INTEL® NEURAL COMPUTE STICK 2

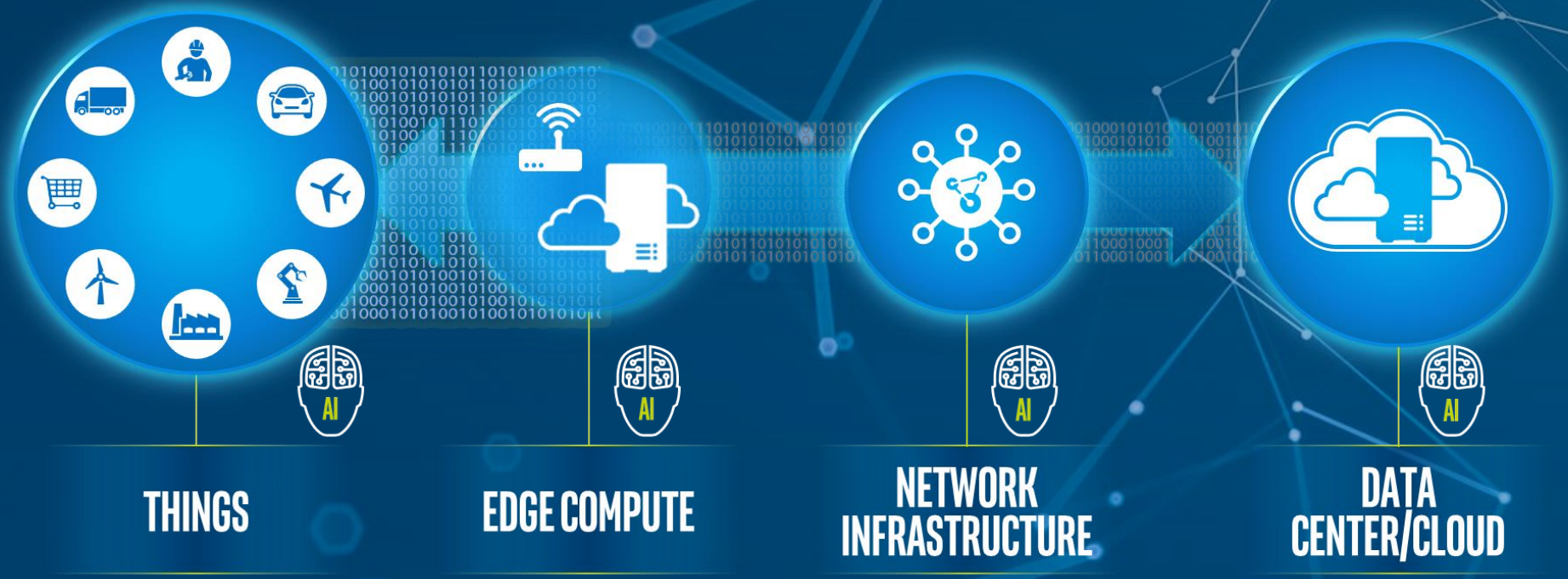
ACCELERATE DEEP LEARNING DEVELOPMENT FOR EDGE DEVICES

AI: DISTRIBUTED COMPUTE FROM DEVICE TO CLOUD
EDGE DRIVERS: BANDWIDTH, STORAGE, LATENCY, SECURITY

45% *of data will be stored, analyzed, and acted on at the edge by 2019*[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]



Intel® Neural Compute Stick 2

1. Source: IDC FutureScape: Worldwide Internet of Things 2017 Predictions
2. ABI Research

COMPUTER VISION AND ARTIFICIAL INTELLIGENCE ARE TRANSFORMING IOT DEVICES AT THE NETWORK EDGE

SMART CITIES

Public Safety & Surveillance
Traffic, Parking and LPR
Emergency Response

FINANCIAL SERVICES

People Counting
Customer (i.e., Gender, Wait Time)
ATM Facial Recognition

INDUSTRIAL

Machine Vision
Asset Inspection (i.e., Pipeline)
Augmented Reality

CASINO GAMING

Public Safety & Surveillance
Facial Recognition

TRANSPORTATION

Autonomous Vehicles
Public Safety (i.e., Bus/Rail)
Traffic & People Counting

HOME, RETAIL & SURVEILLANCE

Security & Surveillance
Responsive Retail Advertising
Digital Home Assitant

ROBOTICS

Manufacturing Automation
Industrial (i.e., Pipeline Welding)

