实验报告

https://github.com/2horse9sun/coursework/blob/main/Al-System/Labs/BasicLabs/Lab1/lab1-report.md

(图片存储在github仓库中, 若因网络原因无法显示, 请查看pdf文件)

1. 实验环境

1.1 硬件环境

CPU(vCPU数目): Intel® Core™ i7-9750H CPU @ 2.60GHz × 12

GPU(型号, 数目): GeForce RTX 2080 with Max-Q Design/PCIe/SSE2 × 1

1.2 软件环境

OS版本: Ubuntu 18.04.5 LTS

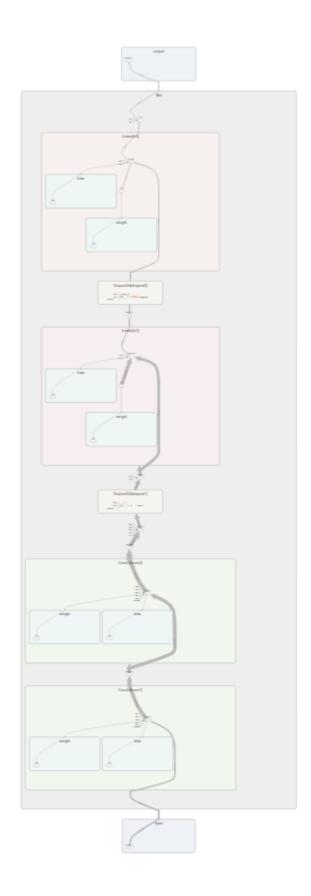
深度学习框架, python包名称及版本: Pytorch 1.5, Tensorflow 1.15.0

CUDA版本: 11.0

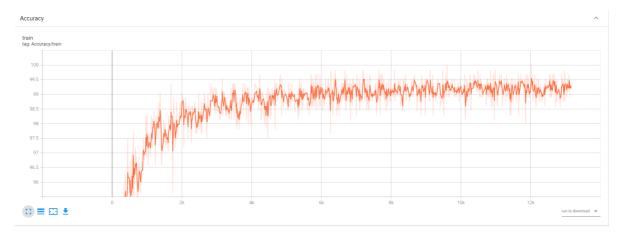
2.实验结果

2.1 模型可视化结果截图

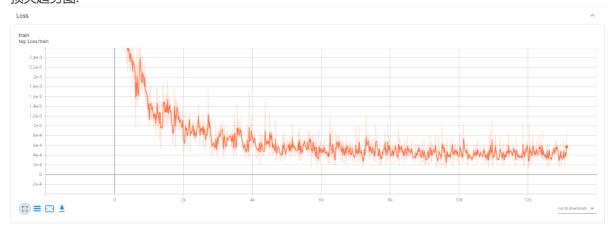
神经网络数据流图:



正确率趋势图:



损失趋势图:



网络分析,使用率前十名的操作(不使用CUDA):

	Self CPU total %,	Self CPU total	CPU total %	CPU total	CPU time avg	Number of Calls
onv2d	0.30%	6.001us	55.92%	1.135ms	567.731us	2
onvolution	0.15%	3.137us	55.62%	1.129ms	564.731us	2
convolution	2.30%	46.608us	55.47%	1.126ms	563.163us	2
kldnn_convolution	53.08%	1.078ms	53.08%	1.078ms	538.894us	2
ddmm	17.26%	350.570us	17.26%	350.570us	175.285us	2
eature_dropout	1.15%	23.341us	9.92%	201.433us	100.717us	2
ax_pool2d	0.26%	5.205us	7.39%	150.119us	150.119us	1
ax_pool2d_with_indices	7.14%	144.914us	7.14%	144.914us	144.914us	1
ernoulli	4.67%	94.758us	4.67%	94.758us	47.379us	2
elu -	3.79%	76.894us	3.79%	76.894us	25.631us	3

