四 川 大 学 计 算 机 学 院、软 件 学 院

实 验 报 告

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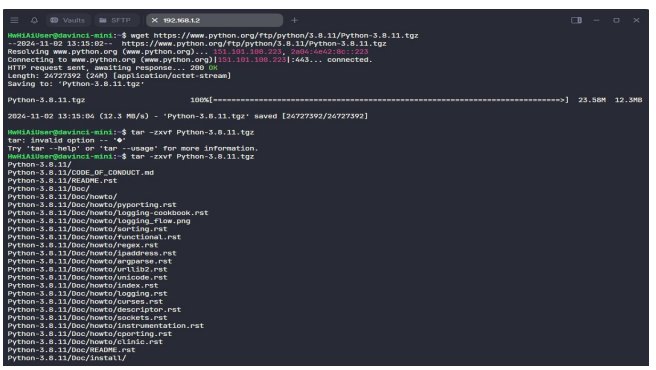
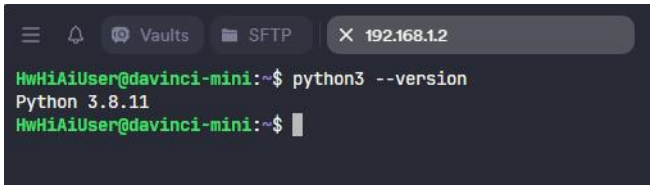
课程名称	智能边缘计算	实验课时	2
实验项目	深度学习：基于 ResNet50 模型的图片分类	实验时间	2024.10.31
实验目的	基于华为云的 Atlas 200 DK 套件，使用 ResNet50 模型进行深度学习，能够对实验图片进行分类识别		
实验环境	Atlas 200 DK、Python 3.8.11		
实验内容（算法、程序、步骤和方法）	一、实验背景 CANN(Compute Architecture for Neural Networks)是华为为昇腾处理器提供的一套软件栈。包括了一系列的库和工具,用于加速机器学习应用在昇腾处理器上的执行效率。它提供了对昇腾处理器的深度优化,使得开发者能够更容易地开发、调优面向昇腾硬件的人工智能应用。 MindStudio 是华为面向昇腾 AI 开发者提供的全流程工具链,致力于提供端到端的昇腾 AI 应用开发解决方案,使能开发者高效完成训练开发、推理开发和算子开发。 二、部署 CANN 1、安装 CANN 依赖的 Python 环境		



经版本检查成功下载 Python 及其依赖



2、下载 Ascend-cann-toolkit 安装包

```
HwHiAiUser@davinci-mini:~$ wget https://ascend-repo.obs.cn-east-2.myhuaweicloud.com/CANN/CANN%206.0.1/Ascend-cann-toolkit_6.0.1_linux-aarch
64.run?response-content-type=application/octet-stream
--2024-11-02 13:47:57--  https://ascend-repo.obs.cn-east-2.myhuaweicloud.com/CANN/CANN%206.0.1/Ascend-cann-toolkit_6.0.1_linux-aarch64.run?
response-content-type=application/octet-stream
Resolving ascend-repo.obs.cn-east-2.myhuaweicloud.com (ascend-repo.obs.cn-east-2.myhuaweicloud.com)... 122.9.88.13, 122.9.88.12, 122.9.88.9
Connecting to ascend-repo.obs.cn-east-2.myhuaweicloud.com (ascend-repo.obs.cn-east-2.myhuaweicloud.com)|122.9.88.13|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 955328269 (911M) [application/octet-stream]
Saving to: 'Ascend-cann-toolkit_6.0.1_linux-aarch64.run?response-content-type=application%2Foctet-stream'

Ascend-cann-toolkit_6.0.1_linux-aa 100%[=============================================================>] 911.07M  11.8MB/s    in 87s

2024-11-02 13:49:29 (10.5 MB/s) - 'Ascend-cann-toolkit_6.0.1_linux-aarch64.run?response-content-type=application%2Foctet-stream' saved [955
328269/955328269]
```