DRONES

Emergency Response
Asset Inspection (i.e., Windmill)

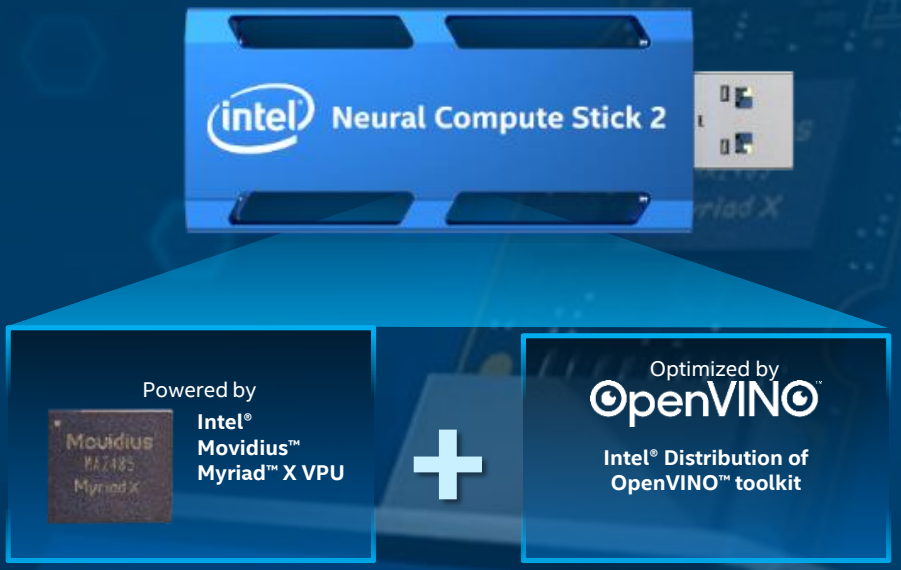
HIGH PERFORMANCE & LOW POWER FOR AI INFERENCE

INTEL® NEURAL COMPUTE STICK 2

BOOST PRODUCTIVITY

SIMPLIFY PROTOTYPING

DISCOVER EFFICIENCIES



UP TO **8X**[1] **HIGHER PERFORMANCE**

On deep neural networks compared to Intel® Movidius™ Neural Compute Stick

MORE CORES. MORE AI INFERENCE.

