



Intel® Movidius™ Neural Compute Stick Workshop

Open Source Hardware User Group, BCS London, 22 February 2018

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Agenda

9:00 AM: Welcome and setup

9:15 AM: Introduction to Intel® Movidius™ Neural Compute Stick (NCS)

9:30 AM: How to run pre-trained neural networks on NCS [Hands-on session]

9:45 AM: Deep dive into NCS developer tools [Hands-on session]

12:00 PM: Lunch

1:00 PM: Open hands-on session

3:00 PM: Break

5:00 PM: Wrap-up

Justin Shenk

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- Intel Software Innovator
- Former neuroscience researcher from USA
- Student at Osnabrueck University, Germany
- Master thesis on deep learning at Peltarion, Stockholm, Sweden

Intel® Movidius™ technology

Game-changing intelligent devices

Powered by Movidius VPU



Hikvision
Intelligent Camera



Hikvision
Industrial Camera



DJI Inspire 2



DJI
Phantom 4 Pro



DJI Mavic Pro



Uniview
IP Camera



Dahua
Industrial Camera



Moto 360°
Camera

Movidius Neural Compute Stick

Redefining the AI developer kit



- Neural Network Accelerator in USB Stick Form Factor
- 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 vision processing unit (VPU) used in drones, surveillance cameras, VR headsets, and other low-power intelligent and autonomous products

