AI is transforming industries like manufacturing, retail, transportation, medical and more. It is moving towards edge computing to enable real-time decision making without the limitations of latency, cost, bandwidth, and power consumption. According to ABI research, 43% share of AI tasks will take place on edge devices instead of cloud in 2023.

**IoT Paradigm Shift:**

**AI at the Edge**

- **Real-time Intelligence**
  - Eliminating round trips to the cloud
  - Minimizes data latency

- **Security & Privacy**
  - Improves security by reducing data transmissions and storage in the cloud

---

**Why Vision Based AI**

- High accuracy rate just like human
- Incredible processing speed
- Can easily inspect object details too small to be seen by the human eye
- Able to mimic human intelligence with tolerance of natural variations

**Training**

- In the Cloud or On Premises

**Inferencing**

- At the Edge

---

**Diagram:**

- Training Dataset
  - "Dog"
  - "Cat"
- Trained Model
- GPU Card
- Data Set
- AI Inference Workload on VPU
- New Data
  - "Cat"
  - "Dog"
Optimized Solutions
Lower data transmission costs and power consumption with optimized solutions

Bandwidth Efficiency
IoT devices are designed for user mobility and minimal bandwidth usage

AI Inferencing at the Edge
Traffic Monitoring
Drone/AGV
Retail Security
Defect Inspection

Edge Inference with VPU Acceleration
There are many approaches for applying AI inference to the edge. In practice, the best approach is to use the same edge device that collects data. By applying additional VPU to the edge device, real-time inferencing and vision task can be efficiently executed on the VPU, freeing the CPU and GPU to handle other important tasks.

Intel® Myriad X MA 2485 Performance Benchmark
The higher the throughput (FPS) the better

<table>
<thead>
<tr>
<th>Model</th>
<th>1 x MA2485</th>
<th>8 x MA2485</th>
<th>Core i3 8100T</th>
<th>Core i7 8700T</th>
<th>Xeon Gold 5218</th>
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<tbody>
<tr>
<td>mobilnet-ssd</td>
<td>57</td>
<td>452</td>
<td>290</td>
<td>352</td>
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<td>inception-resnet-v2</td>
<td>7</td>
<td>59</td>
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<td>41</td>
<td>253</td>
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<td>googlenet-v1</td>
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<tr>
<td>resnet-50</td>
<td>35</td>
<td>268</td>
<td>85</td>
<td>158</td>
<td>993</td>
</tr>
</tbody>
</table>
Advantech Edge AI Solutions

To help customers jumpstart AI deployment and realize its full potential, Advantech has developed integrated hardware and software solutions that support AI from the cloud to the edge. Our solutions combine a high-performance AI engine with optimized industrial-grade software to enable deep learning for diverse applications such as drone and AGV control, retail management, medical imaging, and traffic monitoring.

Applications
- License Plate Recognition
- Vehicle Classification
- Robot Vision
- Facial Recognition

On-Premise Training
- Training & Modeling
- Enterprise Services
  - Training Server
  - Deep Learning Suite
  - Intel
  - NVIDIA CUDA
  - Keras
  - Kubernetes
  - Docker

Supported Frameworks
- TensorFlow

Model Deployment
- EdgeAI Suite
  - OpenVINO
- Pretrained Model
- Deployment Wizard
- 3rd Party SDK

Docker Container

AI Acceleration Modules
- VEGA-320 M.2+Ekey
- VEGA-330 MiniPCIe
- VEGA-340 PCIe x4

Inference
- AIR-100 4K Multi-display
- AIR-101 Din-Rail

VEGA-300 AI modules are low-power plug-in modules in various form factors, including M.2, mini PCIe, and PCIe x4, that can be easily integrated into existing systems to reduce CPU load.

Edge AI Inference Systems
- AIR-100/101/200
The AIR-300 series offer powerful server-grade performance and can serve as either training or inference systems to accelerate deep-learning operations.
Advantech has developed its Edge AI Suite to enable accelerated deep-learning inference on edge devices. Integrated with Intel’s Distribution of OpenVINO™ toolkit, the Edge AI Suite provides a deep-learning model optimizer, inference engine, pre-trained models, as well as a user-friendly GUI toolkit. Customers can use Python-based tools to quickly import their existing Caffe, TensorFlow, Onnx, and MXNet trained models and deploy them to edge devices. The Edge AI Suite also integrates the system VPU/CPU/memory for real-time status monitoring and performance benchmarking.

