Report : Cifar10 performance and Robot model with camera

Summary of my internship

- Performance on a cifar10 model
- Difference of the batch size
- Make a pytorch model for the robot
- Training of both model on llrai01
- Make them work on the jetson
- Add the camera

Jetson nano 2GB developer kit

- GPU : NVIDIA Maxwell™ à 128 cœurs
- CPU : Quad-core ARM® A57 à 1,43 GHz
- RAM : 2 Go 64 bits LPDDR4 25,6 Go/s
  + Swap : 5.1GB (only for CPU)
- Stockage : MicroSD 32GB class 10
- Image : JetPack 4.5

- Software : python 3.6.9
  - Tensorflow : 2.4.1-cuda10.2
  - Pytorch : 1.10.0a0+git36449ea-cuda10.2

llrai01

- GPU : Tesla V100-SXM2-32GB
- CPU : 95x Intel(R) Xeon(R) Gold 6240R CPU @ 2.40GHz
- RAM : 395GB

- Software version :
  - Tensorflow : tensorflow-gpu/2.8.0-py3.9.12-cuda11.4-cudnn8.2
  - Pytorch : 1.12.0-cuda11.4 python 3.8.13

HP zbook laptop

- GPU : Intel® HD Graphics 520 + AMD FirePro W4190M
- CPU : Intel® Core™ i7-6500U CPU @ 2.50GHz
- RAM : 16GB

- Software version :
  - Tensorflow : tensorflow-gpu/2.6.0 cuda11.3.1 python 3.9.12
  - Pytorch : 1.12.0+cpu python 3.8.10

Comparative table Cifar10 Pytorch

Time	HP zbook laptop	Llrai01	Jetson
Import	2,04 s	1,15 s	6,37 s
Loader setup	1,90 s	4,50 s	49,5 s
Model setup	0,00 s	2,18 s	108s = 1,48min
Train 1	40,6 s	41,03 s	372s = 6,12min
Train 2	38,9 s	31,70 s	171s = 2,51min
Train/image	0,78 ms	0,63 ms	3,42 ms
Train 3	39,2 s	27,7 s	169s = 2,49min
Mean train	39,6 s	33,5 s	237s = 3,57min
Mean test/epoch	4,59 s	2,60 s	18,8 s
Test/image	0,46 ms	0,26 ms	1,88 ms
Mean loading	2,82E-2 s	0,34 s	4,13 s
Loading/image	4,7E-04 ms	5,67E-03 ms	6,88E-02 ms

Comparative table Cifar10 tensorflow

Time	HP zbook laptop	Llrai01	Jetson
Import	6,71 s	3,14 s	16,7 s
Loader setup	57,69 s	1,02 s	87,6 s
Model setup	0,14 s	5,67 s	52,1 s
Train 1	36 s	31 s	345 s
Train 2	39 s	27 s	184 s
Train/image	0,78 ms	0,54 ms	3,68 ms
Train 3	36 s	26 s	193 s
Mean train	36,95 s	28 s	241 s
Mean test/epoch	2,62 s	2 s	62,07 s
Test/image	0,26 ms	0,20 ms	6,2 ms

Comparative table Cifar10 HP zbook laptop

Time	tensorflow	Pytorch
Import	6,71 s	2,04 s
Loader setup	57,69 s	1,90 s
Model setup	0,14 s	0,00 s
Train 1	36 s	40,6 s
Train 2	39 s	38,9 s
Train/image	0,78 ms	0,78 ms
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Mean train	36,95 s	39,6 s
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Comparative table Cifar10 Llrai01

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Comparative table Cifar10 Jetson

