

# 1. Documentation

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# Intel Neural Compute Stick2 (NCS2) :

NCS2 acts as a USB accelerator

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Intel Movidius Myriad X Vision Processing Unit (VPU) a specialized processors for machine learning

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Accelerates TensorFlow neural network inferences and improves performances by 10x factor

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Supports multiple softwares (Ubuntu, CentOS, Windows 10...) and multiple algorithms (TensorFlow, Caffe, ApacheMXNet...) via an Open Neural Network Exchange conversion.

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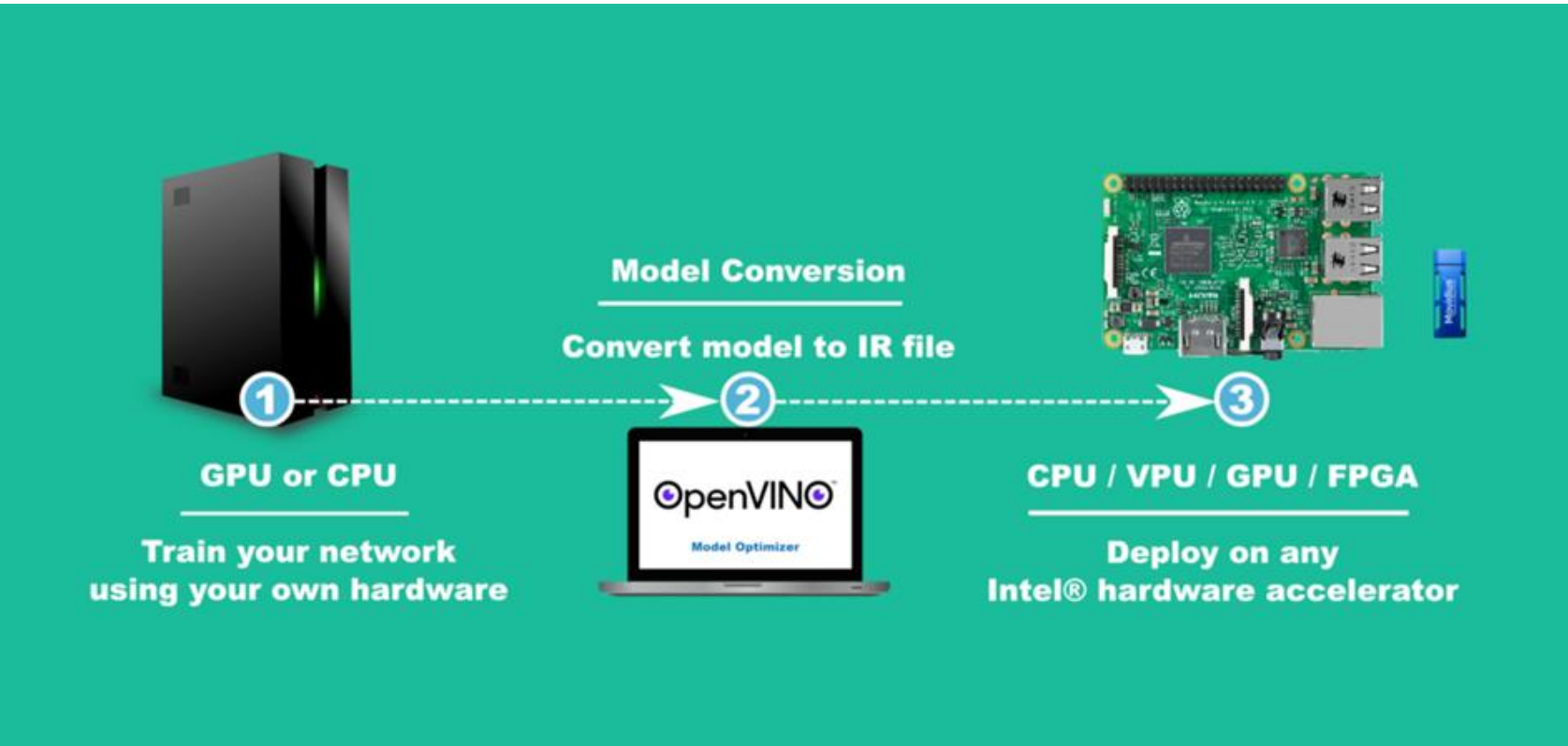
Used in our project to achieve end to end learning for self-driving car + traffic sign and pedestrian detection and handling object detection models with deep learning D-CNN (mobilenetv2ssdcoco , mobilenetv2ssdcoco quantized...)