Movidius Neural Compute Stick

Redefining the AI developer kit



NC SDK

Free download @ developer.movidius.com

NC Toolkit

Profiler

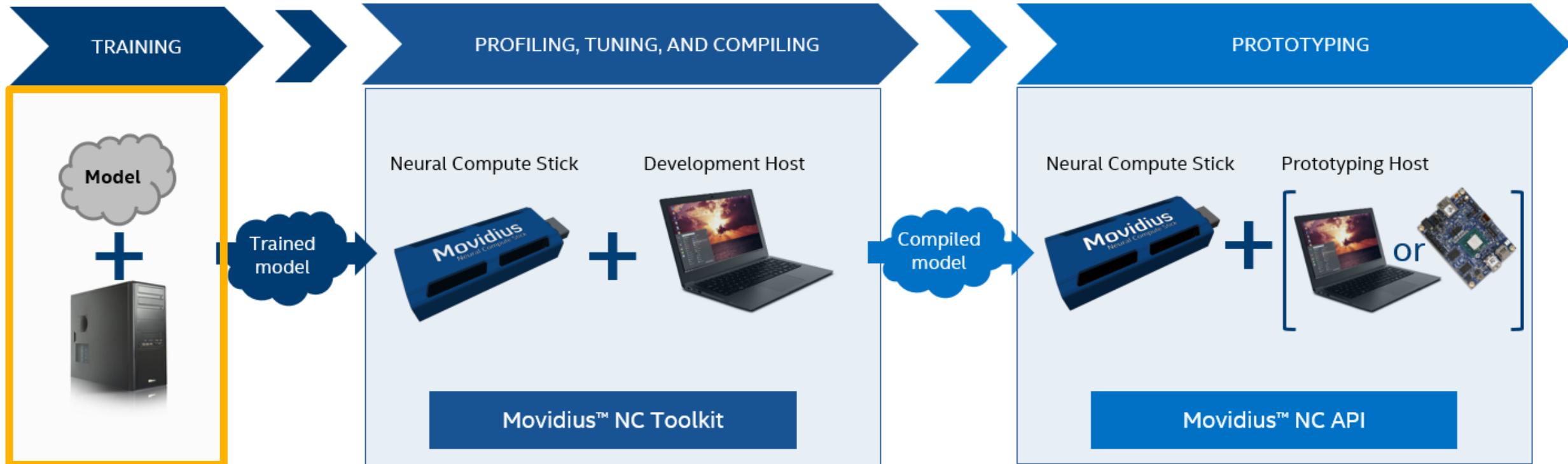
Checker

Compiler

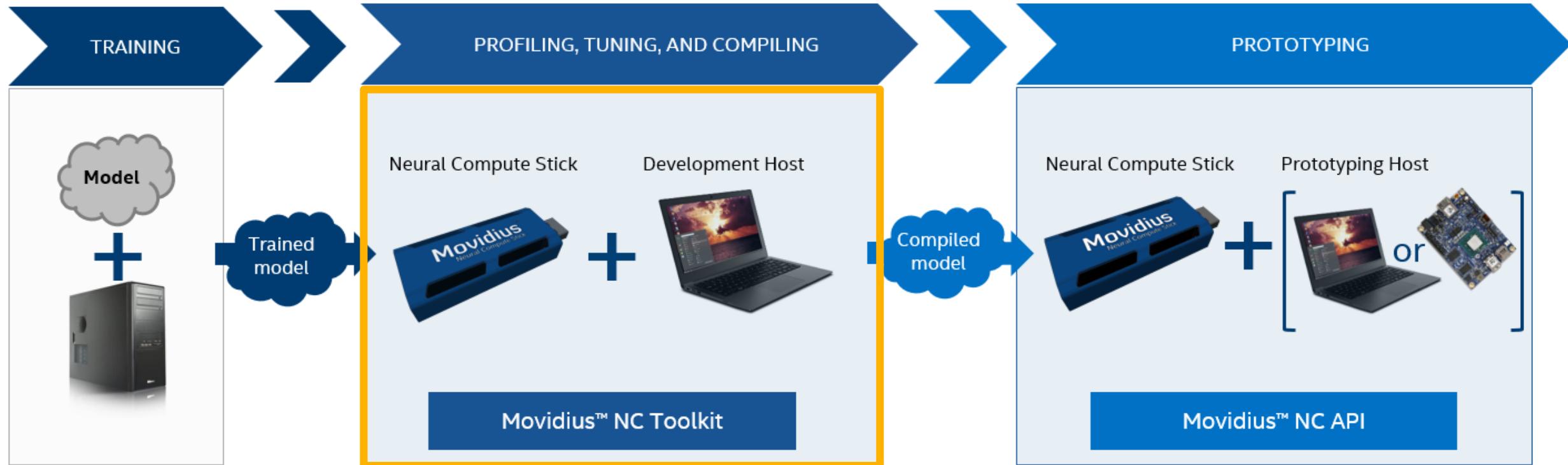
NC API

API

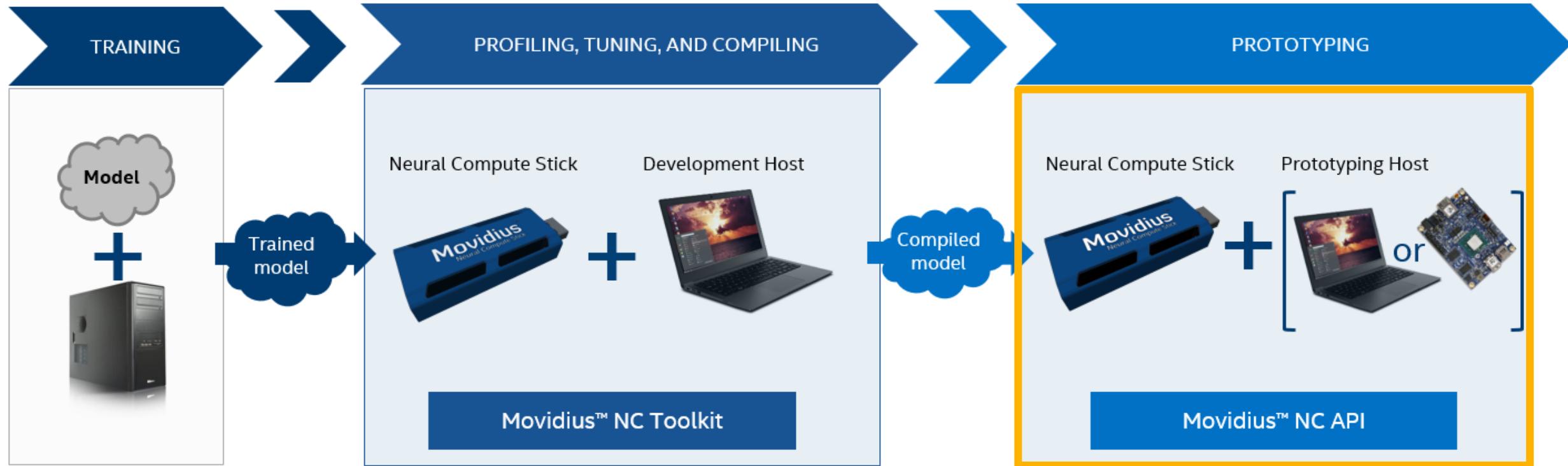
NC SDK workflow



NC SDK workflow



NC SDK workflow



Hands-on exercises

Explore developer.movidius.com

A developer-friendly website

Try out the following pages:

- Start
- Github (ncsdk, ncappzoo, blogs)
- **Support > Docs**
- Support > Forums
- Where to buy

The screenshot shows the developer.movidius.com website. At the top, there's a navigation bar with links for HOME (which is highlighted in orange), GET STARTED, FORUM, DOWNLOADS, and WHERE TO BUY. The main title is "Movidius™ Neural Compute Stick" with the subtitle "Accelerate deep learning development at the edge". Below this, there's a "WHERE TO BUY" button. The central content area has two main sections: "What is the Neural Compute Stick?" which describes it as a tiny fanless deep learning device powered by a low-power high-performance Movidius™ Vision Processing Unit (VPU) found in various smart security cameras, drones, and industrial equipment; and "What can you do with the NCS?", which discusses its use for rapid prototyping, validation, and deployment of Deep Neural Network (DNN) inference applications at the edge. Both sections include images: the first shows the physical blue stick, and the second shows a bowl of fruit with colored bounding boxes around them.

