## embedded VISION SUMMIT 2018

### Rethinking Deep Learning: Neural Compute Stick

Ashish Pai May 23, 2018



#### **AGENDA**



- The need for intelligence at the edge
- Introduction to
  - Movidius<sup>™</sup> Vision Processing Units
  - Movidius™ Neural Compute Stick
- Edge compute use cases
- Barriers to moving intelligence to the edge
- Deep Learning at the edge Al in Production Program



#### THE NEED FOR INTELLIGENCE AT THE EDGE







#### LETS LOOK AT A LARGER SCALE....





20 billion connected devices by 20201



... generating billions of petabytes of data traffic between devices & the cloud

1 Source: http://www.gartner.com/newsroom/id/3598917

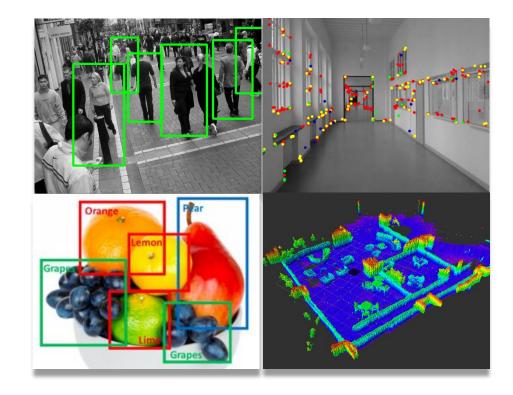


## COMPUTER VISION AND ARTIFICIAL INTELLIGENCE AT THE EDGE



A Revolutionary Low-Power SOC for Visual Intelligence

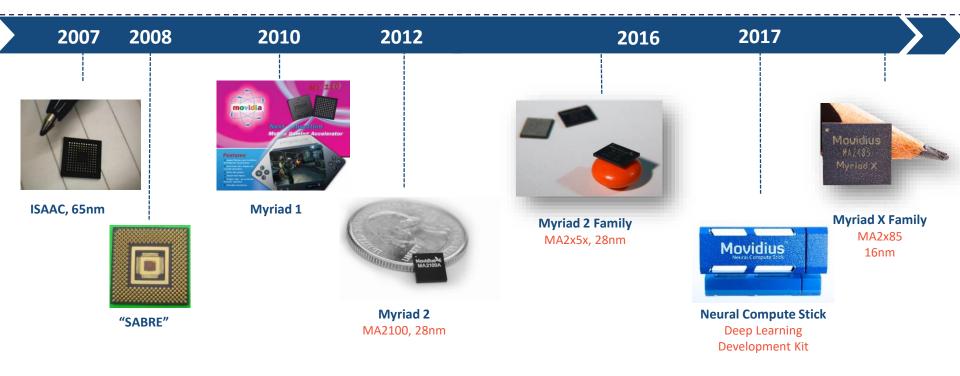






#### A DECADE OF INNOVATION





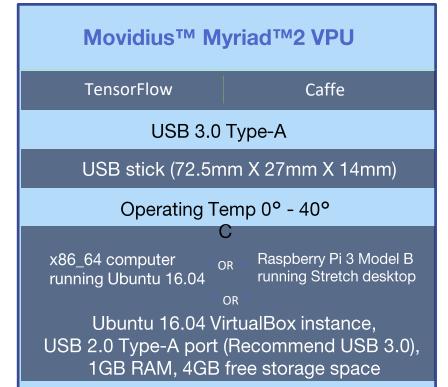


#### MOVIDIUS™ NEURAL COMPUTE STICK





- Neural Network Accelerator in USB Stick Form Factor
- Real-time on-device inference;
   no cloud connectivity required
- No additional heat-sink, no fan, no cables, no additional power supply
- Prototype, tune, validate and deploy deep neural networks at the edge
- Features the same Movidius<sup>™</sup> vision processing unit (VPU) used in drones, surveillance cameras, VR headsets, and other low-power intelligent and autonomous products





#### **GAME-CHANGING INTELLIGENT DEVICES**



#### Launched within the past years powered by Intel® Movidius™ VPU



Hikvision Intelligent Camera



Hikvision Industrial Camera



DJI Inspire 2



DJI Phantom 4 Pro



DJI Spark



DJI Mavic Pro



Uniview IP Camera



Dahua Industrial Camera



Moto 360° Camera



Google Clips



### **GOOGLE CLIPS**









### **TELLO**







#### **KEY CAPABILITIES**



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#### DEEP LEARNING IN SURVEILLANCE



#### Typical use cases could be:

- Robot
- Security camera
- Smart-home assistant

#### **Key capabilities:**

- Object detection
- Object classification
- Facial recognition
- Natural language processing