网络分析,使用率前十名的操作(使用CUDA):

ame	Self CPU total %	Self CPU total	CPU total %	CPU total	CPU time avg	CUDA total %	CUDA total	CUDA time avg	Number of Call
onv2d	0.01%	14.061us	94.79%	163.393ms	81.697ms	24.66%	163.392ms	81.696ms	
onvolution	0.01%	12.638us	94.78%	163.379ms	81.690ms	24.65%	163.377ms	81.689ms	
convolution	0.03%	54.797us	94.77%	163.366ms	81.683ms	24.65%	163.368ms	81.684ms	
udnn_convolution	94.67%	163.197ms	94.67%	163.197ms	81.599ms	24.63%	163.211ms	81.606ms	
in_memory	3.46%	5.962ms	4.72%	8.133ms	2.033ms	0.88%	5.857ms	1.464ms	
mpty	1.22%	2.100ms	1.22%	2.100ms	349.992us	0.34%	2.239ms	373.172us	6
ddmm	0.19%	323.341us	0.19%	323.341us	161.670us	0.05%	338.312us	169.156us	
eature dropout	0.03%	52.848us	0.10%	177.576us	88.788us	0.03%	174.766us	87.383us	
elu	0.04%	76.737us	0.04%	76.737us	25.579us	0.01%	72.234us	24.078us	
et_	0.04%	71.361us	0.04%	71.361us	8.920us	0.01%	66.174us	8.272us	
elf CPU time total: 172.381 UDA time total: 662.713ms	ms								

通过分析可以看出,卷积操作占用了大多数CPU时间,因此对卷积进行重点优化可以提升性能。

2.2 网络分析,不同批大小结果比较

不使用CUDA:

batch_size= 1:

Name	Self CPU total %	Self CPU total	CPU total %	CPU total	CPU time avg	Number of Calls
conv2d	1.28%	25.415us	59.51%	1.180ms	589.946us	2
convolution	0.15%	2.979us	58.23%	1.154ms	577.239us	2
_convolution	3.60%	71.408us	58.08%	1.151ms	575.749us	2
_ mkldnn_convolution	54.39%	1.078ms	54.39%	1.078ms	539.137us	2
addmm	16.46%	326.368us	16.46%	326.368us	163.184us	2
feature_dropout	0.93%	18.496us	8.73%	173.167us	86.583us	2
max_pool2d	0.24%	4.783us	6.53%	129.399us	129.399us	1
max_pool2d_with_indices	6.29%	124.616us	6.29%	124.616us	124.616us	1
bernoulli_	4.41%	87.404us	4.41%	87.404us	43.702us	2
relu	3.51%	69.583us	3.51%	69.583us	23.194us	3
Self CPU time total: 1.983ms						

batch_size= 16:

Name	Self CPU total %	Self CPU total	CPU total %	CPU total	CPU time avg	Number of Calls
conv2d	1.19%	24.428us	55.35%	1.140ms	569.788us	2
convolution	0.28%	5.777us	54.16%	1.115ms	557.573us	2
_convolution	3.86%	79.570us	53.88%	1.109ms	554.685us	2
mkldnn_convolution	49.91%	1.028ms	49.91%	1.028ms	513.821us	2
addmm	19.94%	410.639us	19.94%	410.639us	205.320us	2
feature_dropout	0.98%	20.107us	8.78%	180.753us	90.376us	2
max pool2d	0.32%	6.598us	6.70%	137.891us	137.891us	1
max_pool2d_with_indices	6.38%	131.293us	6.38%	131.293us	131.293us	1
bernoulli_	4.21%	86.662us	4.21%	86.662us	43.331us	2
relu	4.20%	86.581us	4.20%	86.581us	28.860us	3
Self CPU time total: 2.059ms						

batch_size= 64:

Name	Self CPU total %	Self CPU total	CPU total %	CPU total	CPU time avg	Number of Calls
onv2d	0.30%	6.001us	55.92%	1.135ms	567.731us	2
onvolution	0.15%	3.137us	55.62%	1.129ms	564.731us	2
convolution	2.30%	46.608us	55.47%	1.126ms	563.163us	2
nkldnn_convolution	53.08%	1.078ms	53.08%	1.078ms	538.894us	2
ıddmm	17.26%	350.570us	17.26%	350.570us	175.285us	2
feature_dropout	1.15%	23.341us	9.92%	201.433us	100.717us	2
nax_pool2d	0.26%	5.205us	7.39%	150.119us	150.119us	1
nax_pool2d_with_indices	7.14%	144.914us	7.14%	144.914us	144.914us	1
pernoulli_	4.67%	94.758us	4.67%	94.758us	47.379us	2
-elu	3.79%	76.894us	3.79%	76.894us	25.631us	3
Self CPU time total: 2.031ms						