Running a pre-trained neural network on NCS

Run a simple image classifier

Reference: <https://movidius.github.io/blog/ncs-image-classifier/>

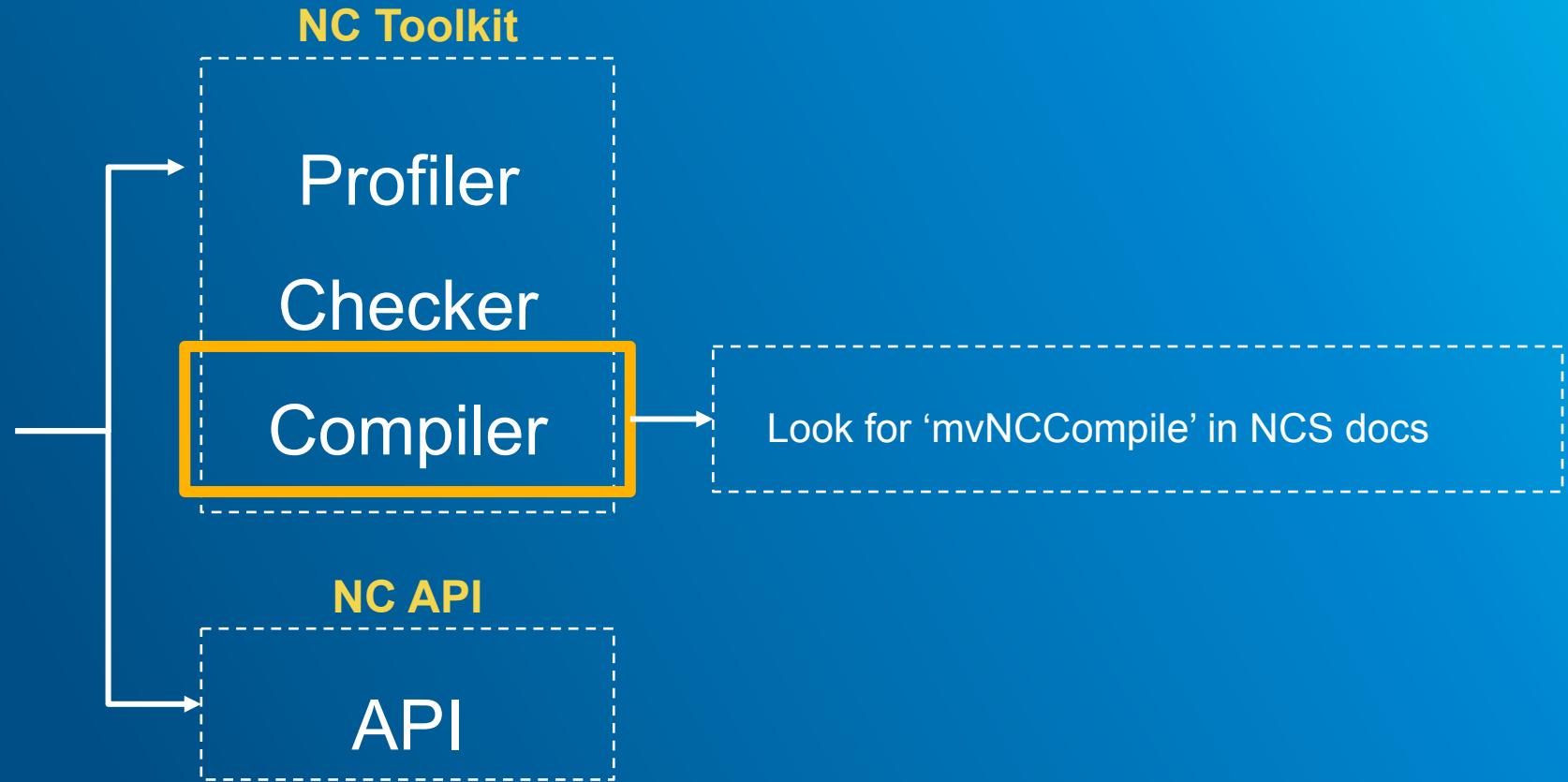
1. `mkdir -p ~/workspace`
2. `cd ~/workspace`
3. `git clone https://github.com/movidius/ncappzoo`
4. `cd ~/workspace/ncappzoo/apps/image-classifier`
5. `make run`

NC SDK Compile

Convert your network into a binary graph file that can be loaded onto the NCS



NC SDK



Compile GoogLeNet caffe model to NCS graph file

Reference: developer.movidius.com > Support > Docs > search for “mvNCCCompile”