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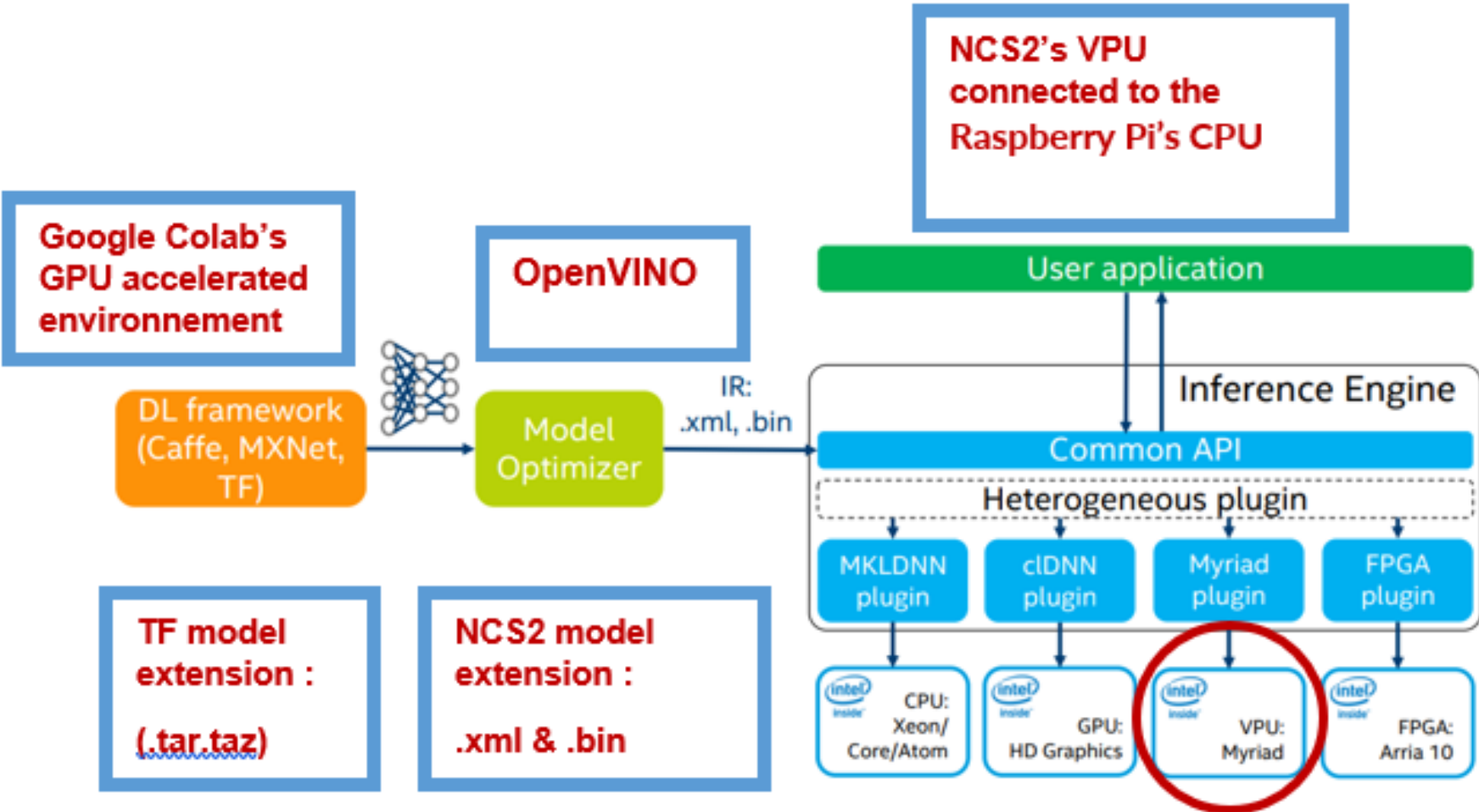
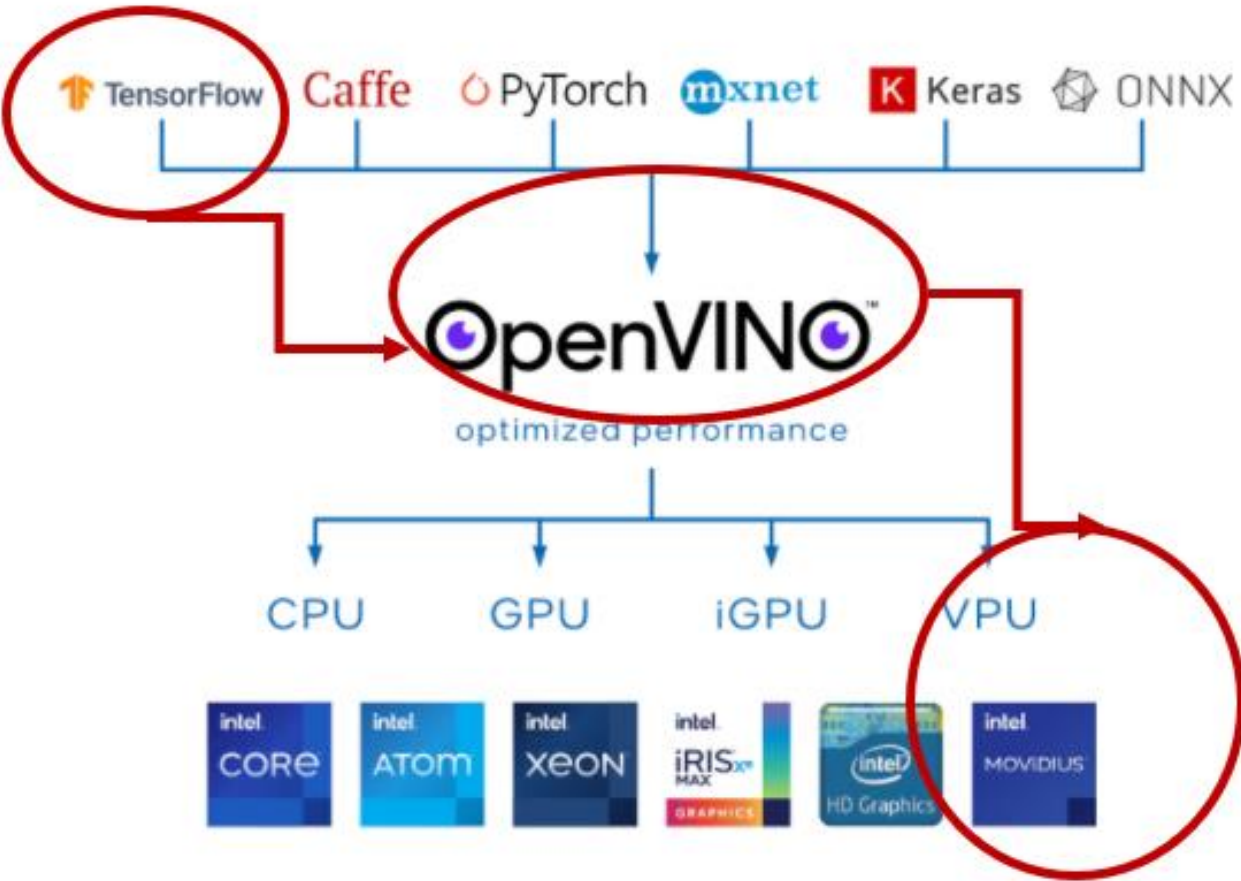