**Features**

**OpenVINO Toolkit**
- OpenVINO R3.1 integrated
- Boosted inference performance
- Heterogeneous executions across CPU/VPU/GPU to optimize workloads

**Pre-Trained Models**
- Rapid object detection (YOLOv3)
- Facial recognition
- Human pose estimation

**Deployment Wizard**
- Quick start tutorial
- Supports various deep learning frameworks
- CPU/VPU/Memory monitoring

**Third-Party AI SDK**
- Facial recognition
- Vehicle classification
- License plate recognition

**Supported Frameworks:**
- TensorFlow
- Caffe

**Intel® Distribution of OpenVINO™ Toolkit**

Based on convolutional neural networks (CNNs), the Intel® Distribution of OpenVINO™ toolkit extends workloads across hardware and maximizes performance.
- High inference performance with optimized workloads
- Supports parallel and heterogeneous inferencing across CPU/ VPU/ GPU
- Supports 10th Gen Intel processors
- Includes optimized calls for OpenCV and OpenVX
Leveraging an industry-leading inference engine powered by CyberLink, Advantech’s FaceView application provides precise, and scalable real-time facial recognition for various AIoT applications in the retail, hospitality, and public safety fields. Advantech also provides an easy-to-integrate SDK for rapid integration with existing systems using APIs.

- Real-time identification with 99.85% accuracy and advanced image pre-processing
- VIP and watchlist management
- Alert notifications
- Plug & play interface for rapid integration

**Function Highlights**

**Quick Start**
- Visualized operations
- Real-time and stored video analytics
- Supports Intel CPU/GPU/VPU accelerations

**Inference Engine/Application**
- Matching and auto-labeling technologies integrated
- Performance index
- Source code provision

**System Monitoring**
- Visualized dashboard
- Benchmark evaluation
- CPU/GPU and memory status

**Model Launcher**
- Leverages OpenVINO model optimization
- Supports various model frameworks
- Model conversion parameter and sample codes offered

**FaceView AI Facial Recognition Industrial App**

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- CPU/GPU and memory status

- Leverages OpenVINO model optimization
- Supports various model frameworks
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AI-Powered Smart Street Lights

Cities are illuminated by thousands of street lights that help drivers and pedestrians find their way home safely. Equipped with AI technology, street lights can be used to not only light up roads, but also support city services such as air quality, humidity, and temperature monitoring, as well as traffic and parking management.

Solution

The customer had already implemented Advantech’s edge computing platform to serve as a gateway computer for collecting data, including temperature and humidity levels, to facilitate operational analysis. Recently, the platform was upgraded with Advantech’s VEGA-320 edge AI acceleration modules embedded into the cameras for analyzing multiple streams of video data and handling real-time tasks such as locating available parking spaces. The customer estimated that this solution increases the utilization of roadside parking by at least 10% to 15%.

Key Benefit

- Compact, low-power design with minimal installation effort
- Video analysis at the edge for instant response
- Saves bandwidth resources and costs

AI-Based AGV Navigation

Automated guided vehicles (AGV) are used to transport and handle goods predictably and reliably. With the integration of AI-based navigation, the optimal route is determined in real time, effectively increasing the runtime efficiency of AGVs for faster and smarter operations.

Solution

For vision-guided AGVs equipped with cameras, Advantech’s VEGA-330 edge AI acceleration mini-PCIe module acts as a vision analytics engine, optimizing image processing and local inference for improved route planning and collision avoidance. This module is capable of processing and analyzing images captured by the camera to facilitate real-time AI-based navigation. By optimizing route planning, AI-based navigation increases the AGV runtime efficiency by up to 20%.

Key Benefit

- Compact design with standard interface for easy integration
- Low power consumption extends the battery life
- Enables AI-based vision-guided navigation
AI Facial Recognition for Retail

The accuracy of facial recognition algorithms has improved significantly in the past few years. AI facial recognition can help retailers proactively prevent shoplifting and enhance customer service.

Solution

The company required a hardware and software integrated solution to enhance its shoplifting prevention and customer service via AI facial recognition. The AIR-100 inference system integrated with FaceView can detect customers’ gender, age, and mood in real-time with 99.85% accuracy rating, enabling further analysis and precision marketing. The solution can also identify VIP customers or people with a shoplifting record, and send instant notifications to staff.