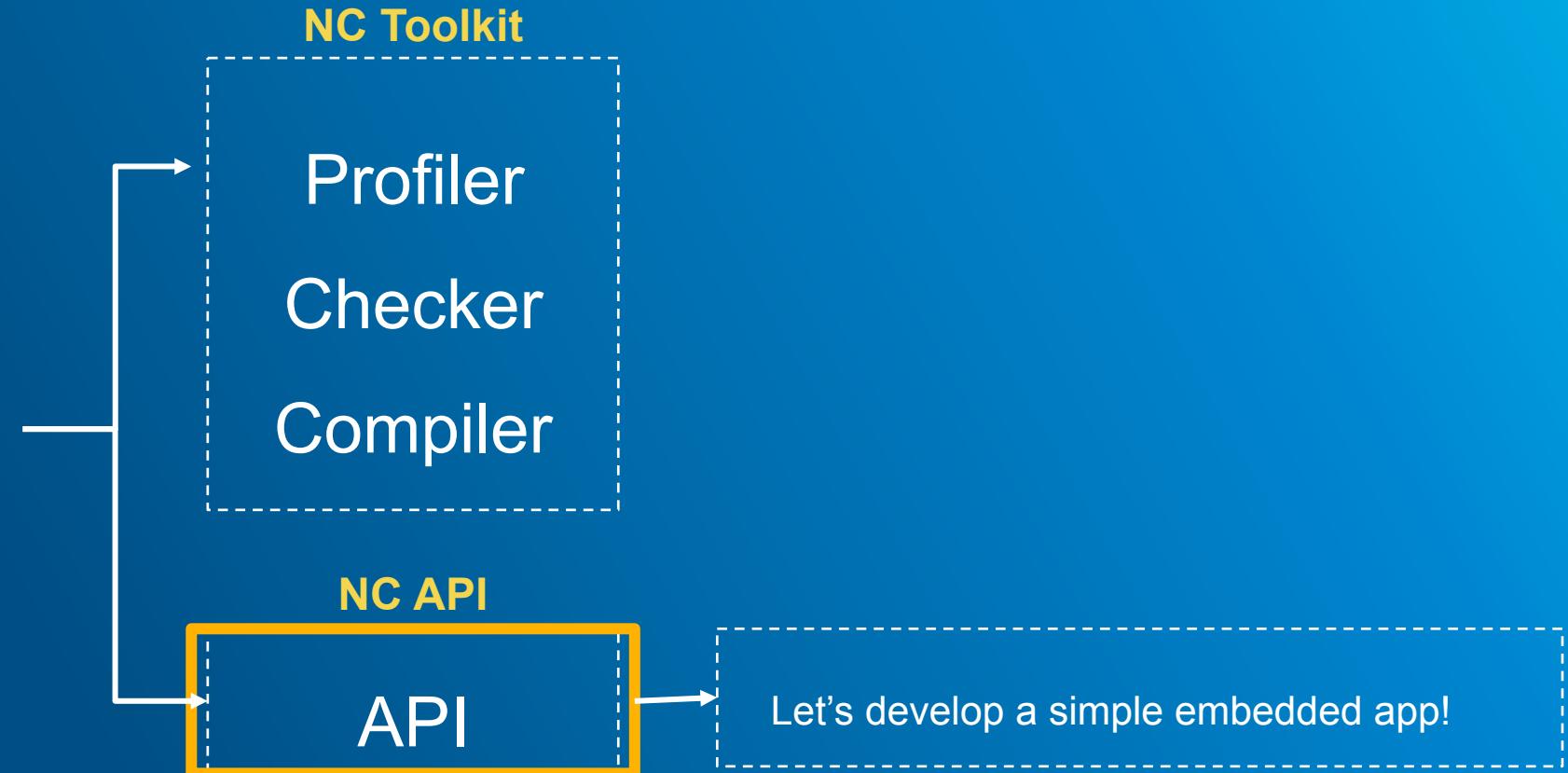
1. mkdir -p ~/workspace
2. cd ~/workspace
3. git clone https://github.com/movidius/ncappzoo
4. cd ~/workspace/ncappzoo/caffe/GoogLeNet
5. rm graph
6. mvNCCCompile -s 12 deploy.prototxt -w bvlc_googlenet.caffemodel
7. Look for ~/workspace/ncappzoo/caffe/GoogLeNet/graph

NC SDK API framework

Develop your own embedded application with deep-learning accelerated image processing



NC SDK



Code walkthrough: image-classifier.py

Reference: <https://movidius.github.io/blog/ncs-image-classifier/>

Deep dive into NCS developer tools

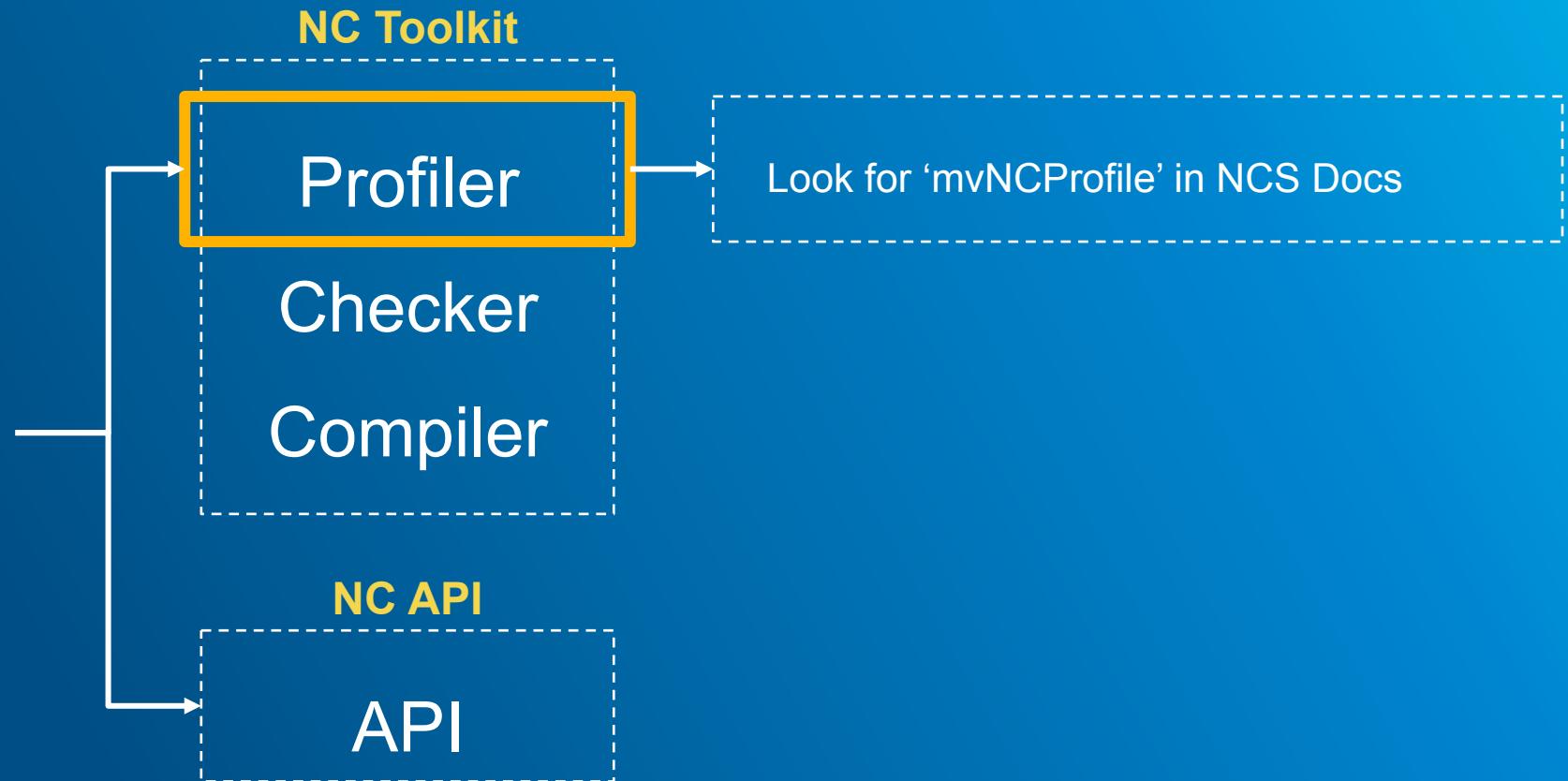
mvNCProfile: Tool to help optimize your neural network for edge applications