# How to connect the NCS2 to the RPi :



To connect the NCS2 to the RPi, the procedure required is:

1. Convert a TensorFlow model to NCS compatible one, using Open VINO Toolkit by Intel (all of this work is done on your pc's CPU or GPU, for TensorFlow's model we use Google Colab)
2. Install a light version of Open VINO on Raspberry, to run inferences onboard
3. Test and deploy the converted model on Raspberry



## 2. Testing the NCS2

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## 2.1 Demo\_Security\_Barrier\_Camera :

Using the deployment tools offered by openvino

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It uses SqueezeNet for the Computer Vision and Pattern Recognition (object detection : black car and the licence numbers)

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The inference is run in the VPU of the neural compute stick (we must specify the command line -d MYRIAD when we run the Demo)

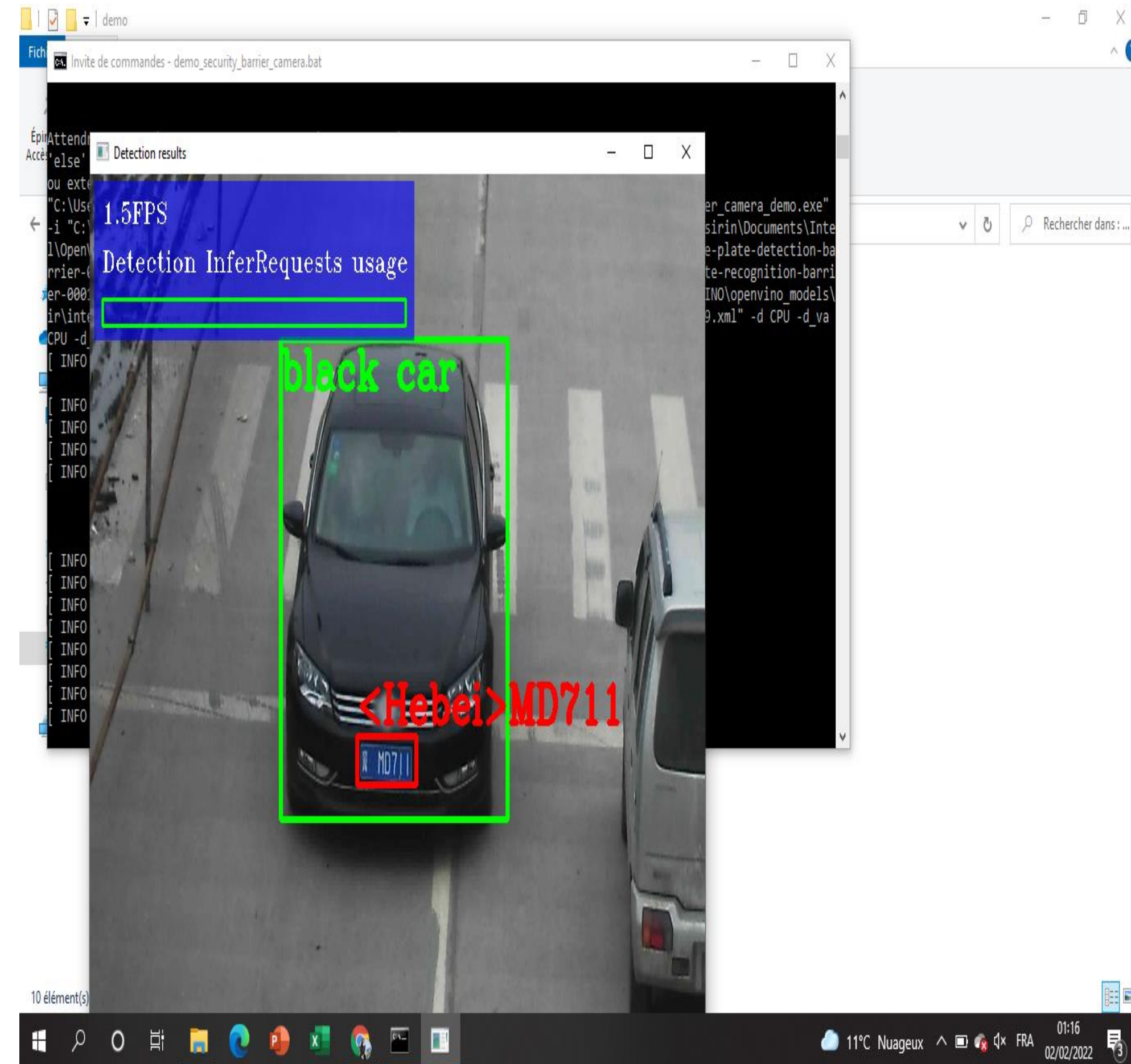
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Software (my host machine Windows 10 with a lite version of intel openvino\_2021.4.752 installed and configured, Squeezenet DNN)  
Hardware (NCS plugged in my PC's USB port).

