DIY SECURITY CAMERA USING INTEL® MOVIDIUS™ NEURAL COMPUTE STICK

Ashwin Vijayakumar
Lead Applications Architect, Embedded Machine Intelligence
Intel® Artificial Intelligence Products Group (AIPG)

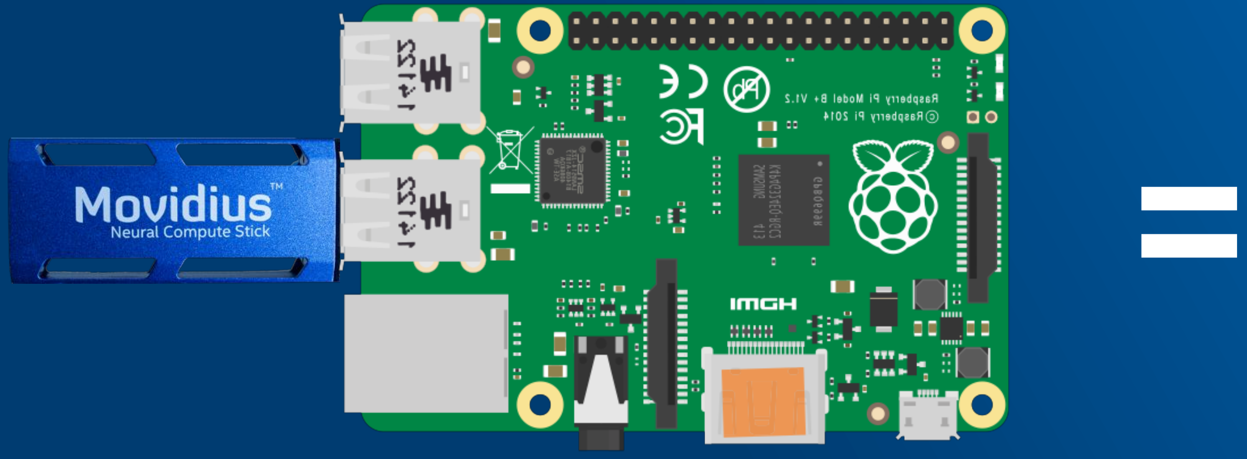
What happened to my package?

“Porch piracy” has been on the rise due to the growing trends in online purchases

- 11 million homeowners have had a package stolen in the last year
- 53% of homeowners are worried about packages left outside their home being stolen
- 74% of packages are stolen during the day when homeowners are at work
- The average value of stolen packages is $50 - $100
- Victims spend close to $200 to replace each stolen package
- 70% of all homeowners expect to receive a package over the holiday season
- FedEx and UPS delivered more than 30 million packages a day between Black Friday and Christmas Day 2016

Data source: https://www.thepackageguard.com/wp-content/uploads/2017/05/DataSheat_PackageTheftDeliveryindustrystats-1.pdf
*Other names and brands may be claimed as the property of others

DIY Porch Pirate Buster!



