COMBOX
TECHNOLOGY

COMBOX NUC SERVER FOR NEURAL NETWORKS INFERENCE

product specification

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AI MARKET OVERVIEW

MARKET TRENDS

2 500 petabytes of video surveillance data generated daily in 2019[1]

2025 $40 BILLION FROM $654 MILLION[2]

effective data analysis can not only deliver actionable insights, but significantly improve operations — helping boost profits

TECHNOLOGY TRENDS

BY 2021 82% of all IP traffic will be video[3]

More video data is collected every day, making it critical for businesses to implement robust data analysis strategies

2019 » 2024 (compound annual growth[4])

+67% AI cameras

+31% AI NVRs/recorders

1. Spectra Tech Brief: Meeting the Challenges of Storing IP Video Surveillance Content. July 2017
2. $40 Billion Artificial Intelligence in Marketing Market — Global Forecast to 2025. February 2018
3. Cisco Complete Visual Networking Index (VNI) Forecast, 2017-2022. February 2019
4. OMDIA Video Surveillance & Analytics Intelligence Database July 2020

AI MARKET OVERVIEW

TRADITIONAL COMPUTER VISION

HEURISTIC ALGORITHMS

HUMAN ENGINEERED

DEEP LEARNING

AI/DEEP LEARNING

REAL-TIME, HIGHER ACCURACY

WE ARE HELPING THESE INDUSTRIES MAKE PEOPLE'S LIVES

SAFER

SMART cities
- Public safety & security
- Traffic, parking and LPR
- Emergency response

MORE EFFICIENT

Financial sector
- People counting
- Reduce customer wait time
- ATM facial recognition

Robotics
- Manufacturing automation
- Industrial

HIGHER QUALITY

Industrial
- Machine vision
- Asset inspection
- Augmented reality

MORE FUN

Casino gaming
- Public safety & security
- Facial recognition

PRODUCTIVE

Transportation
- Public safety
- Traffic & people counting

RELAXING, SAFER

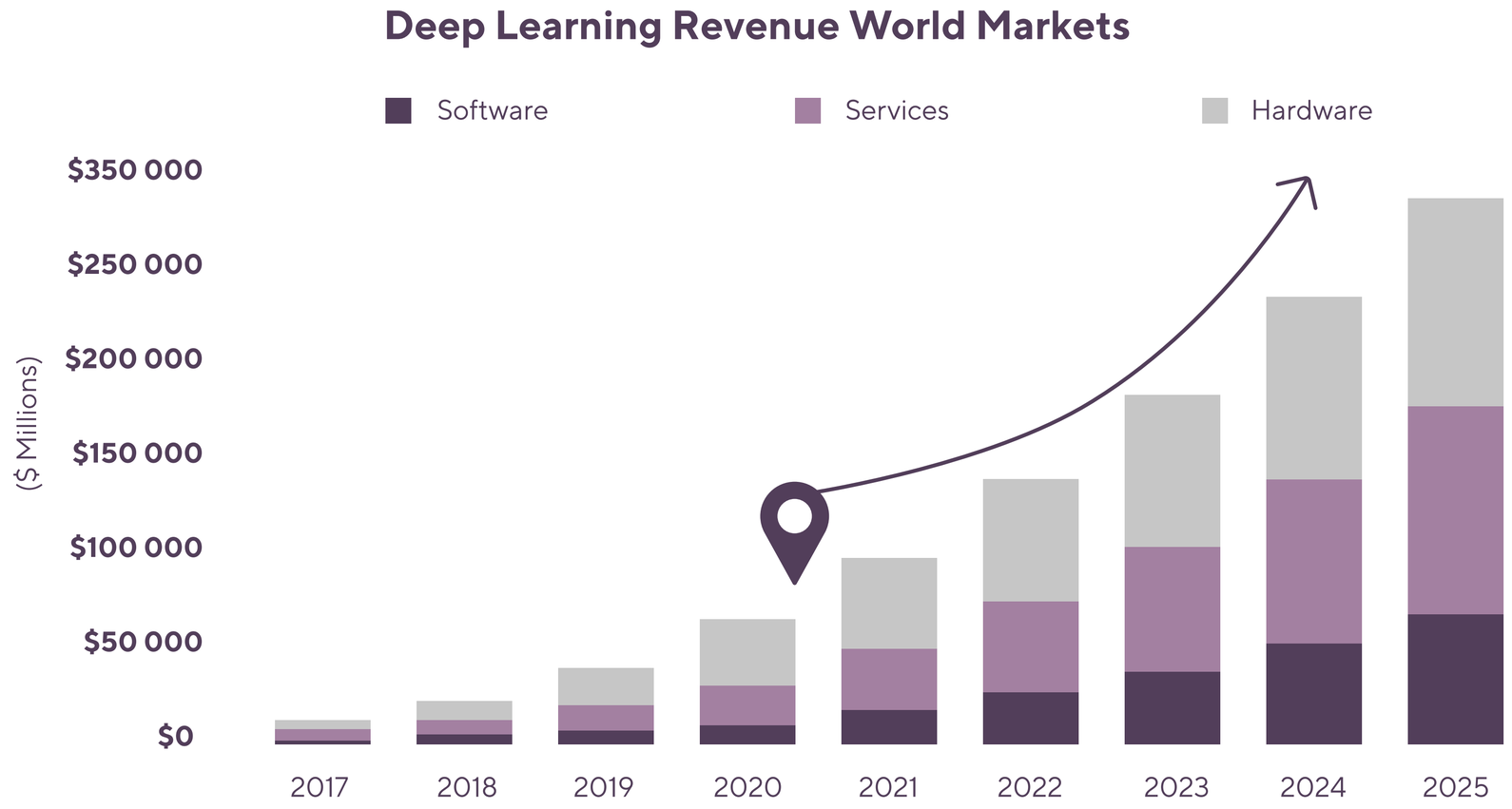
Home & retail
- Security
- Responsive retail advertising
- Digital home assistant