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This Demo downloads a SqueezeNet model, uses the Model Optimizer to convert the model to the .bin and .xml Intermediate Representation (IR) files. The Inference Engine requires this model conversion so it can use the IR as input and achieve optimum performance on Intel hardware.

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## 2.2 Demo with ssd\_mobilenet\_v2\_coco\_2018\_03\_29 on images :

First we download the pretrained model ssd\_mobilenet\_v2\_coco from model ZOO

Then we use Openvino's model optimizer to do the IR conversion of the model and generate from it's frozen\_inference\_grapg.pb both XML file(frozen\_inference\_grapg.xml) and BIN file (frozen\_inference\_grapg.bin)

Then we run the XML file using Openvino's inference engine That uses object\_detection\_sample\_ssd.py offred along in the python samples of Openvino

The output of this Demo is the input image with a boundary box showing the face detection.

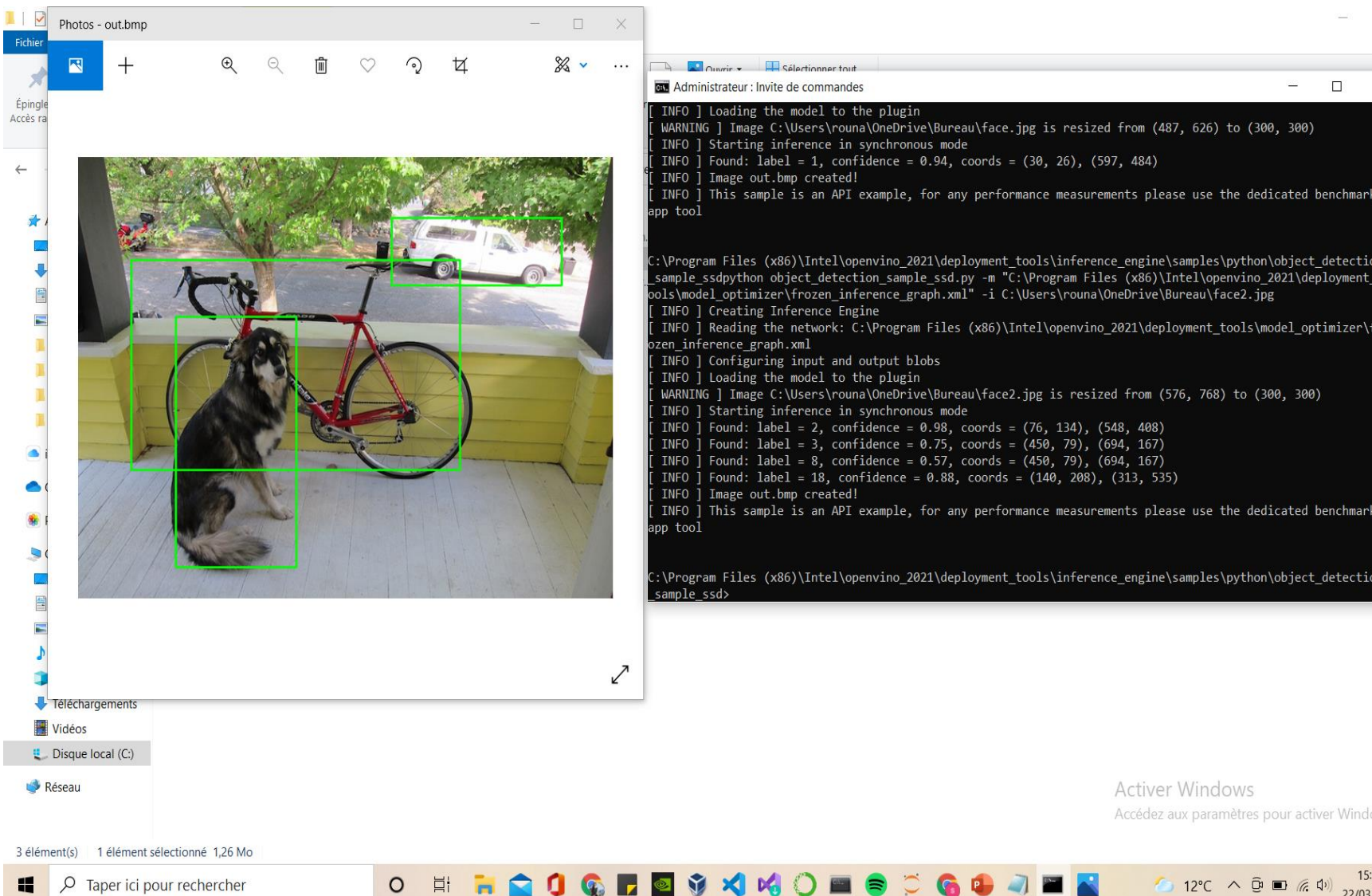
Software (my host machine Windows 10 with a lite version of intel openvino\_2021.4.752 installed and configured,ssd\_mobilenet\_v2\_coco\_2012\_03\_29 DNN)  
Hardware(NCS plugged in my PC's USB port).

```
Administrateur : Invite de commandes
- Mean values: Not specified
- Scale values: Not specified
- Scale factors: Not specified
- Precision of IR: FP32
- Enable fusing: True
- Enable grouped convolutions fusing: True
- Move mean values to preprocess section: None
- Reverse input channels: True

TensorFlow specific parameters:
- Input model in text protobuf format: False
- Path to model dump for TensorBoard: None
- List of shared libraries with TensorFlow custom layers implementation: None
- Update the configuration file with input/output node names: None
- Use the configuration file used to generate the model with Object Detection API: C:\Users\rouna\Downloads\ssd_mobilenet_v2_coco_2018_03_29\pipeline.config
- Use the config file: C:\Program Files (x86)\Intel\openvino_2021\deployment_tools\model_optimizer\ssd_v2_support.json
- Inference Engine found in: C:\Program Files (x86)\Intel\openvino_2021\python\python3.6\openvino

Inference Engine version: 2021.4.2-3974-e2a469a3450-releases/2021/4
Model Optimizer version: 2021.4.2-3974-e2a469a3450-releases/2021/4
C:\Users\rouna\AppData\Roaming\Python\Python36\site-packages\tensorflow_core\python\pywrap_tensorflow_internal.py:15: DeprecationWarning: the imp module is deprecated in favour of importlib; see the module's doc
umentation for alternative uses
import imp
The Preprocessor block has been removed. Only nodes performing mean value subtraction and scaling (if applicable) are kept.
[ SUCCESS ] Generated IR version 10 model.
[ SUCCESS ] XML file: C:\Program Files (x86)\Intel\openvino_2021\deployment_tools\model_optimizer\frozen_inference_graph.xml
[ SUCCESS ] BIN file: C:\Program Files (x86)\Intel\openvino_2021\deployment_tools\model_optimizer\frozen_inference_graph.bin
[ SUCCESS ] Total execution time: 52.09 seconds.
It's been a while, check for a new version of Intel(R) Distribution of OpenVINO(TM) toolkit here https://software.intel.com/content/www/us/en/develop/tools/openvino-toolkit/download.html?cid=other&source=prod&ca
mpid=ww_2022_bu_IOTG_OpenVINO-2022-1&content=upg_all&medium=organic or on the GitHub*

C:\Program Files (x86)\Intel\openvino_2021\deployment_tools\model_optimizer>
```