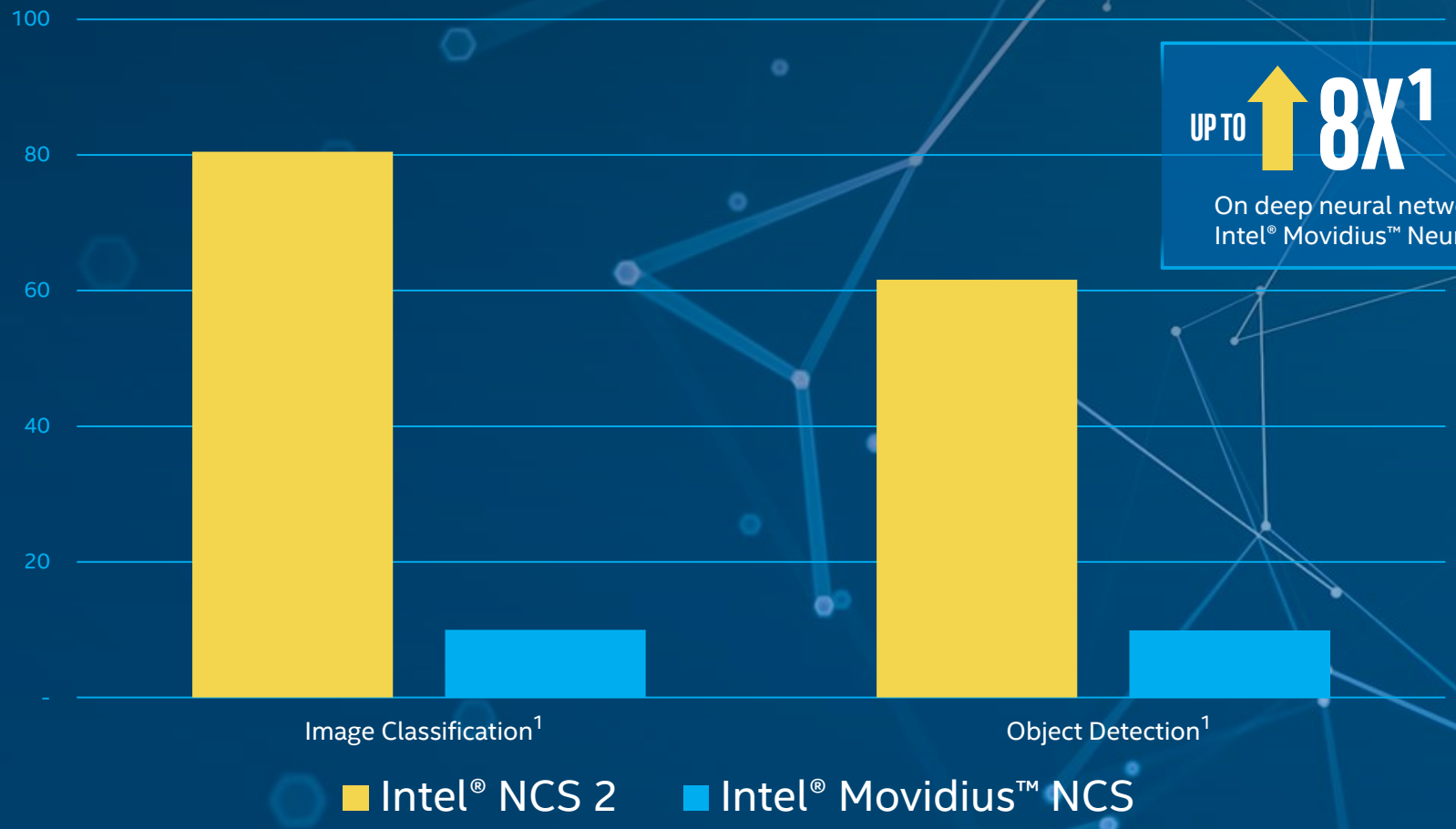
- ✓ Start quickly with plug-and-play simplicity
- ✓ Develop on common frameworks and out-of-box sample applications
- ✓ Prototype on any platform with a USB port
- ✓ Operate without cloud compute dependence

Order now for $99 MSRP*: Where to buy

Intel® Neural Compute Stick 2

*MSRP is not a guarantee of final retail price. MSRP may be changed in the future based upon economic conditions.