Time	tensorflow	Pytorch
Import	16,7 s	6,37 s
Loader setup	87,6 s	49,5 s
Model setup	52,1 s	108s = 1,48min
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Train 2	184 s	171s = 2,51min
Train/image	3,68 ms	3,42 ms
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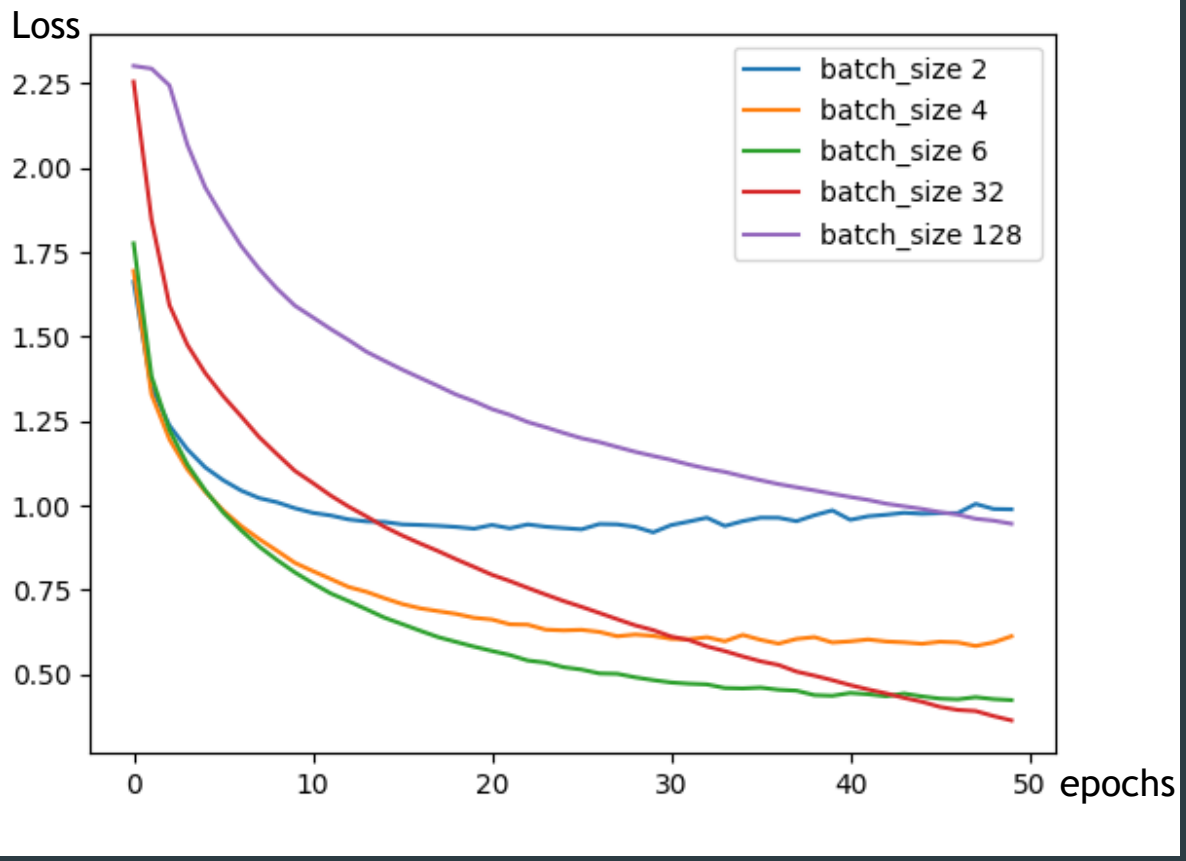
Comparison with others performance test (different model)

Average inference time	
PyTorch CPU Average inference time (s)	0.748
PyTorch CPU + TorchScript Average inference time (s)	0.625
PyTorch GPU Average inference time (s)	0.046
PyTorch GPU + TorchScript Average inference time (s)	0.036
TensorFlow CPU Average inference time (s)	0.823
TensorFlow GPU Average inference time (s)	0.043
TensorFlow GPU + XLA Average inference time (s)	0.035

https://medium.com/huggingface/benchmarking-transformers-pytorch-and-tensorflow-e2917fb891c2

