -p, -r

ResNet-18, -50, -101, -152

SqueezeNet v1.0, v1.1

SSD MobileNet v1,

SSD300

SSD512

VGG16, VGG19

YoloTiny v1, v2, v3

Yolo v3



## AlexNet

GoogLeNet v3

Inception v3

ResNext-101

SqueezeNet v1.1

VGG16, VGG19



## AlexNet

CaffeNet

DenseNet-121, -161, -169, -201

GoogLeNet v1, v2, v3, v4

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Yolo v2, v3



# Warehouse Robot Vision /AGV

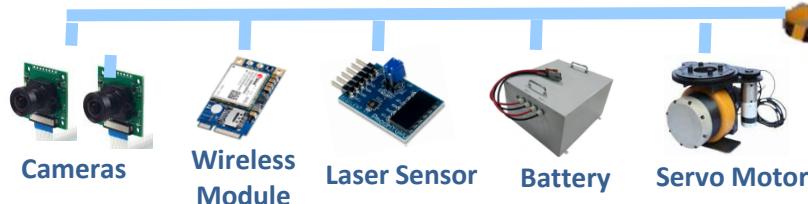
Empowering Trackless Navigation and a Safer Workplace

Advantech helps customer to integrate the VEGA-330 edge AI inferencing module with two Intel Movidius VPUs on board into his AGV cart. This enables the AGV to be self-guided via camera vision, and performs obstacle detection to avoid accident in a human-machine mixed workplace.



## Key Benefit:

- Compact with standard interface, makes integration much easier
- Low power budget, prolonging the battery working hour
- Enables vision based AI self-guided navigation





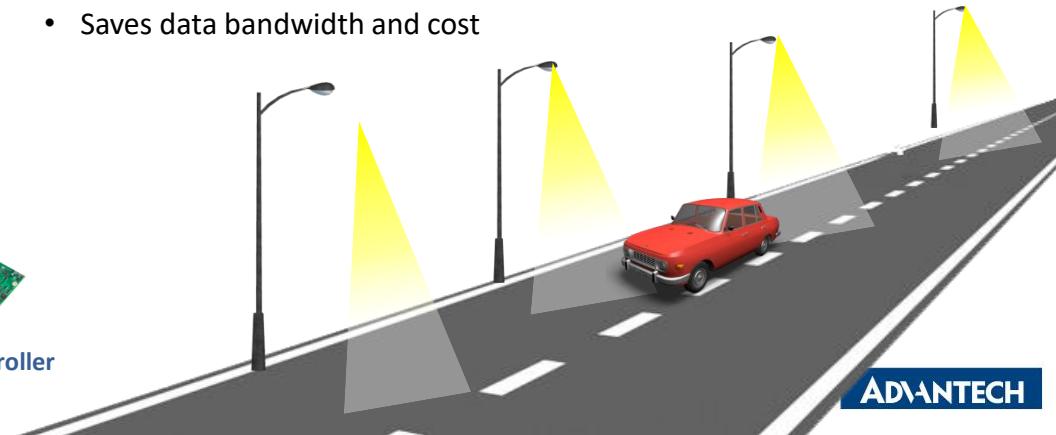
# AI-Powered Smart Street Light

Enabling Edge Inferencing for Real-time Traffic Monitoring

Advantech helps our customer to design an edge AI inferencing module with multiple Intel Movidius VPUs on board which perfectly fits in current smart street light enclosure.

## Key Benefit:

- Compact and low power budget, minimized design change effort
- Analyzes video at the edge and reacts instantly
- Saves data bandwidth and cost



# 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:



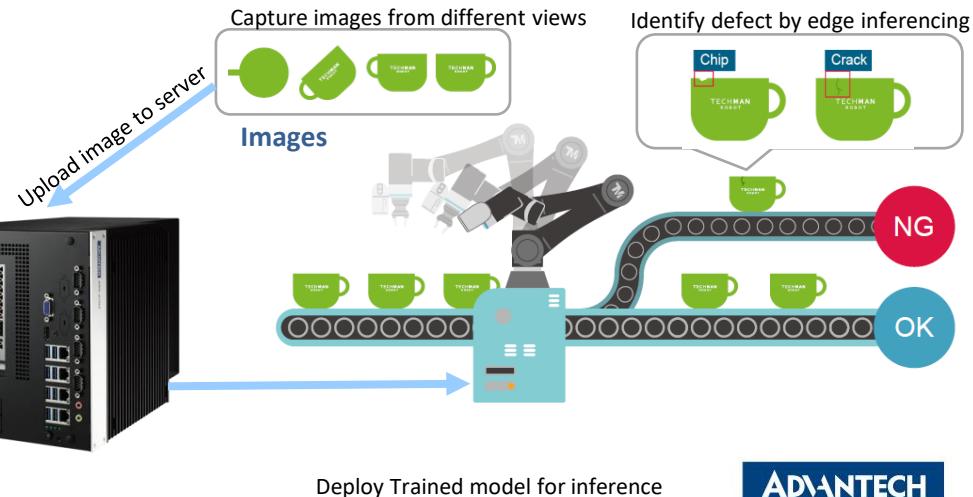
# Robotic AOI Defect Inspection

Techman Robot applies AI defect inspection technology to enamel coated products, detecting air bubble and crack in mug manufacturing factory. Advantech AIR-300 is selected as training server to perform image pre-processing, data labeling and AI model training.



