CARLA Preliminary Survey

**MIPS**

CPU usage 2.428 GHz \* 1.77 insn per cycle = 4298 MIPS

GPU usage 30% Averange GPU occupancy \* 10.7TFLOPS(FP32 float) = 3.2 TFLOPS

**Storage Size**

| 0 1959 C+G ...\_0.8.2/CarlaUE4/Binaries/Linux/CarlaUE4 914MiB | (500MB-1000MB)

| 0 3988 C python 2807MiB |

**Network bandwitdh**

**#Step1 Set up CARLA client**

CARLA version : 0.8.2

URL : <https://github.com/carla-simulator/carla/releases/tag/0.8.2>

./CarlaUE4.sh -carla-server -benchmark -fps=10 -windowed -ResX=800 -ResY=600 -carla-world-port=5000

(the -carla-world-port needs to be consistent with the port in training code)

**#Step2 Train RL model.**

Using Intel Nervanasystems/coach and DDPG algorithm for continus action.

Intel Nervanasystems/coach ： <https://github.com/NervanaSystems/coach>

A Chinese introduction for DDPG algorithm : <https://blog.csdn.net/kenneth_yu/article/details/78478356>

The behavior policy and reward policy are simulated by simple CNN : <https://github.com/NALLEIN/RLSurveyOnCARLA>

**#Step3 Some performance metrics**

tools : NVIDIA CUDA Tookit and Intel Vtune

User Name root

Operating System 4.15.0-64-generic NAME="Ubuntu"

VERSION="16.04.6 LTS (Xenial Xerus)"

CPU

---

Parameter r003cgc

----------------- ---------------------------------------------

Name Intel(R) Xeon(R) Processor code named Skylake

Frequency 2903999123

Logical CPU Count 24

GPU

---

Parameter r003cgc

------------------- ------------------------

Name GV104 [GeForce GTX 1180]

Vendor NVIDIA Corporation

#####################################################################################

**Summary for 10 iteration**

Elapsed Time: 81.435

Paused Time: 0.0

CPU Time: 19.213

Average CPU Utilization: 0.211

CPI Rate: 0.551

#####################################################################################

**Hardware Event Type Hardware Event Count:Self Hardware Event Sample Count:Self Events Per Sample**

---------------------------------- ------------------------- -------------------------------- -----------------

INST\_RETIRED.ANY 88653000000 30570 2900000

CPU\_CLK\_UNHALTED.THREAD 48809900000 16831 2900000

CPU\_CLK\_UNHALTED.REF\_TSC 55793100000 19239 2900000

CPU\_CLK\_UNHALTED.REF\_XCLK 459613788 4596 100003

CPU\_CLK\_UNHALTED.ONE\_THREAD\_ACTIVE 419312579 4193 100003

#####################################################################################

**$ perf stat**

20751.070400 task-clock (msec) # 0.236 CPUs utilized

35,160 context-switches # 0.002 M/sec

2,367 cpu-migrations # 0.114 K/sec

837,820 page-faults # 0.040 M/sec

50,391,194,733 cycles # 2.428 GHz

89,303,064,353 instructions # 1.77 insn per cycle

18,187,427,949 branches # 876.457 M/sec

146,512,652 branch-misses # 0.81% of all branches

87.927363686 seconds time elapsed

#####################################################################################

**Uncore Event summary**

--------------------

Uncore Event Type Uncore Event Count:Self

------------------------- -----------------------

UNC\_M\_CAS\_COUNT.RD[UNIT0] 493335249

UNC\_M\_CAS\_COUNT.RD[UNIT1] 460540856

UNC\_M\_CAS\_COUNT.RD[UNIT2] 0

UNC\_M\_CAS\_COUNT.RD[UNIT3] 465438233

UNC\_M\_CAS\_COUNT.RD[UNIT4] 457365518

UNC\_M\_CAS\_COUNT.RD[UNIT5] 0

UNC\_M\_CAS\_COUNT.WR[UNIT0] 443238317

UNC\_M\_CAS\_COUNT.WR[UNIT1] 437154950

UNC\_M\_CAS\_COUNT.WR[UNIT2] 0

UNC\_M\_CAS\_COUNT.WR[UNIT3] 435973849

UNC\_M\_CAS\_COUNT.WR[UNIT4] 434973956

UNC\_M\_CAS\_COUNT.WR[UNIT5] 0

amplxe: Executing actions 100 % done

-collect io

CPU Time: 23.377s

Effective Time: 23.137s

Spin Time: 0.240s

Imbalance or Serial Spinning: 0s

Lock Contention: 0s

Other: 0.240s

Overhead Time: 0s

Creation: 0s

Scheduling: 0s

Reduction: 0s

Atomics: 0s

Other: 0s

Instructions Retired: 110,136,200,000

CPI Rate: 0.587

Wait Rate: 0.000

#####################################################################################

**Bandwidth Utilization**

Bandwidth Domain Platform Maximum Observed Maximum Average % of Elapsed Time with High BW Utilization(%)

---------------------- ---------------- ---------------- ------- ---------------------------------------------