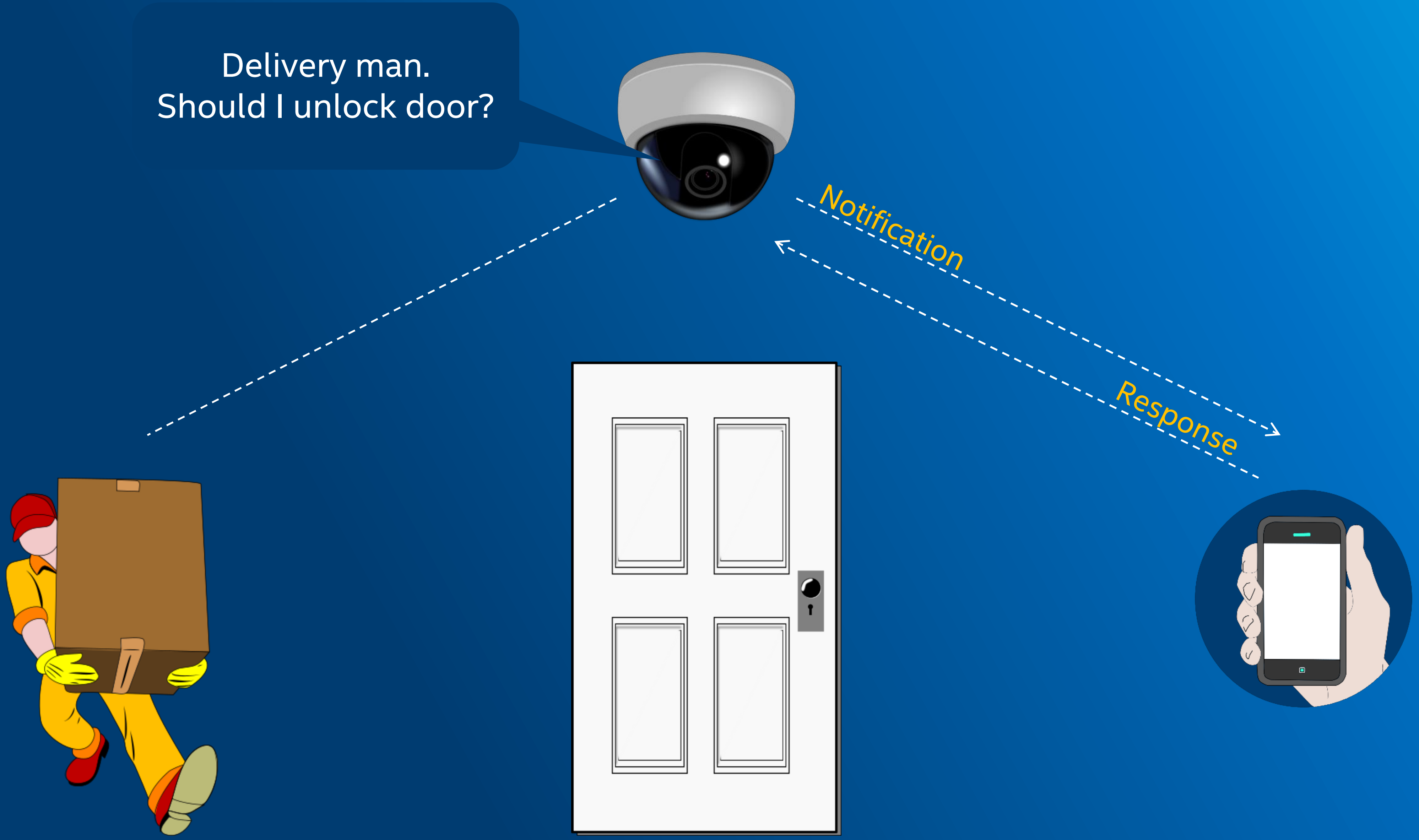
Raspberry Pi image source: https://upload.wikimedia.org/wikipedia/commons/2/26/Raspberry_Pi_B%2B_illustration.svg
Pirate image source: https://commons.wikimedia.org/wiki/File%3APiratey%2C_vector_version.svg