## Why Advantech AIR-300?

- Intel Desktop core i7 quad core processor with NVidia 2080Ti GPU card as training engine provides sufficient computing power for AI model training.
- Four GbE ports provides sufficient bandwidth to collect captured images from multiple production lines.
- Four 2.5" SATA III drive bay provides maximum 20TB storage capacity.



**ADVANTECH**

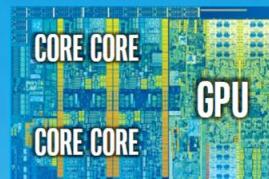
# Intel® Distribution of OpenVINO™ Toolkit



COMPLEMENTARY TO MAJOR FRAMEWORKS

CROSS-PLATFORM FLEXIBILITY

HIGH PERFORMANCE, HIGH EFFICIENCY



INTEL COMPUTE



INTEL VISION ACCELERATORS

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SSD512

VGG16, VGG19

YoloTiny v1, v2, v3

Yolo v3



## AlexNet

GoogLeNet v3

Inception v3

ResNext-101

SqueezeNet v1.1

VGG16, VGG19



## AlexNet

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Yolo v2, v3





# Edge AI Suite V1.2

with OpenVINO Toolkits R3 2019



## Heterogeneous Hardware Acceleration

optimized performance of Intel®-based accelerators: CPUs, GPUs, and VPUs with GUI usability information.



## YoloV3 Tiny Benchmarking

Pre-optimized environment with debug guideline sample for quick performance evaluation.



## All-in-One Installer

Integrate all required Inference environments of reduce customer's development time, and built-in ready-to-use AI pretrained model for customer reference.

The screenshot shows the Intel OPENVINO Toolkit interface. It includes sections for Model Optimizer (Code Sampling & 10 Pre-trained Models), Inference Engine (Optimized inference), Traditional Computer Vision Tools & Libraries (OpenCV\*, OpenX\*, Photography Vision), and Optimized Libraries (OpenCV\*, OpenX\*, Photography Vision). The interface also features a Welcome Page, Quick Start, Model Launcher, System Monitoring, Application (Scenario selection), Information (Model details), Input (Data source selection), Demo (Platform selection), and a sidebar for Intel Architecture-Based Platforms Support (e.g., Gen9™, 9.4 (64-bit), Ubuntu™ 18.04).

The screenshot shows the ADVANTECH VEGA-300 Edge AI Acceleration Modules interface. It displays a live video feed of people walking through a hallway, with a digital overlay showing a heatmap of detected faces. To the right, there is a summary table for face detection:

Average FPS	Face detection rate
75.0472	~75.0472

Below the table, it says "Powered by VEGA-320:" followed by a list of features:

- Intel® Movidius™ Myriad™ X VPU
- 4x 4K@30
- 4x 4K@60
- Supports Edge AI Suite

# 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



### Customer Behavior Analytics

- Dashboard for decision makers



### Customer Management

- Easy enrollment
- VIP/Watchlist management



Corporate



Retail



Hospitality



Bank/Government

# FaceView I.App Function Highlights



## FaceView Industrial App



### Visitor Identification

- ✓ Registered ID and gender/age/emotion recognition
- ✓ Image improving for poor lighting and motion blurry