HEALTHFUL

Medical imaging
- Segmentation

(MRI scans to detect disease)

THE AI COMPUTING ERA OFFERS GROWING OPPORTUNITY



• AI to create

$13 TRILLION

additional economic activity **by 2030**[5]

• Machines to impact jobs—in a good way

58M NEW JOBS **by 2022**[6]

5. https://www.mckinsey.com/featured-insights/artificial-intelligence/notes-from-the-AI-frontier-modeling-the-impact-of-ai-on-the-world-econom
6. https://www.forbes.com/sites/amitchowdhry/2018/09/18/artificial-intelligence-to-create-58-million-new-jobs-by-2022-says-report/#710234644d4b

Chart Source: Tractica

WHAT IS INTEL NUC?

Next Unit of Computing (NUC) is a line of small-form-factor barebone computer kits designed by Intel.

They can be used at home, office, industrial and in inference too.

We use Intel NUC 8 gen in our inference servers because:

- **Powerful CPU Intel Core i5 8259U 2,3 GHz with 4 cores and 8 threads**
- **Integrated GPU Iris Plus 655, that can be used in inference**
- **Small sizes of device 117x51x112 mm**
- **M.2 and SATA III interfaces for HDD**
- **2 DDR4 slots for memory up to 32 GB**

INTRODUCING COMBOX NUC SERVER FOR NEURAL NETWORKS INFERENCE, A COMPUTE-EFFICIENT 1U SERVER FOR CLOUD AI

- High Performance CV & Deep Learning Inference
- Power Efficiency with Low Cost
- 32 cores and 64 threads in 8 CPUs Intel Core i5
- 8 Integrated GPUs Iris Plus
- Low power consumption less than 500 watt

COMBOX NUC SERVER ENABLES A WIDE SET OF NEW APPLICATIONS

AI appliance

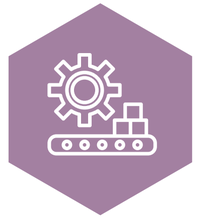
NVR

On premise server

Shopper tracking

Medical imaging

Auto plate recognition



Industrial automation

and many more...