3、检查安装包完整性并进行安装

```
HwHiAiUser@davinci-mini:~$ ./Ascend-cann-toolkit --check
Verifying archive integrity...  100%   SHA256 checksums are OK. ./Ascend-cann-toolkit does not contain an embedded MD5 checksum.
 ./Ascend-cann-toolkit does not contain a CRC checksum.
 All good.
Verifying archive integrity...  100%   SHA256 checksums are OK. All good.
Uncompressing ASCEND_RUN_PACKAGE  100%
[Toolkit] [20241102-13:53:26] [INFO] LogFile:/home/HwHiAiUser/var/log/ascend_seclog/ascend_toolkit_install.log
HwHiAiUser@davinci-mini:~$
```

```
HwHiAiUser@davinci-mini:~$ ./Ascend-cann-toolkit --install
Verifying archive integrity...  100%   SHA256 checksums are OK. All good.
Uncompressing ASCEND_RUN_PACKAGE  100%
[Toolkit] [20241102-13:55:18] [INFO] LogFile:/home/HwHiAiUser/var/log/ascend_seclog/ascend_toolkit_install.log
[Toolkit] [20241102-13:55:18] [INFO] install start
[Toolkit] [20241102-13:55:18] [INFO] The installation path is /home/HwHiAiUser/Ascend.
[Toolkit] [20241102-13:55:18] [INFO] install package CANN-runtime-1.84.15.1.310-linux.aarch64.run start
[Toolkit] [20241102-13:55:33] [INFO] CANN-runtime-1.84.15.1.310-linux.aarch64.run --full --quiet --nox11 install success
[Toolkit] [20241102-13:55:33] [INFO] install package CANN-compiler-1.84.15.1.310-linux.aarch64.run start
[Toolkit] [20241102-13:57:49] [INFO] CANN-compiler-1.84.15.1.310-linux.aarch64.run --full --pylocal --quiet --nox11 install success
[Toolkit] [20241102-13:57:49] [INFO] install package CANN-opp-1.84.15.1.310-linux.aarch64.run start
[Toolkit] [20241102-14:00:17] [INFO] CANN-opp-1.84.15.1.310-linux.aarch64.run --full --quiet --nox11 install success
[Toolkit] [20241102-14:00:17] [INFO] install package CANN-toolkit-1.84.15.1.310-linux.aarch64.run start
[Toolkit] [20241102-14:02:15] [INFO] CANN-toolkit-1.84.15.1.310-linux.aarch64.run --full --pylocal --quiet --nox11 install success
[Toolkit] [20241102-14:02:15] [INFO] install package CANN-aoe-1.84.15.1.310-linux.aarch64.run start
[Toolkit] [20241102-14:02:24] [INFO] CANN-aoe-1.84.15.1.310-linux.aarch64.run --full --quiet --nox11 install success
[Toolkit] [20241102-14:02:24] [INFO] install package Ascend-mindstudio-toolkit_5.0.0_linux-aarch64.run start
[Toolkit] [20241102-14:02:40] [INFO] Ascend-mindstudio-toolkit_5.0.0_linux-aarch64.run --full --quiet --nox11 install success
[Toolkit] [20241102-14:02:40] [INFO] install package Ascend-test-ops_6.0.1_linux.run start
[Toolkit] [20241102-14:02:40] [INFO] Ascend-test-ops_6.0.1_linux.run --full --quiet --nox11 install success
[Toolkit] [20241102-14:02:40] [INFO] install package Ascend-pyACL_6.0.1_linux-aarch64.run start
[Toolkit] [20241102-14:02:41] [INFO] Ascend-pyACL_6.0.1_linux-aarch64.run --full --quiet --nox11 install success
[Toolkit] [20241102-14:02:41] [INFO] install package CANN-ncs-1.84.15.1.310-linux.aarch64.run start
```