INTEL® NEURAL COMPUTE STICK 2
MORE CORES. MORE AI INFERENCE



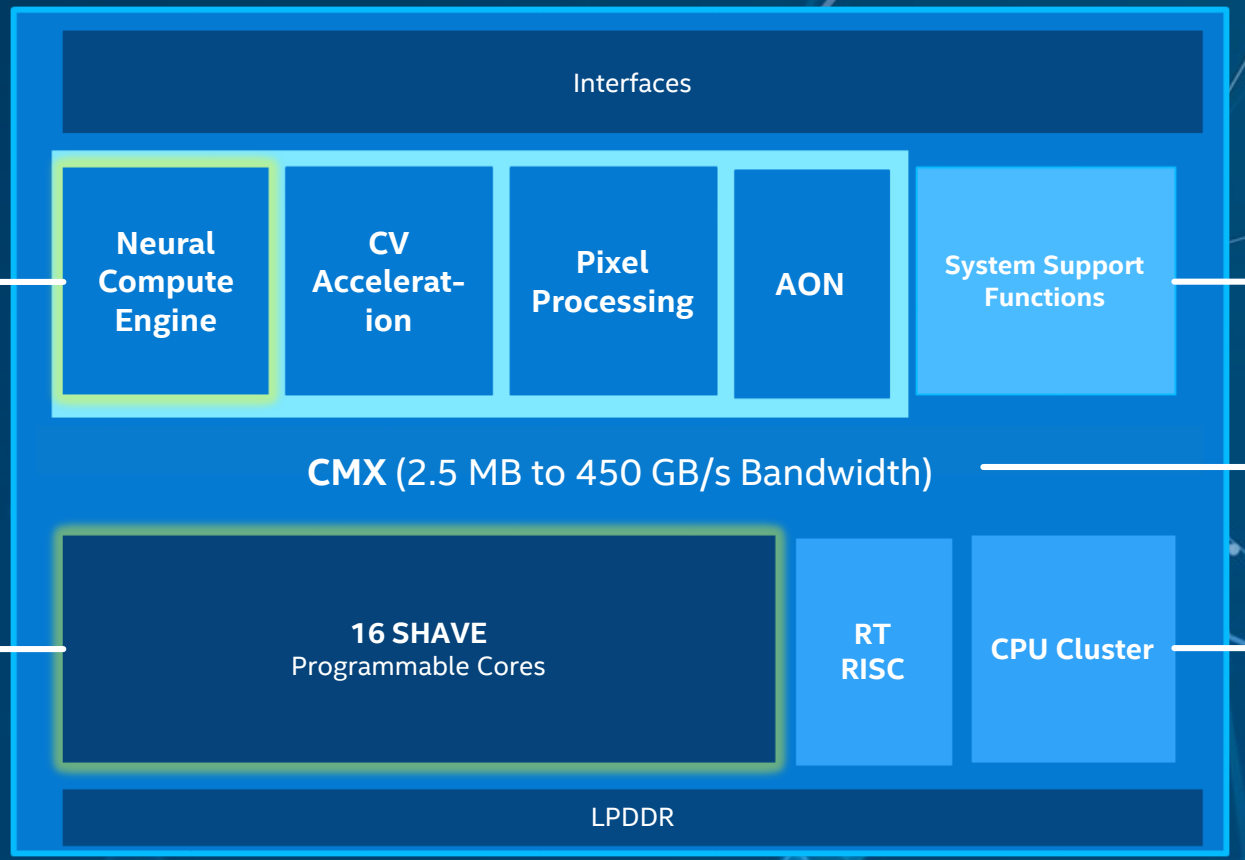
UP TO 8X[1] HIGHER PERFORMANCE

On deep neural networks compared to Intel® Movidius™ Neural Compute Stick

INTEL® NEURAL COMPUTE STICK 2: FEATURING THE INTEL® MOVIDIUS™ MYRIAD™ X VPU

A self-sufficient, all-in-one processor that features the powerful **Neural Compute Engine** and **16 programmable SHAVE cores** that deliver class-leading performance for deep neural network inference applications.

An entirely new deep neural network (DNN) inferencing engine that offers flexible interconnect and ease of configuration for on-device DNNs and computer vision applications



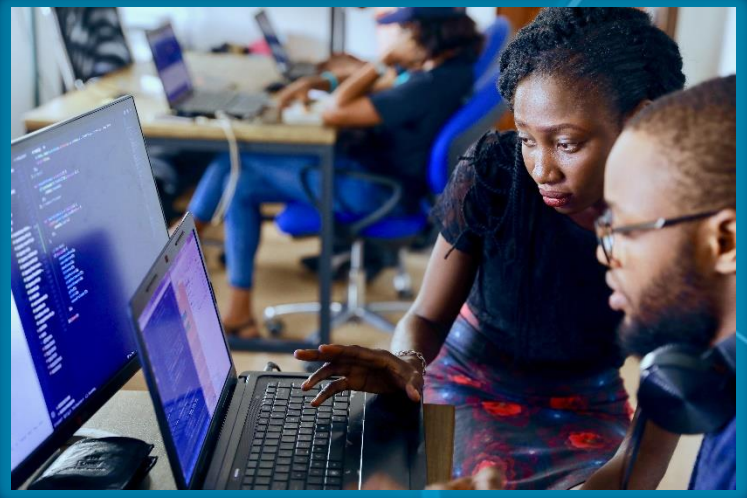
System support functions operate frames, tiles, CODEC, compression and security