Agenda

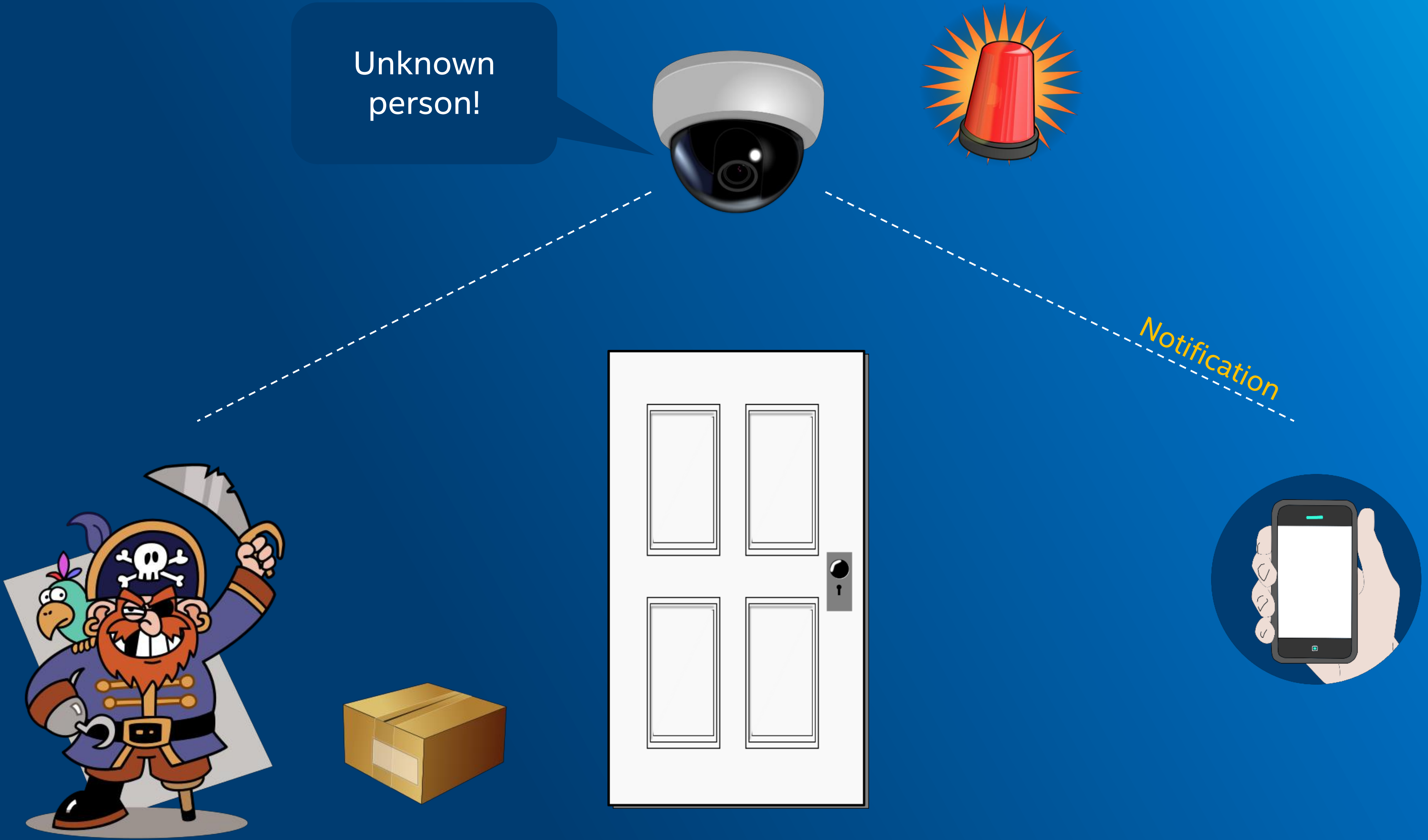
- Final outcome: Build a DIY security camera
- Section 1 [0:15]: Requirements gathering
- Section 2 [0:30]: Getting started with the Intel® Movidius™ Neural Compute Stick
- Section 3 [1:30]: Prototype the security cam application
- Section 4 [2:30]: Deploy the application onto an embedded platform
- Section 5 [3:20]: Wrap-up, Q&A

Section 1: Requirements gathering

What do you think a “porch pirate buster” should be able to do?



Image(s) source: https://publicdomainvectors.org/



Unknown person!

Notification

Image(s) source: https://publicdomainvectors.org/

Group exercise

Take 5 mins to build a list of requirements

Great list of requirements, but let’s be realistic!

Filter the requirements to the most basic features, so it can fit into a 3.5 hour hands-on session

Person detected.
Notify user.