## 2.3 Demo with ssd\_mobilenet\_v2\_coco\_2018\_03\_29 on videos for real-time object detection :

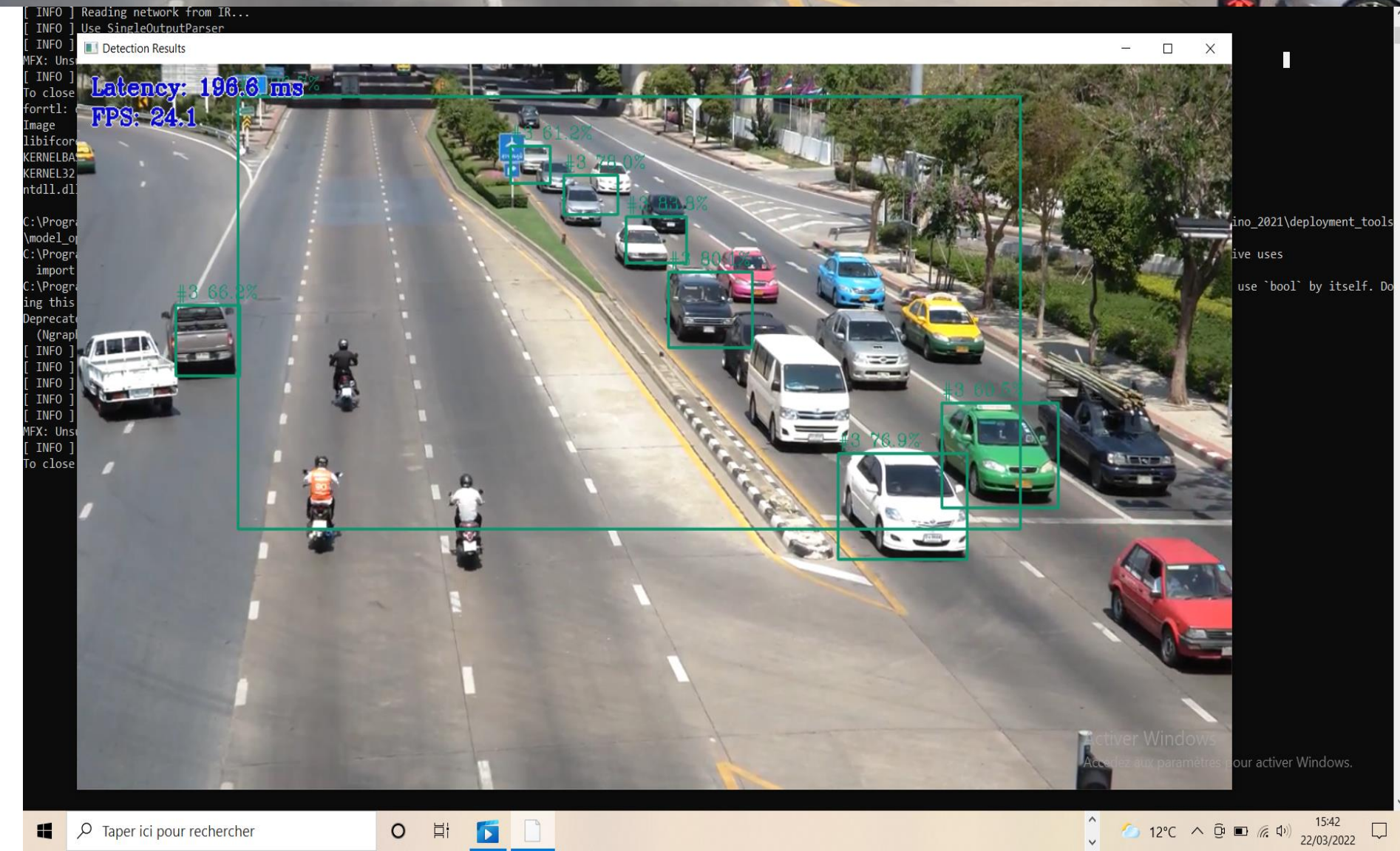