Homogeneous memory design for low-power, UL latency, sustained High Performance, and locally stored data

VLIW (DSP) programmable processors are optimized for complex vision & imaging workloads

RISC Processors, RTOS Schedulers, Pipeline Managers, Sensor Control Frameworks

BRING GREATER INTELLIGENCE TO NETWORK EDGE DEVICE PROTOTYPES



BOOST PRODUCTIVITY

With the enhanced hardware processing capabilities of the Intel® Movidius™ Myriad™ X VPU

SIMPLIFY PROTOTYPING

Streamline development of multiplatform computer vision Solutions using the Intel® Distribution of OpenVINO™ toolkit—increasing deep learning performance

DISCOVER EFFICIENCIES

By deploying exceptional performance per watt per dollar at the edge

Intel® Neural Compute Stick 2

OpenVINO™

DEEP LEARNING

Caffe | mxnet | ONNX | TensorFlow

- >100 Networks Supported
- CV Algorithms
- Model Optimizer
- Inference Engine

COMPUTER VISION

Open CV | Open CL | OpenVX™

- CV Library (Kernel & Graphic APIs)

AGNOSTIC, COMPLEMENTARY TO MAJOR FRAMEWORKS

HIGH PERFORMANCE, HIGH EFFICIENCY FOR THE EDGE

CROSS-PLATFORM FLEXIBILITY

APRIL 2019 RELEASE
WHAT'S NEW?

- **11 new pre-trained models** on Open Model Zoo for a total of 40+ models
- **Raspberry PI* hardware** support
- Support for **binary weights** to boost performance
- **7 new supported layers**

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

Open Source version ▸ 01.org/openvinotoolkit

Release Notes ▸ https://software.intel.com/en-us/articles/OpenVINO-RelNotes

EXPEDITE DEVELOPMENT AND DEPLOYMENT
PRE-TRAINED MODELS

Description	Pre-trained Model	Supported Samples
Face detection for driver monitoring	face-detection-adas-0001	Interactive face detection
Age and gender recognition	age-gender-recognition-retail-0013	Interactive face detection
Emotion recognition for retail	emotions-recognition-retail-0003	Interactive face detection
License plate detector	vehicle-license-plate-detection-barrier-0106	Security barrier camera
Vehicle attributes recognition	vehicle-attributes-recognition-barrier-0039	Security barrier camera
License plate recognition	license-plate-recognition-barrier-0001	Security barrier camera
Person, vehicle and bike detection	person-vehicle-bike-detection-crossroad-0078	Crossroad camera
Person re-identification	person-reidentification-retail-0076	Crossroad camera
	person-reidentification-retail-0031	Crossroad camera pedestrian tracker
	person-reidentification-retail-0079	Crossroad camera
Person detection	person-detection-retail-0013	Any SSD-based sample
Face detection for retail	face-detection-retail-0004	Any SSD-based sample
Face and person detection for retail	face-person-detection-retail-0002	Any SSD-based sample
Vehicle detection	vehicle-detection-adas-0002	Any SSD-based sample
Landmarks regression fro retail	landmarks-regression-retail-0009	Smart classroom

View Documentation ▸ http://docs.openvinotoolkit.org/latest/_docs_Pre_Trained_Models.html

INTEL® DISTRIBUTION OF OPENVINO™ TOOLKIT
SUPPORTED NETWORKS

View Documentation ▸ https://docs.openvinotoolkit.org/latest/_docs_IE_DG_supported_plugins_MYRIAD.html

Caffe

- AlexNet
- CaffeNet
- GoogleNet (Inception) v1, v2, v4
- VGG family (VGG16, VGG19)
- SqueezeNet v1.0, v1.1
- ResNet v1 family (18** ***, 50, 101, 152)
- MobileNet (mobilenet-v1-1.0-224, mobilenet-v2)
- Inception ResNet v2
- DenseNet family** (121,161,169,201)
- SSD-300, SSD-512, SSD-MobileNet, SSD-GoogleNet, SSD-SqueezeNet