使用CUDA:

batch_size= 1:

	0.15.000.1.1.1.0	0.15.000.1.1.1							
Name	Self CPU total %	Self CPU total	CPU total %	CPU total	CPU time avg	CUDA total %	CUDA total	CUDA time avg	Number of Calls
conv2d	0.01%	22.841us	92.43%	163.223ms	81.612ms	24.02%	163.219ms	81.609ms	2
convolution	0.01%	17.851us	92.42%	163.200ms	81.600ms	24.02%	163.201ms	81.601ms	2
convolution	0.03%	58.311us	92.41%	163.183ms	81.591ms	24.02%	163.184ms	81.592ms	2
udnn convolution	92.31%	163.011ms	92.31%	163.011ms	81.506ms	23.99%	163.028ms	81.514ms	2
oin_memory	2.14%	3.779ms	7.10%	12.537ms	3.134ms	2.49%	16.922ms	4.231ms	4
set_	2.91%	5.132ms	2.91%	5.132ms	641.516us	0.78%	5.276ms	659.548us	8
is_pinned	1.69%	2.993ms	1.69%	2.993ms	748.217us	0.44%	3.000ms	749.992us	4
empty	0.38%	668.863us	0.38%	668.863us	111.477us	0.08%	520.715us	86.786us	6
addmm	0.18%	311.550us	0.18%	311.550us	155.775us	0.05%	327.625us	163.812us	2
feature_dropout	0.02%	40.563us	0.10%	184.145us	92.072us	0.03%	180.953us	90.477us	2
Self CPU time total: 176.596	lms .								
CUDA time total: 679.504ms									

batch_size= 16:

Name	Self CPU total %	Self CPU total	CPU total %	CPU total	CPU time avg	CUDA total %	CUDA total	CUDA time avg	Number of Calls
conv2d	0.01%	15.168us	91.90%	161.820ms	80.910ms	24.66%	161.817ms	80.908ms	
convolution	0.01%	13.105us	91.90%	161.805ms	80.903ms	24.66%	161.807ms	80.903ms	
_convolution	0.03%	55.997us	91.89%	161.792ms	80.896ms	24.66%	161.795ms	80.897ms	
cudnn_convolution	91.79%	161.612ms	91.79%	161.612ms	80.806ms	24.63%	161.627ms	80.814ms	
pin_memory	7.02%	12.368ms	7.63%	13.426ms	3.357ms	0.84%	5.515ms	1.379ms	
is_pinned	0.47%	819.002us	0.47%	819.002us	204.750us	0.12%	813.471us	203.368us	
addmm	0.17%	305.966us	0.17%	305.966us	152.983us	0.05%	322.000us	161.000us	
empty	0.12%	216.227us	0.12%	216.227us	36.038us	0.21%	1.379ms	229.827us	
feature_dropout	0.02%	41.784us	0.11%	185.088us	92.544us	0.03%	182.562us	91.281us	
add	0.04%	75.216us	0.04%	75.216us	37.608us	0.01%	75.781us	37.891us	
Self CPU time total: 176.074	ms								
CUDA time total: 656.173ms									
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batch_size= 64:

ame	Self CPU total %	Self CPU total	CPU total %	CPU total	CPU time avo	CUDA total %	CUDA total	CUDA time avo	Number of Call
onv2d	0.01%	14.061us	94.79%	163.393ms	81.697ms	24.66%	163.392ms	81.696ms	2
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et_	0.04%	71.361us	0.04%	71.361us	8.920us	0.01%	66.174us	8.272us	
elf CPU time total: 172.381	ms								