PyTorch (1.3.0) / TensorFlow (2.0)
Results in second

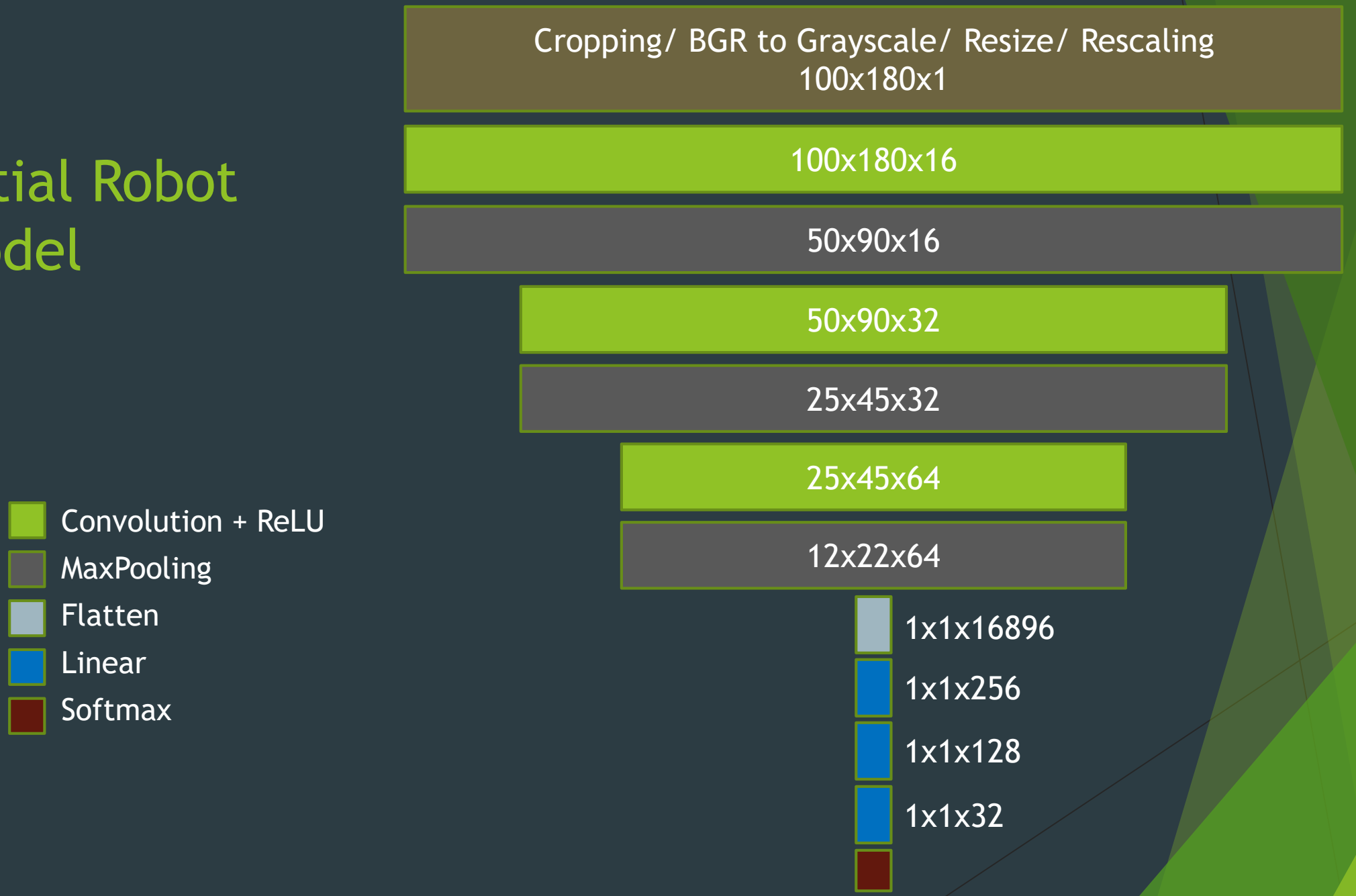
Batch 50 epochs



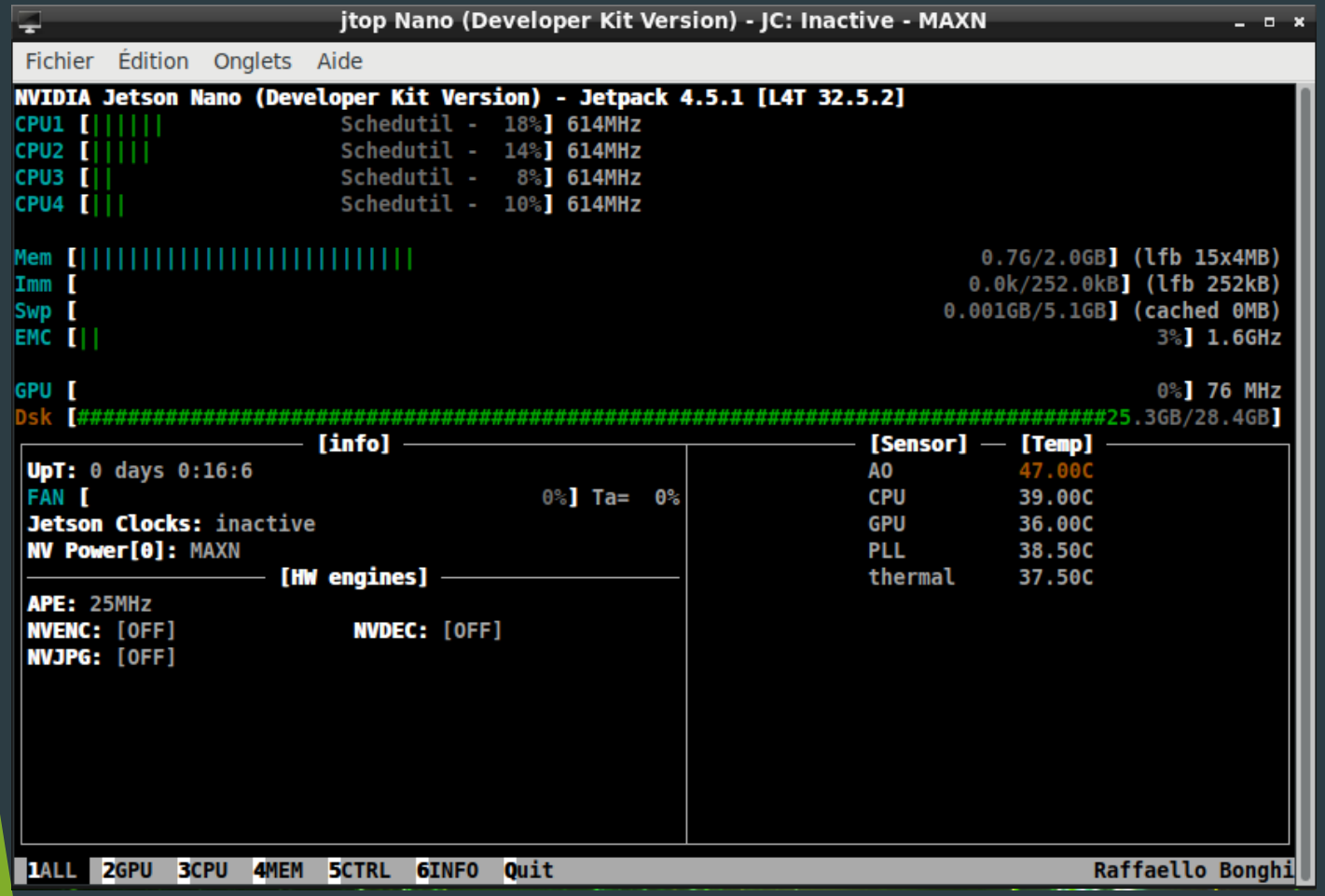