DRAM, GB/sec 68 23.900 2.712 0.0%

PCIe Bandwidth, MB/sec 20 2,876.900 118.732 32.3%

#######################################################################################

**#memory usage**

watch -n 10 nvidia-smi

+-----------------------------------------------------------------------------+

| NVIDIA-SMI 418.87.00 Driver Version: 418.87.00 CUDA Version: 10.1 |

|-------------------------------+----------------------+----------------------+

| GPU Name Persistence-M| Bus-Id Disp.A | Volatile Uncorr. ECC |

| Fan Temp Perf Pwr:Usage/Cap| Memory-Usage | GPU-Util Compute M. |

|===============================+======================+======================|

| 0 GeForce RTX 2080 Off | 00000000:B3:00.0 On | N/A |

| 29% 39C P2 55W / 245W | 4782MiB / 7949MiB | 28% Default |

+-------------------------------+----------------------+----------------------+

+-----------------------------------------------------------------------------+

| Processes: GPU Memory |

| GPU PID Type Process name Usage |

|=============================================================================|

| 0 1215 G /usr/lib/xorg/Xorg 564MiB |

**| 0 1959 C+G ...\_0.8.2/CarlaUE4/Binaries/Linux/CarlaUE4 914MiB |**

| 0 2415 G /opt/teamviewer/tv\_bin/TeamViewer 17MiB |

| 0 2630 G compiz 156MiB |

| 0 3319 G ...uest-channel-token=16826002803080008326 145MiB |

**| 0 3988 C python 2807MiB |**

| 0 4407 G ...equest-channel-token=952686068419984835 170MiB |

#####################################################################################

**#nsight-sys executable (details inn GPUTrace.txt)**

#GPU Trace (CUDA API calling and time cost and memory usage for one iteration)

set /proc/sys/kernel/perf\_event\_paranoid=-1

NVIDIA Nsight Systems version 2019.3.7.5-3837e03

Regs: Number of registers used per CUDA thread. This number includes registers used internally by the CUDA driver and/or tools and can be more than what the compiler shows.

SSMem: Static shared memory allocated per CUDA block.

DSMem: Dynamic shared memory allocated per CUDA block.

SrcMemType: The type of source memory accessed by memory operation/copy

DstMemType: The type of destination memory accessed by memory operation/copy

#####################################################################################

**Top Hotspots**

Function Module CPU Time

------------------------------ ------------------------------------------------- --------

PyArray\_ToString \_multiarray\_umath.cpython-36m-x86\_64-linux-gnu.so 2.178s

\_\_memmove\_avx\_unaligned libc-2.23.so 1.586s

call\_mkl\_cpy \_multiarray\_umath.cpython-36m-x86\_64-linux-gnu.so 1.326s

\_PyEval\_EvalFrameDefault python3.6 0.654s

ImagingResampleHorizontal\_8bpc \_imaging.cpython-36m-x86\_64-linux-gnu.so 0.572s

[Others] N/A 17.060s

Effective Physical Core Utilization: 2.5% (0.303 out of 12)

| The metric value is low, which may signal a poor physical CPU cores

| utilization caused by:

| - load imbalance

| - threading runtime overhead

| - contended synchronization

| - thread/process underutilization

| - incorrect affinity that utilizes logical cores instead of physical

| cores

| Explore sub-metrics to estimate the efficiency of MPI and OpenMP parallelism

| or run the Locks and Waits analysis to identify parallel bottlenecks for

| other parallel runtimes.

|

Effective Logical Core Utilization: 1.3% (0.308 out of 24)

| The metric value is low, which may signal a poor logical CPU cores

| utilization. Consider improving physical core utilization as the first

| step and then look at opportunities to utilize logical cores, which in

| some cases can improve processor throughput and overall performance of

| multi-threaded applications.

|

Collection and Platform Info

Application Command Line: /home/webml/anaconda3/envs/carlaRL/bin/python "/home/webml/carlaStart/RL/rl\_CARLA/ddpg\_main.py"

User Name: root

Operating System: 4.15.0-64-generic NAME="Ubuntu" VERSION="16.04.6 LTS (Xenial Xerus)" ID=ubuntu ID\_LIKE=debian PRETTY\_NAME="Ubuntu 16.04.6 LTS" VERSION\_ID="16.04" HOME\_URL="http://www.ubuntu.com/" SUPPORT\_URL="http://help.ubuntu.com/" BUG\_REPORT\_URL="http://bugs.launchpad.net/ubuntu/" VERSION\_CODENAME=xenial UBUNTU\_CODENAME=xenial

Computer Name: webml-cclaire

Result Size: 1 GB

Collection start time: 01:54:00 30/09/2019 UTC

Collection stop time: 01:55:15 30/09/2019 UTC

Collector Type: Event-based sampling driver,User-mode sampling and tracing

CPU

Name: Intel(R) Xeon(R) Processor code named Skylake

Frequency: 2.904 GHz

Logical CPU Count: 24

Max DRAM Single-Package Bandwidth: 68.000 GB/s