Simplified requirements

1. Small enough to fit on/near a door
2. Low-power consumption
3. Low-cost hardware requirements
4. Detects a ‘person’ in real-time

Section 2: Getting started

With the Intel® Movidius™ Neural Compute Stick

Deploy Caffe Model on Intel® Movidius™ NCS

Reference: https://github.com/movidius/ncappzoo/tree/master/caffe/GoogLeNet

1. mkdir -p ~/workspace
2. cd ~/workspace
3. git clone https://github.com/movidius/ncappzoo
4. cd ~/workspace/ncappzoo/caffe/GoogLeNet
5. make run

Deploy TensorFlow* Model on Intel® Movidius™ NCS

Reference: https://github.com/movidius/ncappzoo/tree/master/tensorflow/inception

1. mkdir -p ~/workspace
2. cd ~/workspace
3. git clone https://github.com/movidius/ncappzoo
4. cd ~/workspace/ncappzoo/tensorflow/inception
5. make run

*Other names and brands may be claimed as the property of others

Deploy MobileNets Models on Intel® Movidius™ NCS

Reference: https://github.com/movidius/ncappzoo/tree/master/tensorflow/mobilenets

1. mkdir -p ~/workspace
2. cd ~/workspace
3. git clone https://github.com/movidius/ncappzoo
4. cd ~/workspace/ncappzoo/tensorflow/mobilenets
5. make run
   - Repeat the exercise with different depth multipliers and input image sizes
   - make run DEPTH=0.75 IMGSIZE=192
   - make run DEPTH=0.50 IMGSIZE=160
   - make run DEPTH=0.25 IMGSIZE=128

What did you observe from this exercise?

HINT: Think about the “real-time” aspect of our requirements

Pick a model that best suits our "real-time" requirement

MobileNets are mobile-friendly neural networks

Network	Inference time	Frames per second
GoogLeNet	91.33099 ms	10.9 fps
Inception-v3	325.1207 ms	3.07 fps
MobileNet (1.0 | 224)	39.26307 ms	25.4 fps

Configurations:
Hardware: Intel Movidius Neural Compute Stick and a laptop based on Intel Core i5-6600 CPU @ 3.3GHz, 32GB RAM
Software: Ubuntu 16.04 + NCSDK 1.12
Test code: FPS numbers were generated using sample codes in https://github.com/movidius/ncappzoo, which is released to the public under MIT license.
[1] https://github.com/movidius/ncappzoo/tree/master/caffe/GoogLeNet
[2] https://github.com/movidius/ncappzoo/tree/master/tensorflow/inception
[3] https://github.com/movidius/ncappzoo/tree/master/tensorflow/mobilenets

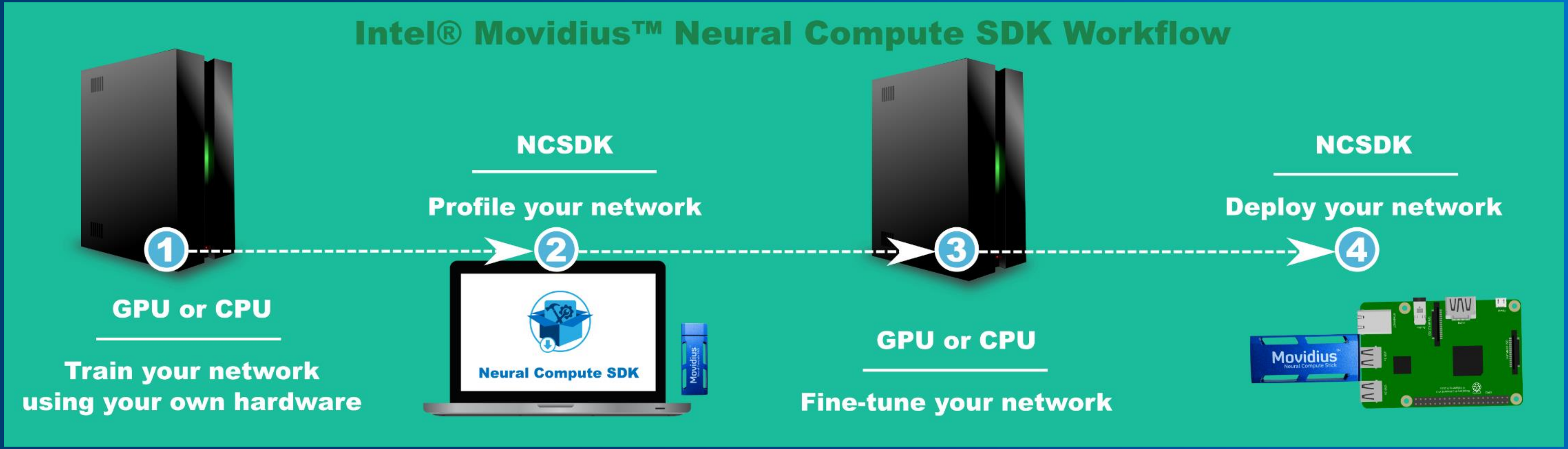
Let’s detect a ‘person’