Test made on a Cifar10 model

Optimal size batch : 32

Initial Robot model

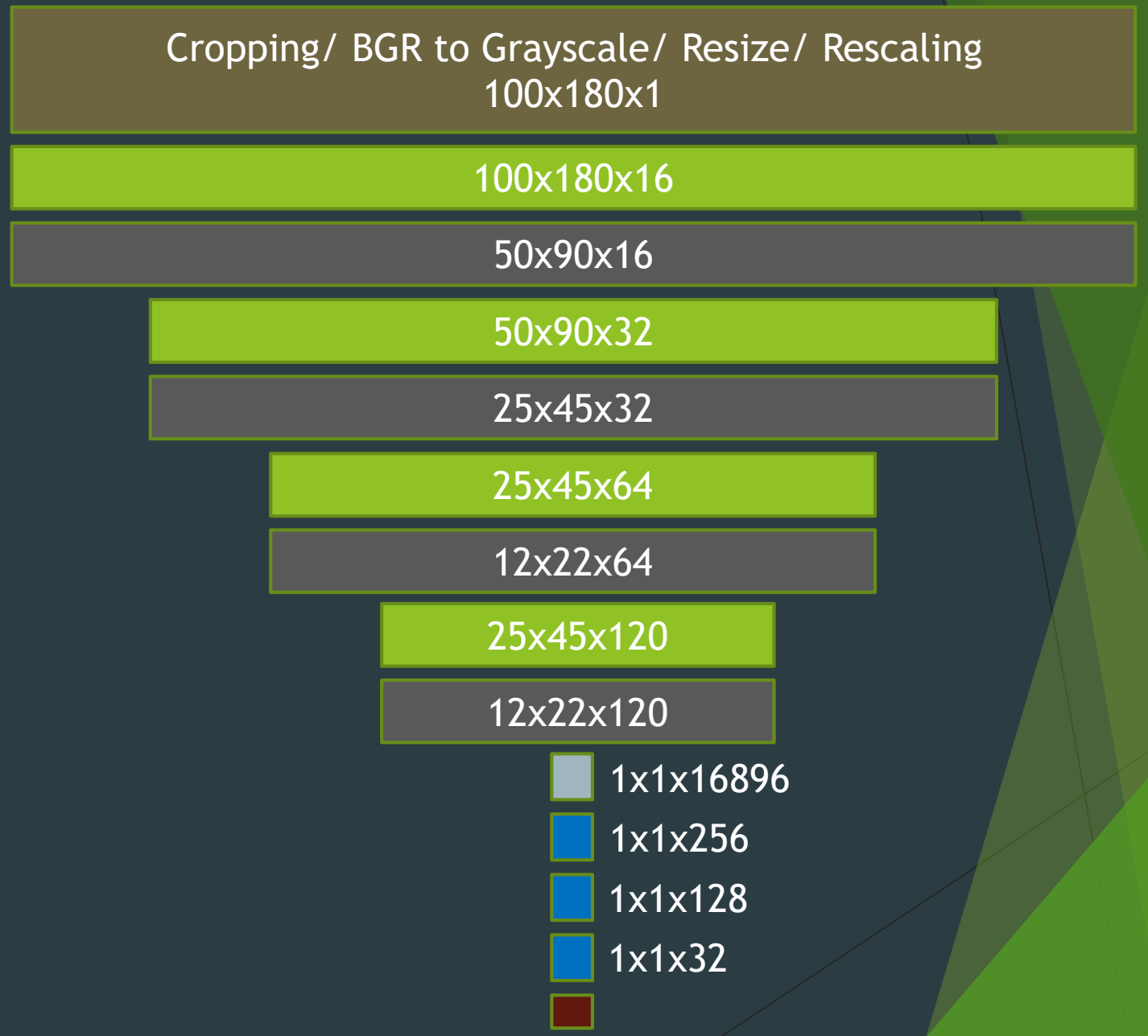


Initial model doesn’t fit in the Jetson