NC SDK Profiler

Get a better insight into your network's complexity, bandwidth & execution time



NC SDK



Run GoogLeNet through NCS profiler

Reference: developer.movidius.com > Support > Docs > search for “mvNCProfile”

1. mkdir -p ~/workspace
2. cd ~/workspace
3. git clone https://github.com/movidius/ncappzoo
4. cd ~/workspace/ncappzoo/caffe/GoogLeNet
5. mvNCProfile -s 12 deploy.prototxt -w bvlc_googlenet.caffemodel
6. Look for ~/workspace/ncappzoo/caffe/GoogLeNet/output_report.html

Win \$20,000 by building a embedded image classifier

Scan this QR code to register for the challenge



In this challenge you will be pushing your network training skills to its limits by fine-tuning CNNs that are targeted for embedded applications. Contestants are expected to leverage the Neural Compute SDK's mvNCProfile tool to analyze the bandwidth, execution time and complexity of their network at each layer, and tune it to get the best accuracy, execution time

developer.movidius.com/competition

Modifying GoogLeNet to run faster on NCS

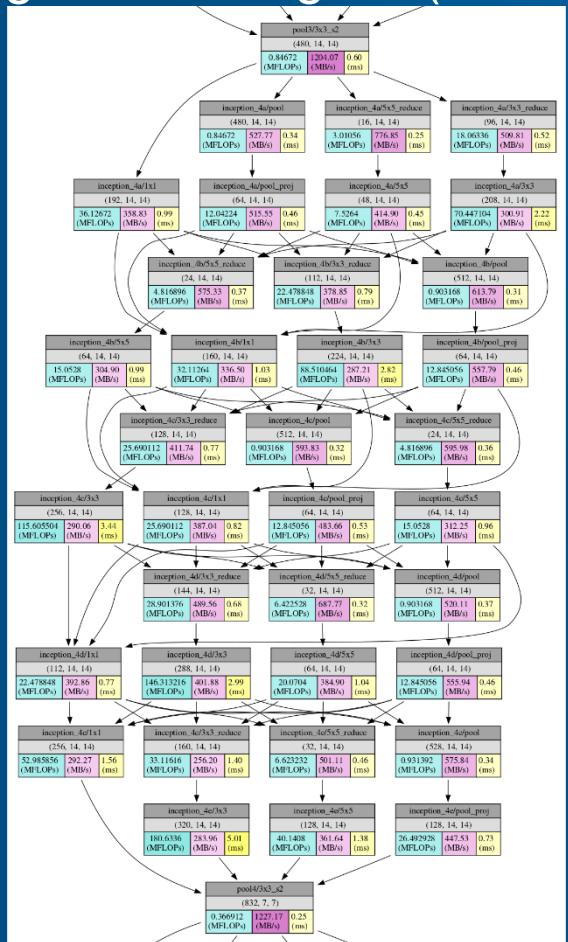
An example project that explores the entire NCS workflow of training-profiling-deploying

Modifying GoogLeNet to run faster on NCS

What we modified, why we modified it, how did it impact execution time?