### Customer Analytics

- ✓ Statistical analysis for customer behavior
- ✓ Watch list history dashboard

### Customer Management

- ✓ Maintain customer database
- ✓ Import & Export VIP/Blacklist ID data

**98.5%**  
ACCURACY RATE

OPTIMIZED FOR  
**EDGE IoT**

**ADVANTECH**



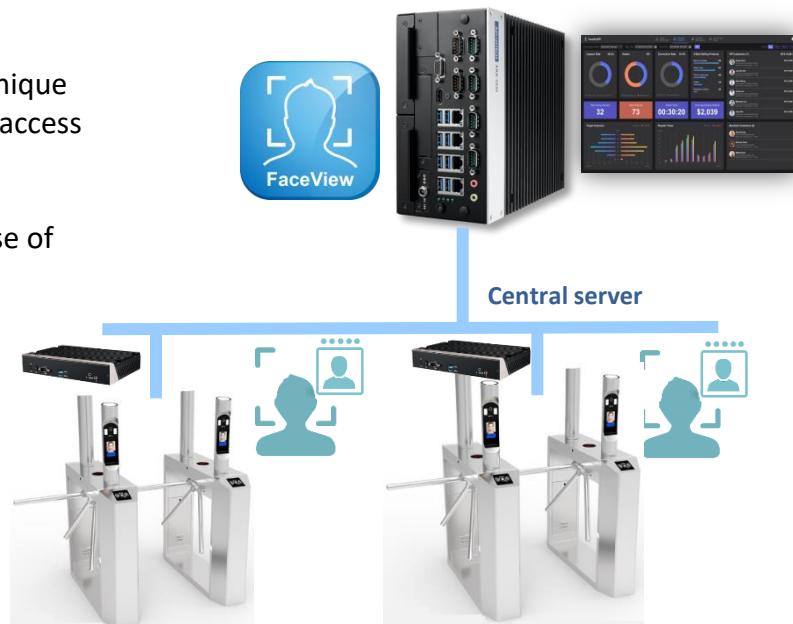
# Facial Recognition Access Control

AI facial recognition offers a new option for access control. FR can identify the unique face print and unlock the door within milliseconds, much faster than RFID based access control system.

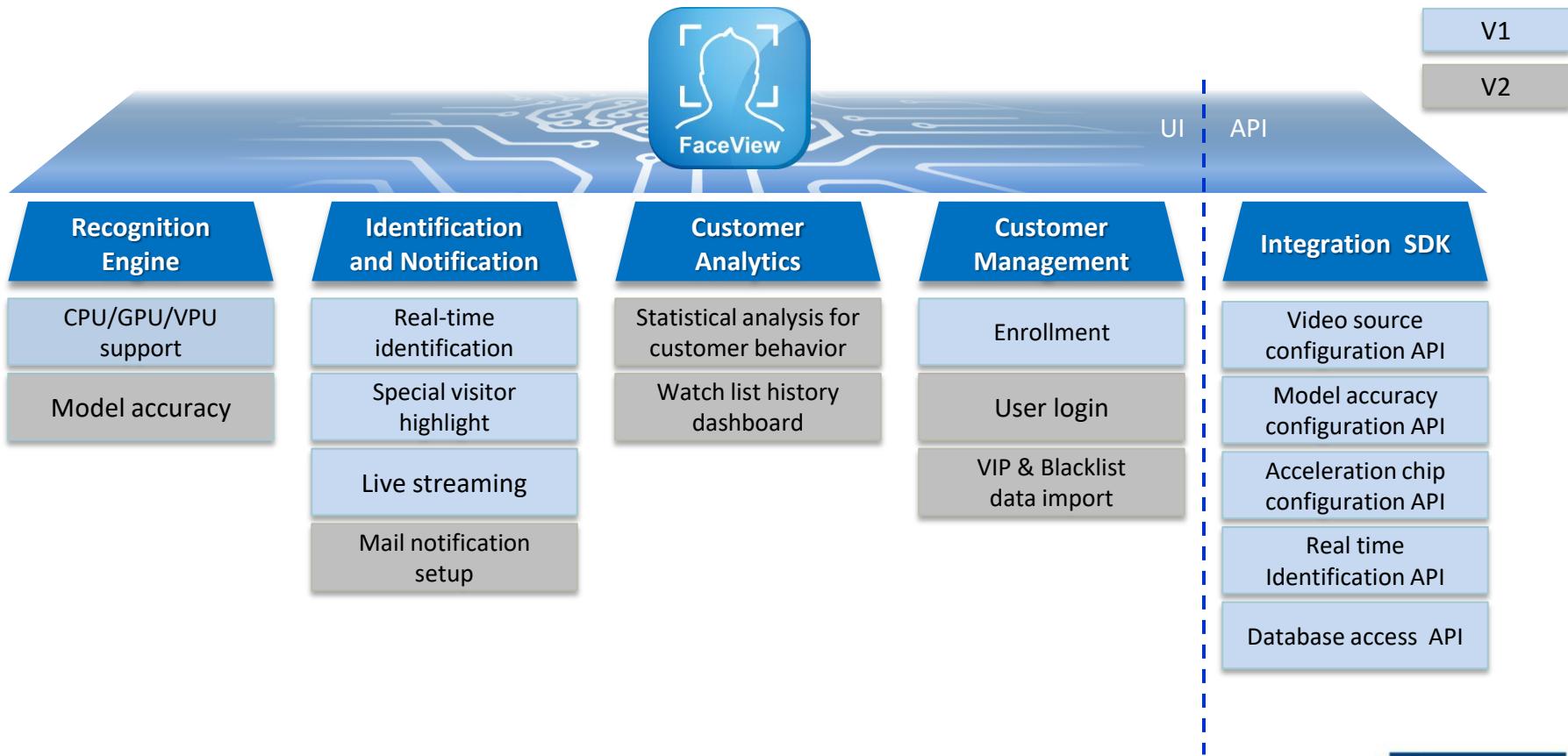
Facial recognition is also comparable to fingerprint scanners in reliability and ease of use –especially when you’re wearing gloves

## **Key Benefit of FaceView I.App:**

- Plug & play with high recognition accuracy, not additional training is needed.
- High compatibility across hardware & OS platform. Can be easily implement onto current environment with only little modification
- Provides functional APIs to help you integrating FaceView functions as part of your solution.