Key Benefit

- High recognition accuracy
- Plug & play functionality, no training required
- Provides functional APIs for easy integration

Robotic AOI Defect Inspection

Manufacturing quality controls have long relied on visual inspection. Traditional machine vision systems may fail to distinguish defects due to the variability and deviation between visually similar parts. By leveraging AI deep learning technology, this problem can be overcome and overall detection accuracy improved.

Solution

Our customer is a robotic visual equipment builder. Their defect inspection solution combines robotic arms with AI capability to detect defects such as air bubble and crack among enamel coated products. Advantech AIR-300 AI system, powered by Intel 65W Core i7 quad core processor and a NVIDIA GPU card, enables real time inferencing and continuous training. It guarantees a high density image processing in real time and parallel computation to accelerating model training time. It also provide high bandwidth and storage capacity to collect captured images from multiple product lines and store massive training datasets.

Key Benefit

- Intel® Core™ i7 quad-core processor with NVidia 2080Ti GPU card
- Four GbE ports offer sufficient bandwidth
- Four 2.5” SATA III drive bays offer 20TB storage capacity

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### AI Acceleration Modules

**VEGA-300 Series**

<table>
<thead>
<tr>
<th>SoC</th>
<th>VEGA-320</th>
<th>VEGA-330</th>
<th>VEGA-340</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 x Myriad X MA2485</td>
<td>1/2 x Myriad X MA2485</td>
<td>4/8 x Myriad X MA2485</td>
<td></td>
</tr>
</tbody>
</table>

**Form Factor**

- M.2 2230 (Key A+E)  
- Full-size mini PCIe  
- Low-profile PCIe x 4

**Dimensions**

- 22 x 30 x 3.63 mm  
- 30 x 50.95 x 4.86 mm  
- 171.1 x 68.9 mm

**Signal Interface**

- PCIe x1, USB 2.0  
- PCIe x1, USB 2.0  
- PCIe x4, Gen 2

**Operating Temperature**

- -20 ~ 60 °C  
- -20 ~ 55 °C  
- -20 ~ 60 °C

**Power Consumption**

- 3.8W  
- 3.8W/7.6W  
- 16.8W/28W

**Driver Support**

- Windows 10 Enterprise(64bit), Ubuntu 16.04.3 LTS(64 bit), CentOS 7.4(64 bit)  
- Windows 10 Enterprise(64 bit), Ubuntu 18.04. LTS(64-bit)

### Edge AI Inference Systems

**AIR-100/200/300**

<table>
<thead>
<tr>
<th>AIR-100</th>
<th>AIR-101</th>
<th>AIR-200</th>
<th>AIR-300</th>
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</thead>
<tbody>
<tr>
<td>Processor</td>
<td>Intel® Atom® x7-E3950</td>
<td>Intel® Atom® x5-E3940</td>
<td>Intel® Core™ i5-6442EQ</td>
</tr>
<tr>
<td>Memory</td>
<td>4GB DDR3L installed</td>
<td>8GB DDR3L installed</td>
<td>8GB DDR4 installed</td>
</tr>
<tr>
<td>Inference Engine</td>
<td>VEGA-320</td>
<td>VEGA-330</td>
<td>VEGA-330</td>
</tr>
<tr>
<td>Display</td>
<td>2 x HDMI 1.4, 2 x HDMI 2.0</td>
<td>2 x HDMI 1.4</td>
<td>1 x VGA, 1x HDMI 1.4</td>
</tr>
<tr>
<td>Expansion</td>
<td>1 x mini PCIe</td>
<td>1 x M.2 2230 E key</td>
<td>1 x mini PCIe</td>
</tr>
<tr>
<td>Storage</td>
<td>1 x 2.5” SSD (64GB)</td>
<td>1 x SATA Slim SSD (64GB)</td>
<td>1 x 2.5” SSD (64GB)</td>
</tr>
<tr>
<td>Operating System</td>
<td>Win10 IoT 2019 (64bit)</td>
<td>Win10 IoT LTSC (64bit)</td>
<td>Win 10 IoT Enterprise 2019 (64 bit)</td>
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<td>Cooling</td>
<td>Passive, fanless</td>
<td>Passive, fanless</td>
<td>Passive, fanless</td>
</tr>
<tr>
<td>Power</td>
<td>19 VDC</td>
<td>12~28 VDC</td>
<td>12~24 VDC</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>0 ~ 50 °C</td>
<td>-20 ~ 55 °C</td>
<td>0 ~ 60 °C</td>
</tr>
</tbody>
</table>
## FaceView Application