HINT: Use image-classifier.py --image workspace/ncappzoo/apps/security-cam/captures/screen_shot.jpg

Key learnings from this section

Take a moment to look into ncappzoo/tensorflow/mobilenets/Makefile

- Frames per second is a key requirement to build a real-time computer vision product
- Image classifier models do not meet our “person detection” requirement
- Basic workflow of deploying neural networks on Intel Movidius NCS



Run object detection on your Intel® Movidius™ NCS

Embedded application development using NC SDK API framework

- Step 1: Open the enumerated device and get a handle to it
- Step 2: Load a graph file onto the NCS device
- Step 3: Pre-process the images
- Step 4: Offload an image to the NCS to run inference
- Step 5: Close the NCS device

HINT: See ~/workspace/ncappzoo/apps/ssd-object-detector

Key learnings from this code walk-through

Take a moment to look into ssd-object-detector/utils/deserialize_output.py

`ssd-object-detector` formats NCS output into an easy-to-use python dictionary

- output_dict['num_detections'] = Total number of valid detections
- output_dict['detection_classes_<X>'] = Class ID of the detected object
- output_dict['detection_scores_<X>'] = Percentage of the confidance
- output_dict['detection_boxes_<X>'] = A list of 2 tuples [(x1, y1) (x2, y2)]

Where <X> is a zero-index count of num_detections

Section 3: Prototype security cam app

Modify the code to only detect person

HINT: Retraining is out-of-scope, so apply `if statements` on output_dict['detection_classes_<X>’]

Run inference on a live camera feed

HINT: See ncappzoo/apps/live-object-detector

Run inference on a live camera feed

Real-time object detection using Intel Movidius NCS

- Step 1: Open the enumerated device and get a handle to it
- Step 2: Load a graph file onto the NCS device
- Step 3: Pre-process the images (includes grabbing frames from a camera)
- Step 4: Offload an image to the NCS to run inference
- Step 5: Close the NCS device

HINT: See ~/workspace/ncappzoo/apps/live-object-detector

Develop my-security-cam

Modify live-object-detector to only detect and capture person(s)

HINT: See ~/workspace/ncappzoo/apps/security-cam

Section 4: Deploy on embedded board

Assemble the Raspberry Pi system

Deploy my-security-cam onto an embedded board

Ensure the dev machine and embedded board are on the same WiFi network

- Step 1: Clone https://github.com/movidius/ncsdk on your embedded board
- Step 2: Clone https://github.com/movidius/ncappzoo on your embedded board
- Step 3: Copy the MobileNet SSD graph and your app from the dev machine to the embedded board
  - scp ~/workspace/ncappzoo/caffe/SSD_MobileNet/graph ncs@raspberrypi-2:~/workshop/ncappzoo/caffe/SSD_MobileNet/
  - scp -r ~/workspace/ncappzoo/apps/my-security-cam ncs@raspberrypi-2:~/workshop/ncappzoo/apps/my-security-cam
- Step 4: Run the app on your embedded board
  - ssh ncs@192.168.1.[YOUR BOARD NUMBER]
  - cd ~/workspace/ncappzoo/apps/my-security-cam
  - python3 security-picam.py
- View images captured by your embedded security camera
  - scp ncs@raspberrypi-2:~/workshop/ncappzoo/apps/my-security-cam/captures ~/Pictures

Feedback

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The Intel® 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/SyopsX

Questions?

0x51 0x75 0x65 0x73 0x74 0x69 0x6F 0x6E 0x73 0x3F

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https://goo.gl/WMTnjJ

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