# FaceView I.APP Software Building Block



# FaceView I.APP User Interface

Photo by camera or files

First Name:

Last Name:

Card Number:  9452-4053-8931-0403

Customer Group: VIP

Contact Information:  sales.Chring@gmail.com

Fill in personal info

Enrollment

CUSTOMER PROFILE

Sort by: All (17) VIP (11) Blacklist (3) Uncategorized (3) Search

CUSTOMER NAME	CUSTOMER GROUP	GENDER	AGE	LAST VISIT TIME	EMAIL	SUBSCRIPTION	ACTIONS	
Amy.Huang	Blacklist	Female	26-30	2019/09/01 00:00:00	Amy.Huang@gmail.com	Active		
Alice.Lin	VIP	Female	26-30	2019/09/01 00:00:00	Alice.Lin@gmail.com	Active		
Alan.Wang	VIP	Male	26-30	2019/09/01 00:00:00	Alan.Wang@gmail.com	Active		
Bella.Chen	VIP	Female	26-30	2019/09/01 00:00:00	Bella.Chen@gmail.com	Active		
Evangeline.Zhang	VIP	Female	26-30	2019/09/01 00:00:00	Evangeline.Zhang1910968@gmail.com	Active		
Emily.Chen	VIP	Female	26-30	2019/09/01 00:00:00	Emily.Chen@gmail.com	Active		
Emma.Zhao	Uncategorized	Female	26-30	2019/09/01 00:00:00	Emma.Zhao@gmail.com	Inactive		
Francescantonio.Lin	Uncategorized	Male	26-30	2019/09/01 00:00:00	Francescantonio.Lin@gmail.com	Inactive		
Jacky.Lee	VIP	Male	26-30	2019/09/01 00:00:00	Jacky.Lee@gmail.com	Active		
Jennifer.Wu	Uncategorized	Female	26-30	2019/09/01 00:00:00	Jennifer.Wu@gmail.com	Inactive		
John.Wu	VIP	Male	26-30	2019/09/01 00:00:00	John.Wu@gmail.com	Active		
Makayla.Lee	VIP	Female	26-30	2019/09/01 00:00:00	Makayla.Lee@gmail.com	Active		
Michael.Chen	Blacklist	Male	26-30	2019/09/01 00:00:00	Michael.Chen@gmail.com	Active		
Olivia.Chen	Blacklist	Male	26-30	2019/09/01 00:00:00	Olivia.Chen@gmail.com	Active		
Oscar.Chen	Blacklist	Male	26-30	2019/09/01 00:00:00	Oscar.Chen@gmail.com	Active		
Wyatt.Chen	Blacklist	Male	26-30	2019/09/01 00:00:00	Wyatt.Chen@gmail.com	Active		

Manage VIP and Blacklist

Visitor behaviors by average and cumulative rules

5 Best-Selling Products

Product	Count	Value
Bacon Crumbles	344	NT \$1,029
Sheet Cake	303	NT \$1,029
Chocolate Brownie	140	NT \$1,029
Vanilla Pudding	124	NT \$1,029
Strawberry Mousse	103	NT \$1,029

VIP records

Customer Name	Card Number	Total Value
Emily.Chen	9876-5432-1234-0987	NT \$1,000
Makayla.Lee	0987-6543-2134-9876	NT \$1,000
John.Wu	1234-5678-9012-3456	NT \$1,000

Blacklist records

Customer Name	Card Number	Total Value
Amy.Huang	9876-5432-1234-0987	NT \$1,000

Analytics

Age vs Gender

Timeslot vs Visitors

Real-time identification

Advantech Taoyuan

Today's Customers

Customer Name	Last Time Visited	Visits per Month
Emily.Chen	2019/09/28 10:30:04	100
Amy.Huang	2019/09/28 10:30:12	100
Jennifer.Wu	2019/09/28 10:30:12	100
Michael.Chen	2019/09/28 10:30:12	100
Jacky.Lee	2019/09/28 10:30:12	100

VIP and Blacklist records on that day

Identification

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# Edge AI Solutions



## Acceleration Modules



## Inference Systems



## Solutions



**ADVANTECH**

# *Co-Creating the Future of the IoT World*