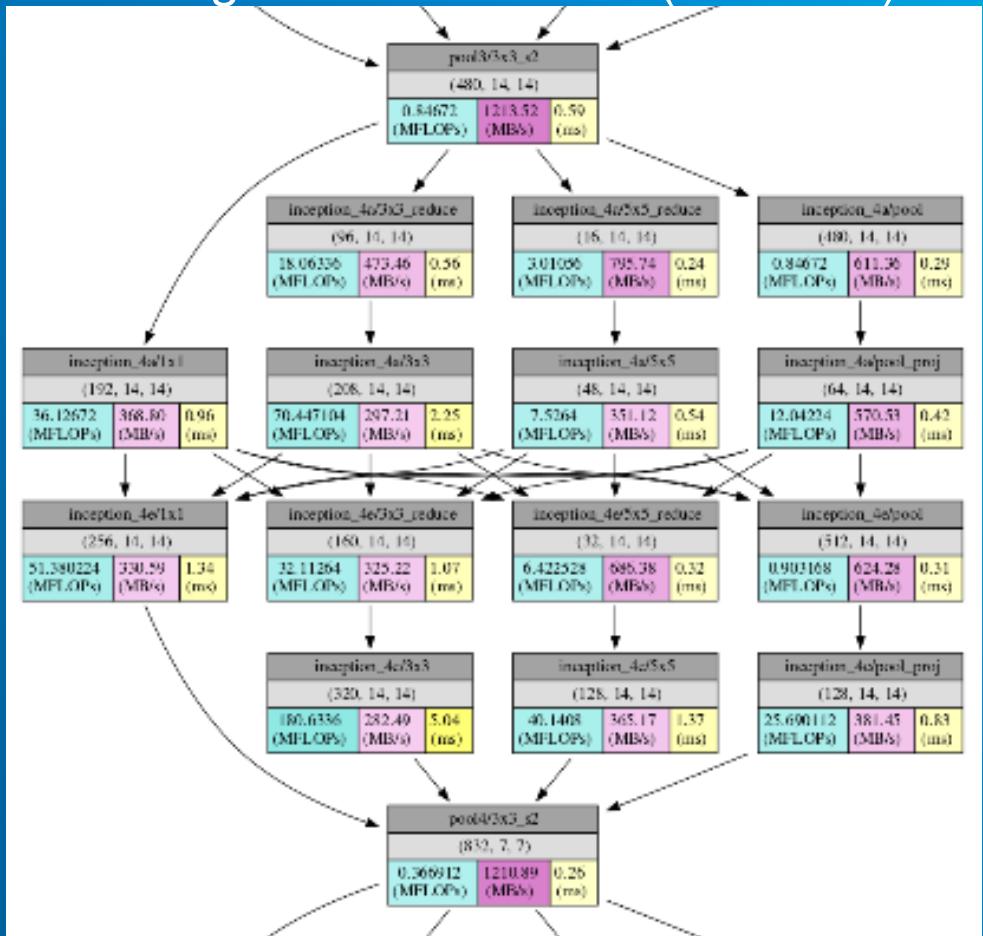
GoogLeNet – original (94.28ms)

4a →
4b →
4c →
4d →
4e →



GoogLeNet – modified (73.03ms)