COMBOX NUC SERVER ENABLES A WIDE SET OF NEW APPLICATIONS

Product CPU	**Intel Core i5**
Processor number	**8259U**
Count of CPUs	**8 pcs**
Status	**Launched**
Launch date	**Q3'19**
Supported Operating Systems	**Ubuntu 18.04**
Board number	**NUC8BEB**
Warranty	**1 year**
Processor base frequency	**2,3 GHz**
TDP	**400 W**

# of cores	**32**
# of threads	**64**
Processor base frequency	**2,3 GHz**
Max turbo frequency	**3,8 GHz**
Max memory size	**256 GB**
ECC memory supported	**No**
Intel Optane memory supported	**Yes**
Intel Virtualization Technology	**Yes**
Intel PTT	**Yes**
Intel AES New Instructions	**Yes**

Recommended customer price

$10 000

DL INFERENCE PERFORMANCE

- Operating system — Ubuntu 18.04.5.
- Measurements are made using ResNet50 and SSD Mobilenet v.2 model with FP16 weights.
- Inference tested with Intel OpenVINO 2021.1 release
- The benchmark_app utility included in Intel OpenVINO is used to measure performance.

DNN	FPS ComBox NUC server
SSD MOBILENET V.2	2215

Testing technique
Performance measurements are performed with blocks of 1 frame and 8 frames are fed to the input of the neural network (batch_size 1 and 8, respectively). The number of frames per second is counted and recorded.

SOFTWARE ARCHITECTURE AND OVERVIEW

PRODUCTIVITY

- Intel OpenVINO™ toolkit
- Ease-of-use programming model
- Simple and industry standard SDKs and APIs

FLEXIBILITY

- Different programming modes
- Consistent UX/DX across product line
- Backward compatibility

Intel OpenVINO toolkit makes media analytics development easier

Intel OpenVINO toolkit (Open Visual Inference and Neural network Optimization) is a free toolkit facilitating the optimization of a deep learning model from a framework and deployment using an inference engine onto Intel hardware.

The toolkit has two versions: OpenVINO toolkit, which is supported by open source community and Intel Distribution of OpenVINO toolkit, which is supported by Intel.

OpenVINO was developed by Intel. The toolkit is cross-platform and free for use under Apache License version 2.0.

The toolkit enables a write-once, deploy-anywhere approach to deep learning deployments on Intel platforms, including CPU, integrated GPU, Intel Movidius VPU, and FPGAs.

WHAT'S INSIDE THE OPENVINO™ TOOLKIT

TensorFlow

Caffe

mxnet

Trained models

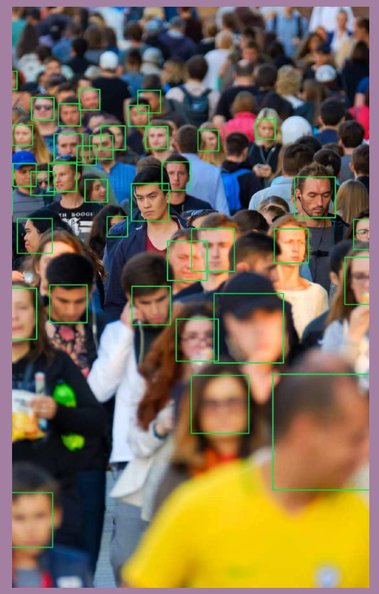
INTEL® DEEP LEARNING DEPLOYMENT TOOLKIT

Model Optimizer
Convert and optimize

IR

IR=Intermediate
Representation format

Inference engine
Optimized inference



COMPONENT TOOLS

Traditional computer vision for Intel CPU/CPU with integrated graphics – optimized computer vision libraries