4、设置环境变量

```
HwHiAiUser@davinci-mini:~$ source ${HOME}/Ascend/ascend-toolkit/set_env.sh
HwHiAiUser@davinci-mini:~$ export LD_LIBRARY_PATH=CANN_INSTALL_PATH/ascend-toolkit/latest/aarch64-linux/devlib/:$LD_LIBRARY_PATH
HwHiAiUser@davinci-mini:~$ vim ~/.bashrc
HwHiAiUser@davinci-mini:~$ source ~/.bashrc
-bash: ./home/HwHiAiUser/Ascend/ascend-toolkit/set_env.sh: No such file or directory
HwHiAiUser@davinci-mini:~$ vim ~/.bashrc
HwHiAiUser@davinci-mini:~$ source ~/.bashrc
HwHiAiUser@davinci-mini:~$
```

三、配置 Mind Studio

1、下载 Mind Studio

```
HwHiAiUser@davinci-mini:~$ wget https://ascend-repo.obs.cn-east-2.myhuaweicloud.com/MindStudio/MindStudio%206.0.0/MindStudio_6.0.0_linux_aarch64.tar.gz?response-content-type=application/octet-stream
--2024-11-02 14:23:50--  https://ascend-repo.obs.cn-east-2.myhuaweicloud.com/MindStudio/MindStudio%206.0.0/MindStudio_6.0.0_linux_aarch64.tar.gz?response-content-type=application/octet-stream
Resolving ascend-repo.obs.cn-east-2.myhuaweicloud.com (ascend-repo.obs.cn-east-2.myhuaweicloud.com)... 122.9.88.9, 122.9.88.12, 122.9.88.11
Connecting to ascend-repo.obs.cn-east-2.myhuaweicloud.com (ascend-repo.obs.cn-east-2.myhuaweicloud.com)|122.9.88.9|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 592582781 (565M) [application/octet-stream]
Saving to: 'MindStudio_6.0.0_linux_aarch64.tar.gz?response-content-type=application%2Foctet-stream'

MindStudio_6.0.0_linux_aarch64.tar.g 100%[=================================================================>] 565.13M  14.0MB/s    in 39s

2024-11-02 14:24:29 (14.5 MB/s) - 'MindStudio_6.0.0_linux_aarch64.tar.gz?response-content-type=application%2Foctet-stream' saved [592582781/592582781]
```

2、下载官方样例

```
HwHiAiUser@davinci-mini:~$ git clone https://gitee.com/ascend/samples.git
Cloning into 'samples'...
remote: Enumerating objects: 97410, done.
remote: Total 97410 (delta 0), reused 0 (delta 0), pack-reused 97410
Receiving objects: 100% (97410/97410), 545.26 MiB | 4.33 MiB/s, done.
Resolving deltas: 100% (63729/63729), done.
Checking out files: 100% (9063/9063), done.
```

3、配置第三方依赖

```
HwHiAiUser@davinci-mini:~$ vim ~/.bashrc
HwHiAiUser@davinci-mini:~$ mkdir -p ${THIRDPART_PATH}
HwHiAiUser@davinci-mini:~$ cp -r ${HOME}/samples/common ${THIRDPART_PATH}
HwHiAiUser@davinci-mini:~$ mkdir -p ${INSTALL_DIR}/driver
HwHiAiUser@davinci-mini:~$ cp /usr/lib64/libmedia_mini.so ${INSTALL_DIR}/driver
HwHiAiUser@davinci-mini:~$ cp /usr/local/Ascend/include/peripheral_api.h ${INSTALL_DIR}/driver
```

四、使用 ResNet50 模型进行图片分类

1、获取并运行 ResNet50

```
HwHiAiUser@davinci-mini:~/samples/python/level2_simple_inference/1_classification/resnet50_mindspore_picture$ wget https://obs-9be7.obs.cn-east-2.myhuaweicloud.com/models/resnet50_mindspore/resnet-90_1875.air
--2024-11-03 03:54:29--  https://obs-9be7.obs.cn-east-2.myhuaweicloud.com/models/resnet50_mindspore/resnet-90_1875.air
Resolving obs-9be7.obs.cn-east-2.myhuaweicloud.com (obs-9be7.obs.cn-east-2.myhuaweicloud.com)... 122.9.88.17
Connecting to obs-9be7.obs.cn-east-2.myhuaweicloud.com (obs-9be7.obs.cn-east-2.myhuaweicloud.com)|122.9.88.17|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 94577811 (90M) [binary/octet-stream]
Saving to: 'resnet-90_1875.air'

resnet-90_1875.air               100%[=============================================================>]  90.20M  8.34MB/s    in 8.6s

2024-11-03 03:54:38 (10.4 MB/s) - 'resnet-90_1875.air' saved [94577811/94577811]
```

```
HwHiAiUser@davinci-mini:~/samples/python/level2_simple_inference/1_classification/resnet50_mindspore_picture$ atc --framework=1 --model=resnet-90_1875.air --output=mnist --soc_version=Ascend310
ATC start working now, please wait for a moment.
ATC run success, welcome to the next use.
```