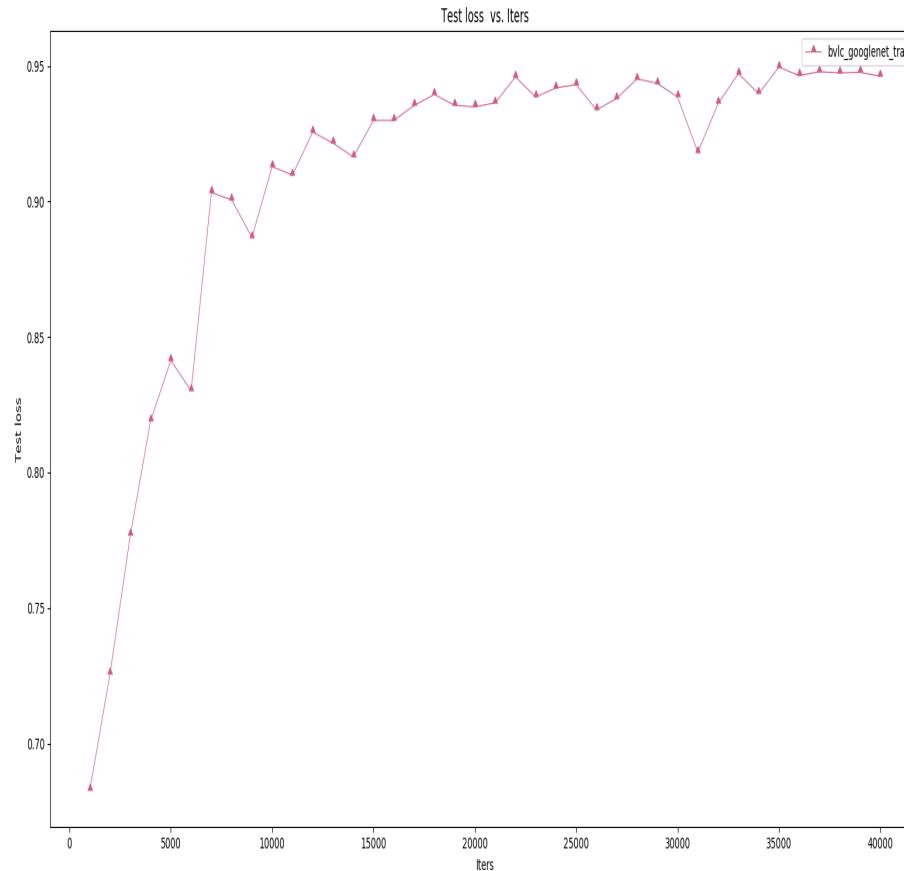
4a →
4e →



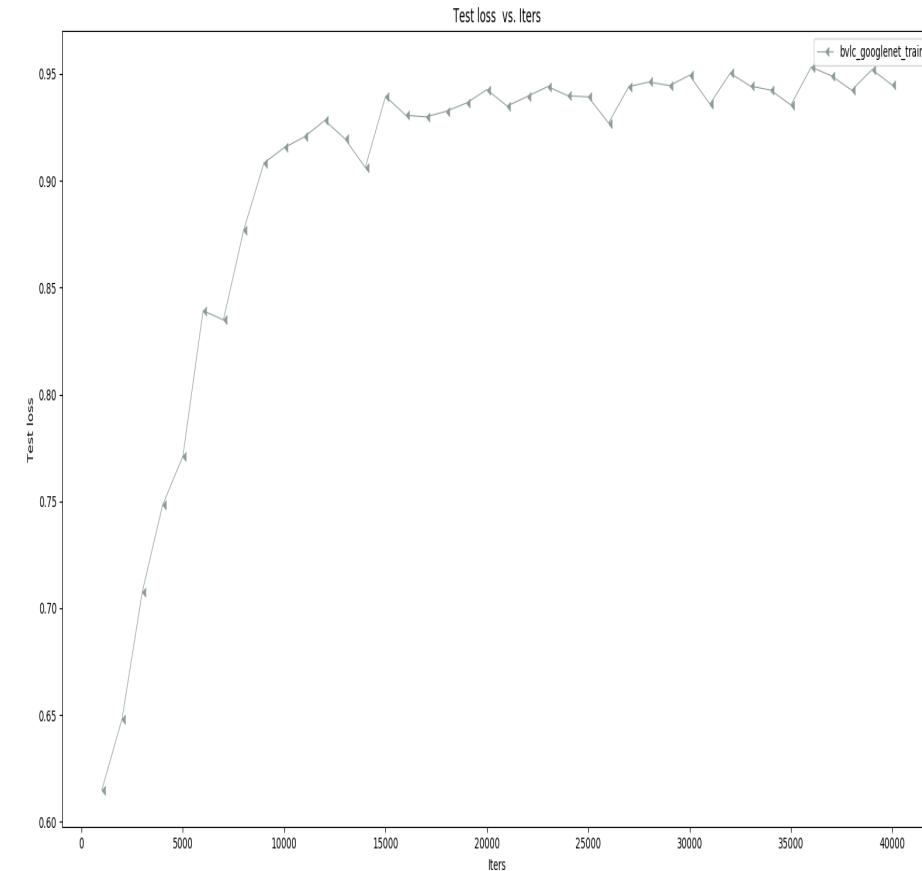
Modifying GoogLeNet to run faster on NCS

Was there an impact on accuracy?