OpenCV ***OpenVX***

Helps increase processor graphics performance – Linux* only

***Intel® Media SDK** ***OpenCL™**
***Intel® Integrated Graphics drivers and runtimes**

Linux for FPGA only

***FPGA runtime environment (RTE)**
(from Intel® FPGA 50K for openCL™)
***Bitstreams**

***Intel® FPGA Deep Learning Acceleration Suite (DLAS)**

CPU | GPU | FPGA | VPU

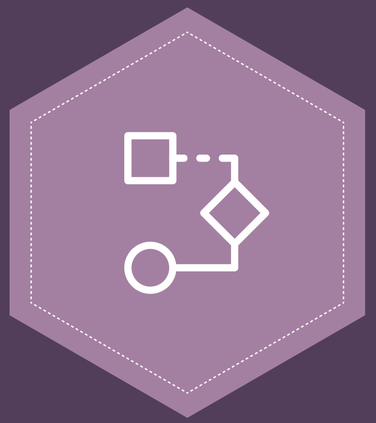
ADVANTAGES OF USING OPENVINO

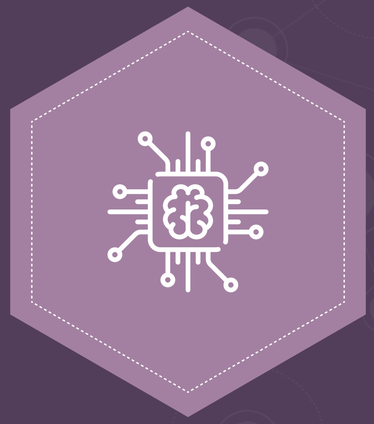
Write once

Deploy anywhere

Easy to use

Leverage common algorithms





High-performance deep learning inference

TYPICAL PIPELINE

#01

Media input

#02

Encode/decode

#03

Pre/post processing

#04

Deep learning inference

#05

Object tracking

#06

Media output

#07

Data move and management

COMBOX NUC SERVER PARITY NNS

Model name	FWK
googlenet-v1	TF
mobilenet-v2	PyTorch
resnet-50-pytorch	PyTorch
squeezenet1.1	PyTorch
yolo-v2-tiny-ava-0001	TF
yolo-v2-ava-0001	TF
googlenet-v3	TF
tiny_yolo_v2	TF
resnet-18	PyTorch
facenet-20180408-102900	TF
yolo_v3	TF/Keras
resnet-101	CF
resnet-152	CF
ssd512	CF
googlenet-v4	TF
icnet-camvid-ava-0001	TF
ssd_mobilenet_v1_coco	TF
vgg16	TF
tiny_yolo_v1	TF
yolo-v2-tiny-vehicle-detection-0001	TF/Keras
resnet-50-tf	TF
unet-camvid-onnx-0001	PyTorch
vehicle-attributes-recognition-barrier-0042	PyTorch
vehicle-license-plate-detection-barrier-0106	TF
mobilenet-v2-1.0-224	TF
vehicle-attributes-recognition-barrier0039	CF
googlenet-v1	CF
googlenet-v2	CF

COMBOX NUC SERVER PARITY NNS

Model name	FWK
googlenet-v4	CF
inception-resnet-v2	TF
mobilenet-v1-0.25-128	TF
mobilenet-v1-0.50-160	TF
mobilenet-v1-1.0-224	TF
mobilenet-v2-1.4-224	TF
resnet-101	TF
resnet-152	TF
resnet-v2-101	TF
resnet-v2-50	TF
ssd_mobilenet_v2_coco	TF
vgg16	CF
vgg19	CF
yolo-v3	CF
resnet-34-pytorch	PyTorch
mobilenet-v2	CF
resnet-50	CF
mobilenet-v1-1.0-224	CF
mobilenet-ssd	CF
age-gender-recognition-retail-0013	CF
emotions-recognition-retail-0003	CF
face-detection-retail-0004	CF
person-detection-retail-0013	CF
head-pose-estimation-adas-0001	CF
inception-resnet-v2	CF
squeezenet1.1	CF
ssd_resnet50_v1_fpn_coco	TF
ssd_mobilenet_v2_quantized	TF
ssdlite_mobilenet_edgetpu_coco_quant	TF
yoloV3	CF

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START WORKING WITH US

COMBOX TECHNOLOGY

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