TensorFlow

- AlexNet
- Inception v1, v2, v3, v4
- Inception ResNet v2
- MobileNet v1, v2
- ResNet v1 family (50, 101, 152)
- ResNet v2 family (50, 101, 152)
- SqueezeNet v1.0, v1.1
- VGG family (VGG16, VGG19)
- Yolo family (yolo-v2, yolo-v3, tiny-yolo-v1, tiny-yolo-v2, tiny-yolo-v3)
- faster_rcnn_inception_v2, faster_rcnn_resnet101
- ssd_mobilenet_v1
- DeepLab-v3+

mxnet

- AlexNet and CaffeNet
- DenseNet family** (121,161,169,201)
- SqueezeNet v1.1
- MobileNet v1, v2
- NiN
- ResNet v1 (101, 152)
- ResNet v2 (101)
- SqueezeNet v1.1
- VGG family (VGG16, VGG19)
- SSD-Inception-v3, SSD-MobileNet, SSD-ResNet-50, SSD-300

NOTE: Not an exhaustive list – only includes popular networks.
** Network is tested on Intel® Movidius™ Neural Compute Stick with BatchNormalization fusion optimization disabled during Model Optimizer import
*** Network is tested on Intel® Neural Compute Stick 2 with BatchNormalization fusion optimization disabled during Model Optimizer import

INTEL® DISTRIBUTION OF OPENVINO™ TOOLKIT
SUPPORTED LAYERS

View Documentation ▸ https://docs.openvinotoolkit.org/latest/_docs_IE_DG_supported_plugins_Supported_Devices.html

- Activation-Clamp
- Activation-ELU
- Activation-Leaky ReLU
- Active-PReLU
- Activation-ReLU
- Activation-ReLU6
- Activation-Sigmoid/Logistic
- Activation-TanH
- ArgMax
- BatchNormalization
- Concat
- Const
- Convolution-Dilated
- Convolution-Grouped
- Convolution-Ordinary
- Crop
- CTCGreedyDecoder*
- Deconvolution
- DetectionOutput*
- Eltwise-Max
- Eltwise-Mul
- Eltwise-Sum
- Flatten
- FullyConnected (Inner Product)
- GRN
- Interp
- LRN (Norm)
- MVN*
- Normalize*
- Pad*
- Permute
- Pooling(AVG,MAX)*
- Power
- PriorBox
- PriorBoxClustered
- Proposal
- PSROIPooling
- RegionYolo
- ReorgYolo
- Resample
- Reshape
- RNN
- ROIPooling
- ScaleShift*
- Slice
- SoftMax
- Split
- Tile

* Support is limited to the specific parameters. Refer to “Known Layers Limitation” section for the device from the list of supported.
Changed since last update

QUICKLY DEPLOY WITH PRE-BUILT PROJECTS
OPEN-SOURCED REFERENCE IMPLEMENTATIONS

Parking Lot Tracker
Receive or post information on available parking spaces by tracking how many vehicles enter and exit a parking lot.

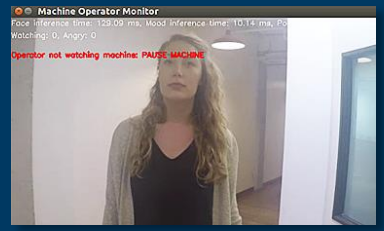
Use Cases
- Track and analyze vehicle activity
- Report on parking space availability

Shopper Gaze Monitor
Build a solution to analyze customer expressions and reactions to product advertising collateral that is positioned on retail shelves.

Use Cases
- Measure active versus inactive user product engagement
- Capture analytics on shopper reactions to visual ads

Shopper Mood Monitor
Detect the mood of shoppers when looking at a retail or kiosk display.

Use Cases
Mall shoppers using interactive or map kiosk
Grocery store shoppers viewing digital signage ads
Hospitals using a kiosk to assist patients or visitors



Machine Operator Monitor
Send notifications when an employee appears to be distracted when operating machinery.