Not enough memory,
Only 2GB

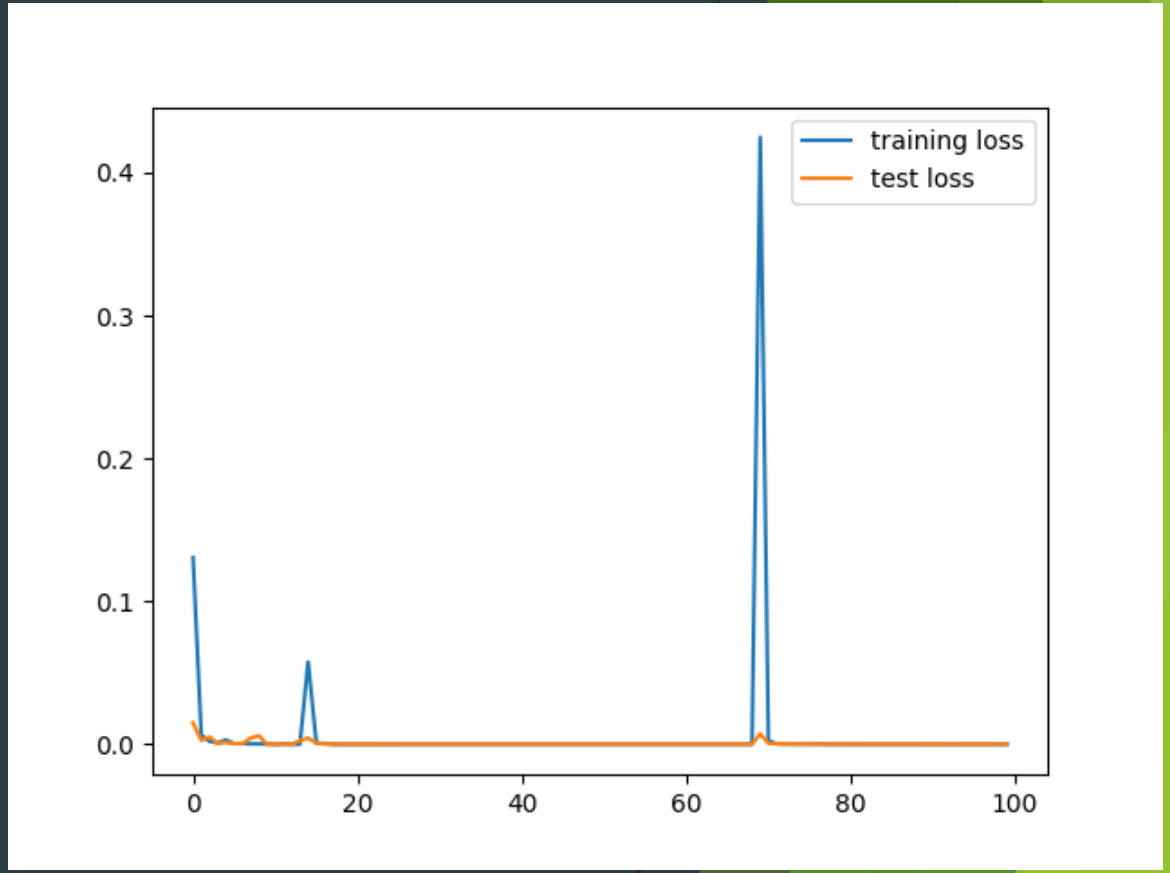
Robot model for the Jetson



Robot training time on llrai01 : pytorch

Time	Pytorch
Import	2.43 s
Loader setup	0.24 s
Model setup	1.10 s
Mean train*	112.33 s
Train/image	2.12 ms
Mean test/epoch	11.98 s
Test/image	2.03 ms