### Key Features

- **Visitor Identification**
  - Registered ID and gender/age/emotion recognition
  - Image improving for poor lighting and motion blurry
- **Customer Analytics**
  - Statistical analysis for customer behavior
  - Watchlist history dashboard
- **Customer Management**
  - Maintain customer database
  - Import & export VIP/blacklist ID data

## Working environment

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>OS</td>
<td>Windows 10 64bit</td>
<td></td>
</tr>
<tr>
<td>Memory</td>
<td>4GB or above</td>
<td></td>
</tr>
<tr>
<td>Storage</td>
<td>32GB or above (Including Windows 10 OS)</td>
<td></td>
</tr>
</tbody>
</table>

## Performance

<table>
<thead>
<tr>
<th>HW Platform</th>
<th>Atom CPU + VEGA-320</th>
<th>Atom CPU + VEGA-330</th>
<th>Core i5 CPU + VEGA-330</th>
</tr>
</thead>
<tbody>
<tr>
<td>True Acceptance Rate((FAR 1E-4))</td>
<td>98.25%</td>
<td>98.95%</td>
<td>99.50%</td>
</tr>
<tr>
<td>True Acceptance Rate((FAR 1E-6))</td>
<td>94.12%</td>
<td>97.99%</td>
<td>98.50%</td>
</tr>
<tr>
<td>Runtime Memory</td>
<td>1GB</td>
<td>2GB</td>
<td>2.5GB</td>
</tr>
</tbody>
</table>

## Ordering Information

| Part Number | 31ASFCVWAD0110 |
Advantech Edge AI Solution Advantages

Complete Solutions
Our solutions range from acceleration modules, inference systems to solution ready packages

GUI-Based AI Toolkit
Edge AI Suite helps with features and power across various neural networks based on OpenVINO toolkit

IoT Management
With IoT device operation management built-in, our solutions help easily manage connected devices.

Regional Service & Customization Centers

Greater China
China
Kunshan 86-512-5777-5666
Beijing 86-10-6298-4346
Shanghai 86-21-3632-1618
Shenzhen 86-755-8212-4222
Chengdu 86-28-8545-0188
Hong Kong 852-2720-5118
Taiwan
Taipei 886-2-2790-7818

Toll Free 0800-810-0345
China Volleyball 86-10-6298-4346
Shanghai Volleyball 86-21-3632-1618
Shenzhen Volleyball 86-755-8212-4222
Chengdu Volleyball 86-28-8545-0188
Hong Kong Volleyball 852-2720-5118
Taiwan Volleyball 886-2-2790-7818

Worldwide Offices

Asia
Japan
Toll Free 0800-500-1055
Tokyo 81-3-6802-1021
Osaka 81-6-6267-1887
Nagoya 81-0600-500-1055
Korea
Toll Free 080-363-9494
Seoul 82-2-3663-9494
Singapore
Singapore 65-6442-1000
Malaysia
Kuala Lumpur 60-3-7725-4188
Penang 60-4-537-9188
Thailand
Bangkok 66-02-2488306-9
Vietnam
Hanoi 84-24-3399-1155
Indonesia
Jakarta 62-21-751-1939
Australia
Toll Free 1300-306-531
Melbourne 61-3-9797-0100
India
Bangalore 91-80-2545-0206
Pune 91-94-2260-2349

Europe
Germany
Toll Free 00800-2426-5060/81
Munich 49-89-12599-0
Düsseldorf 49-2103-97-855-0
France
Paris 33-1-4119-4666
Benelux & Nordics
Breda 31-76-523-3100
UK
Newcastle 44-0-191-262-4844
London 44-0-870-493-1433
Poland
Warsaw 48-22-31-51-100
Russia
Moscow 8-800-555-01-50
St. Petersburg 8-800-555-81-20
Czech Republic
Ustí nad Orlicí 420-465-521-020
Ireland
Oranmore 353-91-792444

Americas
North America
Toll Free 1-888-576-9668
Cincinnati 1-513-742-8895
Milpitas 1-408-519-3898
Irvine 1-949-420-2500
Ottawa 1-815-434-8731
Brazil
Toll Free 0800-770-5355
São Paulo 55-11-5592-5367
Mexico
Toll Free 1-800-467-2415
Mexico City 52-55-6275-2727

www.advantech.com
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