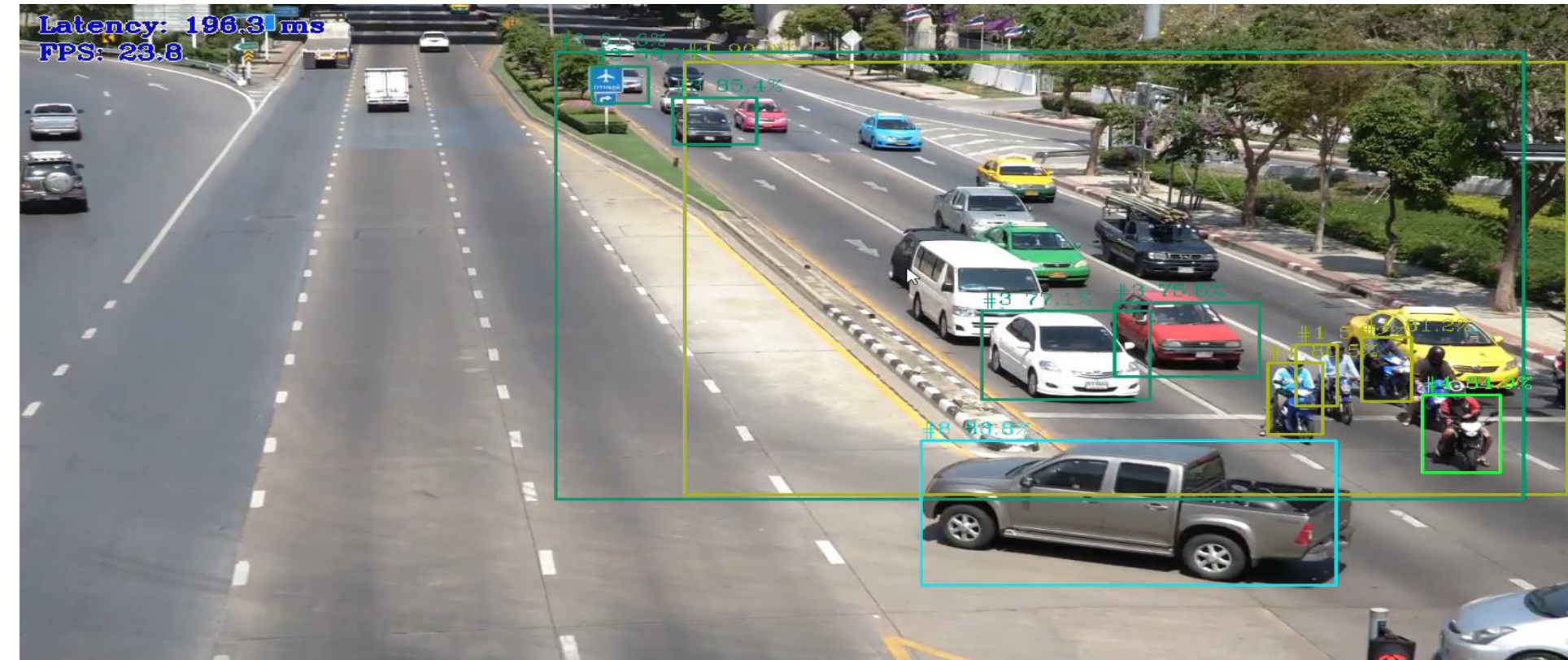
First we download the pretrained model `ssd_mobilenet_v2_coco` from model ZOO