### **USE CASE WITH NEURAL COMPUTE STICK**



#### LITTLE RIPPER LIFESAVER\* UAV

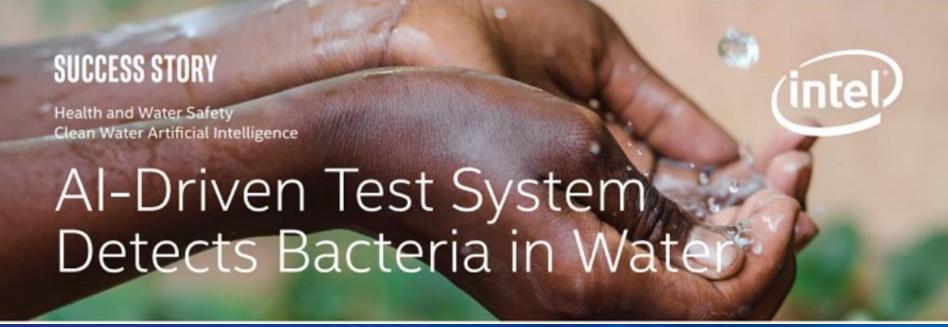


https://newsroom.intel.com/editorials/data-most-important-force-society-today/https://www.youtube.com/watch?v=QJOMfDyhUyo



#### **USE CASE WITH NEURAL COMPUTE STICK**





NCS helps build an effective system for identifying bacteria using pattern recognition and machine learning. Won first prize in the World Virtual GovHack, receiving USD 200,000 that will help fund the next phase of the Clean Water AI project.



#### **INDUSTRY ADOPTION OF NCS**



- Tens of thousands of NCS sticks sold-out with thousands of developers actively working on it
- Winner of 2018 CES "Best of Innovation" in the Embedded category
- Developers, entrepreneurs, businesses strongly looking to scale



#### **INTEL® AI IN PRODUCTION PROGRAM**



- Reduce cost, time and complexity of designing AI@edge products
- Provide a path to product for NCS prototypers
- Provide a seamless design experience SW and HW on Intel® Movidius™
- Provide an alternative solution to bulky hardware for DNN acceleration





## WHO NEEDS THE INTEL® AI IN PRODUCTION PROGRAM?



# SMALL, AGILE COMPANIES

from scratch

with
fewer resources
to build Al@Edge
products

# SYSTEM INTEGRATORS

who
build multiple solutions
that utilize the same
base capabilities

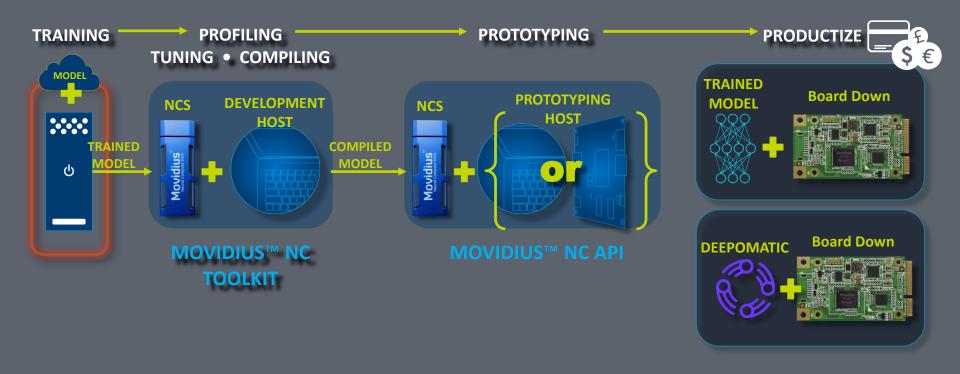
# LARGE COMPANIES

driving
rapid innovation
and need to quickly learn
from market and adapt



#### **INTEL® AI IN PRODUCTION PROGRAM**







### SCALING INFERENCE PERFORMANCE







#### **LET'S REVIEW**



- Moving AI to the edge is important for a number of reasons (lots of data, latency, and privacy)
- Deep Learning has progressed in many areas where these use cases can be run on the edge (object detection, classification, etc.)
- Intel® Movidius™ NCS is an easy-to-use prototyping vehicle for developing your edge devices



#### **EXPLORE:** developer.movidius.com



#### Try out the following pages:

- Main page
- Getting started
- Downloads
- Docs
- Forums
- Where to buy
- Community GitHub @ <u>http://github.com/Movidius/ncappzoo</u>
- Blog
- https://movidius.github.io/blog/



#### What is the Neural Compute Stick?

The Movidius\*\* Neural Compute Stick (NCS) is a tiny fanless deep learning device that you can use to learn AJ programming at the edge. NCS is powered by the same love power high performance Movidius\*\* Vision Processing Unit (VPU) that can be found in millions of smart security cameras, gesture controlled drones, inclustrial machine vision equipment, and more.



# Const

#### What can you do with the NCS?

The Movidius Neural Compute Stick enables rapid prototyping, validation and deployment of Deep Neural Network (DNN) Inference applications at the edge. Its low-power VPU architecture enables an entirely new segment of Al applications that aren't reliant on a connection to the cloud.

The NCS combined with Movidius" Neural Compute SDK allows deep learning developers to profile, tune, and deploy Convolutional Neural Network (CNN) on low-power applications that require real-time inferencine.





## Thank-you

