

Accelerate Development of High-Performance Computer Vision and Deep Learning Inference into Vision Applications



PRODUCT BRIEF



Intel® Distribution of OpenVINO™ toolkit (open visual inference and neural network optimization) is a free software kit that helps developers and data scientists speed up computer vision workloads, streamline deep learning inference and deployments, and enable easy, heterogeneous execution across Intel® platforms from edge to cloud. It helps to:

- Unleash deep learning inference using a common API. Streamline deep learning inference and deployment using standard or custom layers without the overhead of frameworks. Includes 40+ pre-trained models and support for 100+ open source and custom models.
- Increase performance for AI and computer vision workloads with heterogeneous processing and asynchronous execution across multiple types of Intel® processors—CPUs, CPUs with integrated graphics, Intel® FPGAs, and Intel® Movidius™ vision processing units (VPUs).
- Accelerate development using optimized OpenCV* and OpenVX* functions.
 Get started quickly with15+ code samples. Add custom kernels into workloads
 (i.e., video/image processing, computer vision routines, feature extraction/
 tracking, OpenCL™).

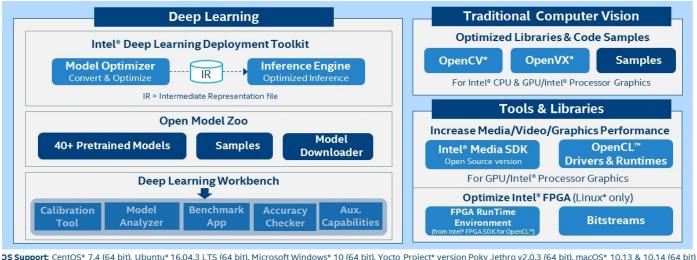
Demand for intelligent vision solutions is increasing from edge to cloud—including digital surveillance, retail, industrial/manufacturing, smart cities and homes, office automation, autonomous driving, and more. Deep learning revenue is expected to grow from \$655 million in 2016 to \$35 billion by 2025².

Top systems require multiple fast, scalable, reliable platforms and devices to support multi-channel streaming, real-time software-based analytics deep learning, and more. Intel's robust hardware and software products give OEMs/ODMs, system integrators, ISVs, and solution providers the tools they need to speed design, development, and deployment of high-performance computer vision solutions—enabling rich solutions for AI everywhere.

What's Inside

- Intel® Deep Learning Deployment Toolkit with model optimizer and inference engine
- Open Model Zoo that includes 40+ optimized pre-trained models
- Deep learning Workbench, a GUI tool for profiling and inference experiments
- OpenCV, OpenVX and Intel® Media SDK to provide optimized traditional computer vision libraries and encode/decode capabilities.

Free Download > software.intel.com/openvino-toolkit



DS Support: CentOS* 7.4 (64 bit), Ubuntu* 16.04.3 LTS (64 bit), Microsoft Windows* 10 (64 bit), Yocto Project* Version Poky Jethro V2.0.3 (64 bit), macOS* 10.13 & 10.14 (64 bit)

Intel® Architecture-Based
Platforms Support

Intel® Architecture-Based

Intel® Vision Accelerator
Design Products & Align Products & Align Products & Align Products of Developer Kits

Figure 1. Includes Intel® Deep Learning Deployment Toolkit with model optimizer, inference engine, and other component tools and libraries.

- OpenCL drivers and runtimes to support custom layer implementations in a neural network.
- FPGA Runtime Environment and bitstreams to jumpstart deep learning inference on FPGAs

Key Components

Intel® Deep Learning Deployment Toolkit Model Optimizer

What it does: I: Imports trained models from various frameworks (Caffe*, Tensorflow*, MxNet*, ONNX*, Kaldi*) and converts them to a unified intermediate representation file. It also optimizes topologies through node merging, horizontal fusion, eliminating batch normalization, and quantization. It also supports graph freeze and graph summarize along with dynamic input freezing.

Why it's important: The Model Optimizer typically provides the biggest performance boost by conversion to data types that match hardware types (FP32 to FP16).

Includes samples for:

- Standard and pipelined image classification
- Image segmentation
- Object detection
- Object detection for Single Shot Multibox Detector (SSD)
- Neural style transfer
- Security barrier
- · Interactive face detection
- People counter
- · Multi-channel face detection

Inference Engine

What it is: A simple and unified API for inference across Intel® architecture. It allows execution of layers across hardware targets (CPU, CPU with integrated graphics, FPGA, and VPU) through heterogeneous support.