Use Cases
- Industrial or manufacturing facilities
- Construction sites
- Warehouses

Intruder Detector
Build an application that alerts you when someone enters a restricted area. Learn how to use models for multiclass object detection.

Use Cases
- Record and send alerts on activity in controlled spaces
- Track parking lots, entrances, and property

Store Traffic Monitor
Monitor three different streams of video that count people inside and outside of a facility. This application also counts product inventory.

Use Cases
- Movement of people
- Foot activity in retail or warehouse spaces
- Inventory availability of products on shelves

Restricted Zone Notifier
Secure work areas and send alerts if someone enters the restricted space.

Use Cases
- Track worker activity in proximity to heavy machinery
- Develop safety solutions using computer vision technologies

Intel® Neural Compute Stick 2

View All ▸ https://software.intel.com/en-us/iot/reference-implementations

INTEL® NEURAL COMPUTE STICK 2
AI IN ACTION

Machine Learning and Mammography
Detecting invasive ductal carcinoma with convolutional neural networks showing how existing deep learning technologies can be utilized to train artificial intelligence (AI) to be able to detect invasive ductal carcinoma (IDC)[1] (breast cancer) in unlabeled histology images.

AI Assists with Skin Cancer Screening
Doctor Hazel, a skin cancer screening service powered by AI that operates in real time, relies on an extensive library of images to distinguish between skin cancer and benign lesions, making it easier for people to seek professional medical advice.

AI Helps Detect Bacteria in Water
Offline analysis is accomplished with a digital microscope connected to a laptop running Ubuntu* and the Intel® Movidius™ Neural Compute Stick. After analysis, contamination sites are marked on a map in real time

Shark Detection to Save Lives
Intel® Movidius™ Neural Compute Stick was used with Australia's Little Ripper Lifesaver UAV to monitor the New South Wales coastline for sharks.

Nudity Detection to Fight Child Pornography
The NaaS (Nudity-detection as a service) the result of a project by Haschek Solutions. It uses a cluster of three Raspberry Pis and two Intel Movidius Neural Compute Sticks to analyze photographs to identify pornographic images.

AI has the power to make a difference and change lives. What will you make?
Get Started Today ▶ intel.com/ncs

CALL TO ACTION

Purchase the Intel® Neural Compute Stick 2

Set up and test using the Intel® Neural Compute Stick 2 Get Started page

Join the Intel® Distribution of OpenVINO™ toolkit™ support forum

Learn about Intel® Vision Products page

RESOURCES

- Intel® Neural Compute Stick 2 website
- Intel® Distribution of OpenVINO™ toolkit overview
- Intel® Neural Compute Stick 2 tutorials
- Where to Buy Intel® Neural Compute Stick 2
- Join us at events
- Intel® AI: In Production ecosystem

KEY CONTACT

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lindsay.d.hiebert@intel.com


intel

LEGAL DISCLAIMER & OPTIMIZATION NOTICE

[1]Testing by Intel as of October 12th, 2018

Deep Learning Workload Configuration. Comparing Intel® Movidius™ Neural Compute Stick based on Intel® Movidius™ Myriad™ 2 VPU vs. Intel® Neural Compute Stick 2 based on the Intel® Movidius™ Myriad™ X VPU with Asynchronous Plug-in enabled for (2xNCE engines). As measured by images per second across GoogleNetV1*. Base System Configuration: Intel® Core™ I7-8700K 95W TDP (6C12T at 3.7GHz base freq and 4.7GHz max turbo freq), Graphics: Intel® UHD Graphics 630 Total Memory 65830088 kB Storage: INTEL SSDSC2BB24 (240GB), Ubuntu* 16.04.5 Linux*-4.15.0-36-generic-x86_64-with-Ubuntu*-16.04-xenial, deeplearning_deploymenttoolkit_2018.0.14348.0, API version 1.2, Build 14348, myriadPlugin, FP16, Batch Size = 1

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Performance results are based on testing as of October 12th, 2018 and may not reflect all publicly available security updates. See configuration disclosure for details. No product can be absolutely secure.

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