Then we use Openvino's model optimizer to do the IR conversion of the model and generate from it's frozen\_inference\_grap.pb both XML file(frozen\_inference\_grap.xml) and BIN file (frozen\_inference\_grap.bin)

Then we run the XML file using Openvino's inference engine That uses `object_detection_demo.py` offered along in the `open_model_zoo` of Openvino's deployment tools.

The output of this Demo is the input video with a real time object detection boundary boxes.

Software (my host machine Windows 10 with a lite version of intel `openvino_2021.4.752` installed and configured, `ssd_mobilenet_v2_coco_2012_03_29` DNN)  
Hardware(NCS plugged in my PC's USB port).





### 3. End-to-End Lane Navigation via Nvidia's Deep Learning Model (using Colab's GPUs)

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## 4.Next Steps

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# Convert our Deep Learning model to the .bin and .xml Intermediate Representation (IR) files to run them over the NCS2 and RPi3 :

After generation the deep learning model for autonomous lane navigation (Lane\_navigation\_finale.h5 and Lane\_navigation\_check.h5)

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We will use intel's **DL Workbench** that converts Keras H5 models to the Saved Model format and then to the OpenVINO™ format (XML and BIN files ) with the Model Optimizer.

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The inference can then be run in the VPU of the neural compute stick and the Raspberry Pi3

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DL Workbench combines OpenVINO™ tools to assist you with the most commonly used tasks: import a model, analyze its performance and accuracy, visualize the outputs, optimize and prepare the model for deployment in a matter of minutes.

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Import a model

Perform baseline inference