Why it's important: The inference engine's interface is implemented as dynamically loaded plugins for each hardware

type. It delivers the best performance for each type without making you implement and maintain multiple code pathways.

Pre-Trained Models/Open Model Zoo

The toolkit includes a set of optimized pre-trained models that can expedite development and improve inference pipelines for Intel® processors. These models can be leveraged for development and production deployment without the need to search for or to train models from scratch.

- Age/gender
- Face detection (standard and enhanced)
- Face reidentification
- · Head position
- Human detection (eye-level and high-angle detection)
- Detect people, vehicles, and bikes
- License plate detection (small and front-facing)
- Vehicle metadata
- Pedestrian and vehicle detection
- Retail environment
- Person attributes recognition crossroad
- Person and action detection for smart classroom
- Emotion recognition
- Identify someone from different videos
- Advanced roadside identification
- Vehicle attributes
- Landmarks regression
- Crossroad object detection
- Semantic segmentation
- Facial landmarks
- Human pose estimation
- Single image super resolution
- Gaze estimation
- Action recognition encoder and decoder
- · Text detection and recognition
- Instance segmentation networks
- · Image retrieval

Binary models:

- ResNet 50
- Face, person, and vehicle detection

Deep Learning Workbench

This Web-based graphical environment allows users to visualize a simulation of performance of deep learning models and datasets on various Intel® architecture configurations (CPU, GPU, VPU). It provides key performance metrics such as latency, throughput, and performance counters for each layer of the selected neural network. This tool includes simple configuration for many inference experiments to detect optimal performance settings.

- Run single versus multiple inferences.
- Calibrate to reduce precision of certain model layers from FP32 to Int8.
- Tune with Winograd Algorithm to automatically determine the optimized algorithm based on convolution layer parameters and hardware configuration
- Run experiments on known data sets and determine accuracy of the model after parameter tuning or calibration using the accuracy checker.

Optimized Libraries and Functions for Traditional Computer Vision

- OpenCV: A well-established, open source, and optimized computer vision library. It includes a wide variety of algorithms and functions available including the Intel® Photography Vision Library, a collection of highly optimized and state of the art computer vision functions.
- OpenVX: An optimized, graph-based approach for computer vision functions that is targeted at real-time, low power applications. More than 15 samples included.

Why You Need It

Boost Computer Vision Performance

- Provides access to Intel's computer vision accelerators (CPU, CPU with integrated graphics, FPGAs, and Intel Movidius VPUs) to accelerate performance.
- Supports heterogeneous execution across multiple types of Intel® processors
- Accelerates model inference through int8 quantization

Streamline Deep Learning Inference and Deployment

- · Enables deep learning inference on edge as well as cloud.
- Includes Deep Learning Deployment Toolkit with a model optimizer and an inference engine, which provides optimized inference across many hardware types.
- Allows you to use standard or custom layers without the overhead of frameworks.
- Includes more than 40 pre-trained models and support for 100+ open source and custom models.

Speed Development for Vision Solutions, Save Time with a Heterogeneous Approach

- Supports heterogeneous execution across multiple types of Intel processors.
- · Improves efficiency and saves development time.

Success Stories



Deep Learning for Healthcare Imaging

Intel and GE brought the power of AI to clinical diagnostic scanning and other healthcare workflows.

Read more >



Performance Boost for a Deep Learning Algorithm

GeoVision sped up its facial recognition solution using Intel® System Studio and the Intel Distribution of OpenVINO toolkit.

Read more >

See more success stories >

 Use the SDK's library of functions, pre-optimized kernels, and optimized calls for OpenCV and OpenVX.Write code once and deploy it to multiple types of Intel processor-based devices, easily customizing it for your models. Delivers broad capabilities to all developers—no domain expertise required.

Accelerate Computer Vision and Deep Learning Inference from Edge to Cloud

Download the free Intel Distribution of OpenVINO toolkit

to speed up computer vision workloads and streamline deep learning deployments with easy, heterogeneous execution across multiple types of Intel hardware.