GoogLeNet - original



GoogLeNet - modified

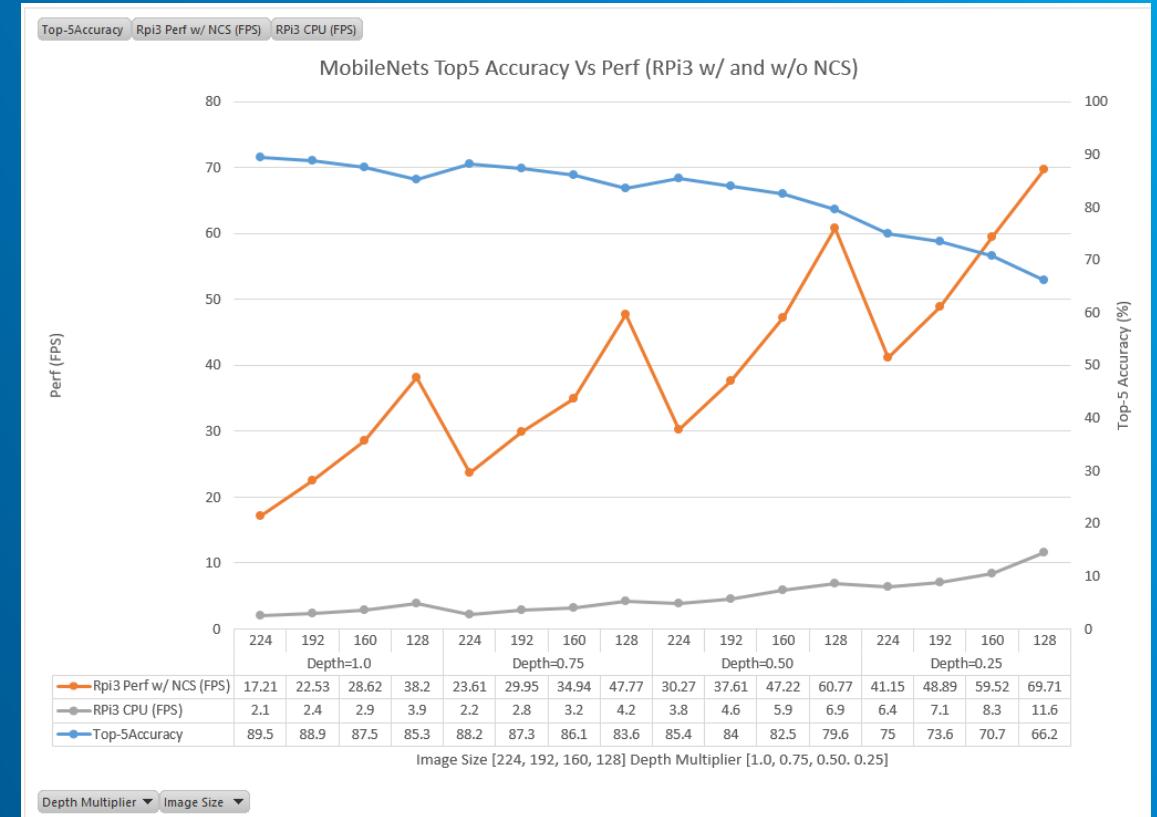
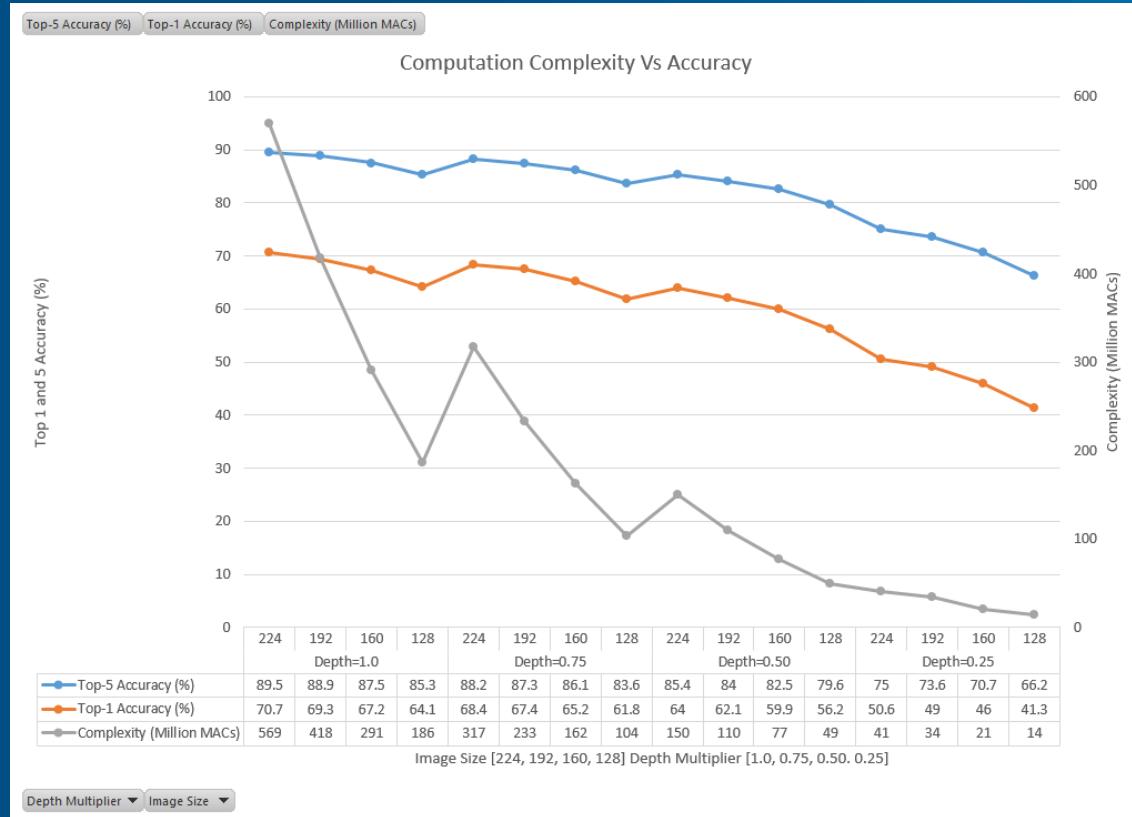


Profiling MobileNets on NCS

Use NCS developer tools to profile, compile and deploy mobilenets on NCS

Comparing execution times of mobilenets on NCS

Reference: <https://movidius.github.io/blog/ncs-rpi3-mobilenets/>



Run MobileNet(s) on NCS

Reference: developer.movidius.com > Support > Docs > search for “mvNCProfile”

1. `mkdir -p ~/workspace`
2. `cd ~/workspace`
3. `git clone https://github.com/movidius/ncappzoo`
4. `cd ~/workspace/ncappzoo/tensorflow/mobilenets`
5. `mvNCProfile -s 12 output/mobilenet_v1_1.0_224.meta -in=input -on=MobilenetV1/Predictions/Softmax`
 - Look for `~/workspace/ncappzoo/tensorflow/mobilenets/output_report.html`
6. Modify image-classifier to run inferences using MobileNet(s)
 - Repeat exercise for mobilenets with different depth multipliers and image sizes

Open hands-on session

Use NCS developer tools to profile, compile and deploy mobilenets on NCS

Feedback

Scan this QR code to fill out our feedback form

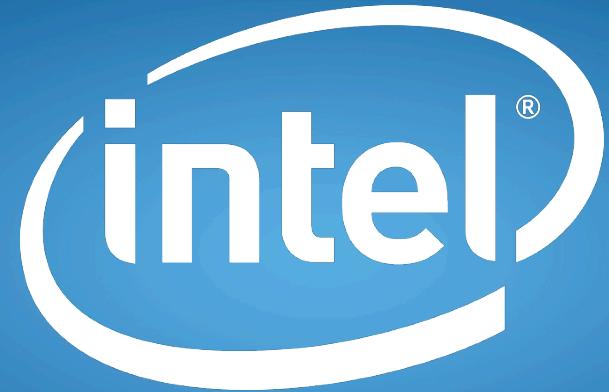


The Movidius NCS is a product designed specifically for developers and data scientists. Our goal with these workshops and competitions is to listen to developer pain points first hand, and incorporate your feedback into upcoming software and hardware revisions.

<https://goo.gl/WMTnjJ>

Questions?

shenk.justin@gmail.com



experience
what's inside™