



NVIDIA Jetson Nano - Object detection camera

Arquiteturas para Sistemas Embutidos

João Gameiro, 93097
Pedro Abreu, 93240

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universidade
de aveiro



Introduction

It detects objects from a pre-trained model yolov4 which detects the 20 Pascal VOC objects which are:

- person.
- bird, cat, cow, dog, horse, sheep.
- aeroplane, bicycle, boat, bus, car, motorbike, train.
- bottle, chair, dining table, potted plant, sofa, tv/monitor.

Requirements:

- NVIDIA Jetson nano
- TensorRT 8.0.x+.
- OpenCV python3 module



Machine Learning Concepts

- **Model**
 - File that has been trained to recognize certain types of patterns
- **Method**
 - The mechanism to train a model (neural network, support vector machine, etc.)
- **Machine learning inference - Optimizing Machine Learning Models**
 - Putting a model to work on live data to produce an actionable output.
- **Neural Networks**
 - Series of algorithms that endeavors to recognize underlying relationships in a set of data through a process that mimics the way the human brain operates.



What is TensorRT?

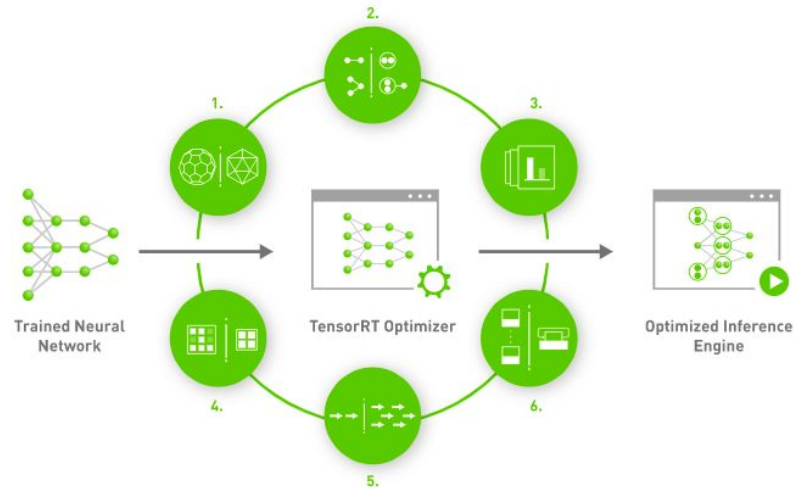
- TensorRT is a machine learning framework developed by Nvidia for faster machine learning inference in NVIDIA GPUs.
- Built on CUDA and provides 40 times faster inference as when compared to CPU only performance
- Provides libraries, technologies and development tools for
 - Artificial Intelligence
 - High Performance Computing
 - Graphics Processing

TensorRT optimization in Machine learning

Machine learning frameworks like TensorFlow(Google) and PyTorch(Meta Ai) adopted in their libraries support for TensorRT.

TensorRT improves sub graph search a neural network in a instance of computation in a NVIDIA GPU environment.

Being yolo a algorithm that implements a neural network for real time object detection. it's favored by TensorRT inference engine.





What is OpenCV

- **OpenCV (Open Source Computer Vision)**
 - Is a huge open-source library for computer vision, machine learning, and image processing,
- It has interfaces for Java, Python, C++, C and MATLAB as well as online documentation for the APIs of these interfaces
- Examples of applications that use OpenCV include:
 - Face detection / face recognition/ facial recognition system
 - Gesture recognition
 - Mobile robotics
 - Object detection
- In this project it was used the cv2 module which is the python module for OpenCV



NAP Object Detection Modules

- Code used for the project was developed for the ATCLL Infrastructure
 - Aveiro Tech City Living Lab (ATCLL) which is composed by an advanced communications infrastructure and a data management and analytics platform.
- **yolo4**
 - Is an object detection module
 - Contains an algorithm that uses neural networks to provide real-time object detection
 - Used in various applications to detect traffic signals, people, parking meters, and animals
 - Popular because of its speed and accuracy



Passos para demonstração

- install dependencies
- download COCO models of yolov4
- transform the model to a ONNX one
- transform the model ONNX to a TensorRT engine one



Demonstração



Bibliography

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- NAP Object Detection Modules for ATCLL Infrastructure
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