Optimize more capabilities by using the Intel Distribution of OpenVINO toolkit with other tools:

- Intel® SDK for OpenCL™ Applications for Intel® CPUs and CPUs with integrated graphics workload balancing
- Intel® System Studio to optimize system bring-up and IOT device application performance

Get Started Now

- Download the free Intel® Distribution of OpenVINO™ toolkit >
- Learn more about Intel Distribution of OpenVINO toolkit >
- Explore Intel® Deep Learning Deployment Toolkit >
- Visit Tech.Decoded, Intel's developer knowledge hub >

Technical Specifications

CPU	Supported Hardware
	6th-10th generation Intel® Core™ processors with Iris® Pro graphics and Intel® HD Graphics
	·
	 Intel® Pentium® processor N4200/5, N3350/5, N3450/5 with Intel HD Graphics Supported Operating Systems
	Microsoft Windows® 10 (64 bit)
	Ubuntu* 18.04.3 LTS (64 bit)
	• CentOS* 7.4 (64 bit)
	Yocto Project* MR3 (64 bit)
	• macOS 10.13, 10.14 (64 bit)
	Supported OpenVINO Toolkit Components
	Intel® Deep Learning Deployment Toolkit
	OpenCV
	OpenVX*
	Deep Learning Workbench
CPU with Integrated Graphics	Supported Hardware
(Intel® Processor Graphics/GPU)	 6th-10th generation Intel® Core™ processors with Iris® Pro graphics and Intel® HD Graphics
	Intel® Pentium® processor N4200/5, N3350/5, N3450/5 with Intel HD Graphics
	Supported Operating Systems
	• Windows 10 (64 bit)
	Ubuntu 16.04.3 LTS (64 bit)
	CentOS 7.4 (64 bit)
	Yocto Project MR3 (64 bit)
	Supported OpenVINO Toolkit Components
	Intel® Deep Learning Deployment Toolkit
	OpenCV
	OpenVX
	Deep Learning Workbench
Intel® FPGAs	Supported Hardware
	Intel® Arria® 10 GX FPGA Development Kit
	Intel® Programmable Acceleration Card with Intel® Arria® 10 GX FPGA
	Supported Operating Systems
	Ubuntu 18.04.2 LTS (64 bit)
	Ubuntu 18.04.2 LTS (64 bit)CentOS 7.4 (64 bit)
	 Ubuntu 18.04.2 LTS (64 bit) CentOS 7.4 (64 bit) Supported OpenVINO Toolkit Components
Intol® Movidius™	Ubuntu 18.04.2 LTS (64 bit) CentOS 7.4 (64 bit) Supported OpenVINO Toolkit Components Intel® Deep Learning Deployment Toolkit
	Ubuntu 18.04.2 LTS (64 bit) CentOS 7.4 (64 bit) Supported OpenVINO Toolkit Components Intel® Deep Learning Deployment Toolkit Supported Hardware
Intel® Movidius™ Vision Processing Unit (VPU)	 Ubuntu 18.04.2 LTS (64 bit) CentOS 7.4 (64 bit) Supported OpenVINO Toolkit Components Intel® Deep Learning Deployment Toolkit Supported Hardware Intel® Movidius™ Neural Compute Stick
	Ubuntu 18.04.2 LTS (64 bit) CentOS 7.4 (64 bit) Supported OpenVINO Toolkit Components Intel® Deep Learning Deployment Toolkit Supported Hardware Intel® Movidius™ Neural Compute Stick Intel® Neural Compute Stick 2
	 Ubuntu 18.04.2 LTS (64 bit) CentOS 7.4 (64 bit) Supported OpenVINO Toolkit Components Intel® Deep Learning Deployment Toolkit Supported Hardware Intel® Movidius™ Neural Compute Stick Intel® Neural Compute Stick 2 Supported Operating Systems
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Vision Processing Unit (VPU)	 Ubuntu 18.04.2 LTS (64 bit) CentOS 7.4 (64 bit) Supported OpenVINO Toolkit Components Intel® Deep Learning Deployment Toolkit Supported Hardware Intel® Movidius™ Neural Compute Stick Intel® Neural Compute Stick 2 Supported Operating Systems Ubuntu 18.04.3 TLS (64 bit) CentOS 7.4 (64 bit) Windows 10 (64 bit) macOS Supported OpenVINO Toolkit Components Intel Deep Learning Deployment Toolkit OpenCV and OpenVX functions (needs to be run against the CPU or GPU)

¹ See image on page 3 for details and configuration.

Performance results are based on testing as of 4/13/2018 and may not reflect all publicly available security updates. See configuration disclosure for details. No product can be absolutely secure. Performance results are based on testing as of 4/13/2/18 and may not reflect all publicly available security updates. See configuration disclosure for details. No product can be absolutely secure.

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² Tractica, 2Q 2017

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