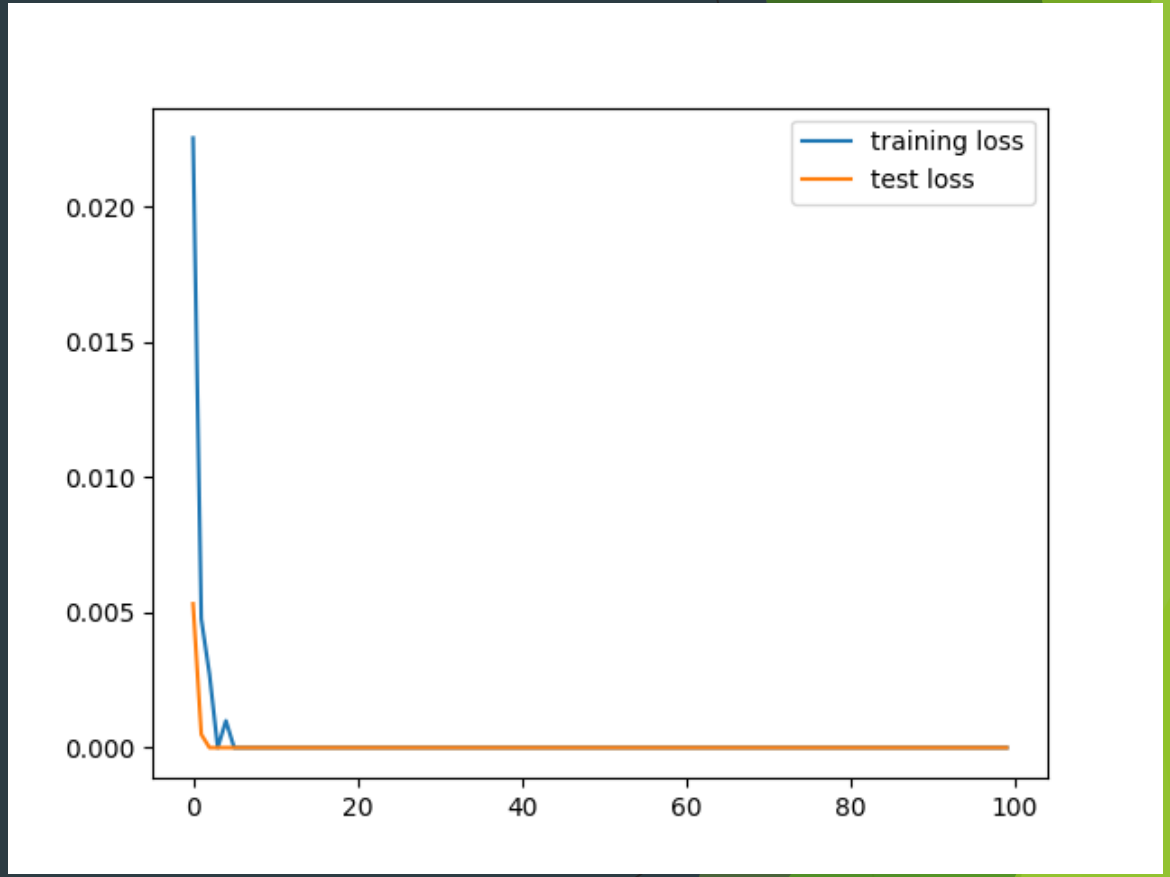
With training set :
Final loss : 2E-4
Final accuray : 100%



Robot training time on llrai01 : tensorflow

Time	tensorflow
Import	2.93 s
Loader setup	9.00 s
Model setup	0.15 s
Mean train*	7.58 s
Train/image	0.13 ms
Mean test/epoch	1.17 s
Test/image	9.9E-2 ms

With training set :
Final loss : 2E-4
Final accuray : 100%



Robot training time on llrai01

Time	tensorflow	Pytorch
Import	2.93 s	2.43 s
Loader setup	9.00 s	0.24 s
Model setup	0.15 s	1.10 s
Mean train*	7.58 s	112.33 s
Train/image	0.13 ms	2.12 ms
Mean test/epoch	1.17 s	11.98 s
Test/image	9.9E-2 ms	2.03 ms

Robot with camera time : tensorflow model

time	Robot model
Import time	18.65 s
Camera setting time	2.39 s
Model loading time	15.54 s
After 2 min :	
Mean image setup time*	6.31 ms
Mean forward time*	0.28 s
Mean frame time*	0.29 s

Test made with a picture took every 2 sec
*mean made on 10 frames

Pytorch not working (Segmentation fault)

Link to the github :

- https://github.com/Loe2b/my_ml