2、导入样例图片

```
HwHiAiUser@davinci-mini:~/samples/python/level2_simple_inference/1_classification/resnet50_mindspore_picture/data$ wget https://obs-9be7.ob
s.cn-east-2.myhuaweicloud.com/data/airplane.jpg
--2024-11-03 03:59:37--  https://obs-9be7.obs.cn-east-2.myhuaweicloud.com/data/airplane.jpg
Resolving obs-9be7.obs.cn-east-2.myhuaweicloud.com (obs-9be7.obs.cn-east-2.myhuaweicloud.com)... 122.9.88.21
Connecting to obs-9be7.obs.cn-east-2.myhuaweicloud.com (obs-9be7.obs.cn-east-2.myhuaweicloud.com)|122.9.88.21|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 27427 (27K) [image/jpeg]
Saving to: 'airplane.jpg'

airplane.jpg                        100%[=============================================================>]  26.78K  --.-KB/s    in 0.03s

2024-11-03 03:59:38 (1.00 MB/s) - 'airplane.jpg' saved [27427/27427]

HwHiAiUser@davinci-mini:~/samples/python/level2_simple_inference/1_classification/resnet50_mindspore_picture/data$ wget https://obs-9be7.ob
s.cn-east-2.myhuaweicloud.com/data/car.jpg
--2024-11-03 03:59:43--  https://obs-9be7.obs.cn-east-2.myhuaweicloud.com/data/car.jpg
Resolving obs-9be7.obs.cn-east-2.myhuaweicloud.com (obs-9be7.obs.cn-east-2.myhuaweicloud.com)... 122.9.88.21
Connecting to obs-9be7.obs.cn-east-2.myhuaweicloud.com (obs-9be7.obs.cn-east-2.myhuaweicloud.com)|122.9.88.21|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 22502 (22K) [image/jpeg]
Saving to: 'car.jpg'

car.jpg                             100%[=============================================================>]  21.97K  --.-KB/s    in 0.03s

2024-11-03 03:59:44 (807 KB/s) - 'car.jpg' saved [22502/22502]
```

样例图片如下所示

3、获取训练结果

```
HwHiAiUser@davinci-mini:~/samples/python/level2_simple_inference/1_classification/resnet50_mindspore_picture/model$ cd ../src/
HwHiAiUser@davinci-mini:~/samples/python/level2_simple_inference/1_classification/resnet50_mindspore_picture/src$ python3 classify.py ../da
ta/
[INFO]  init resource stage:
[INFO]  Init resource success
[INFO]  Init model resource start...
[INFO]  AclLiteModel create model output dataset:
[INFO]  malloc output 0, size 40
[INFO]  Create model output dataset success
[INFO]  Init model resource success
crop shape =  (224, 224, 3)
img shape =  (224, 224, 3)
pre process end
post process
data shape =  (1, 10)
vals shape =  (10,)
images:../data/car.jpg
======== top5 inference results: =============
label:1  confidence: 1.000000, class: automobile
label:6  confidence: 0.000000, class: frog
label:8  confidence: 0.000000, class: ship
label:9  confidence: 0.000000, class: truck
label:3  confidence: 0.000000, class: cat
crop shape =  (224, 224, 3)
img shape =  (224, 224, 3)
pre process end
post process
data shape =  (1, 10)
vals shape =  (10,)
images:../data/airplane.jpg
======== top5 inference results: =============
label:0  confidence: 0.999992, class: airplane
label:1  confidence: 0.000005, class: automobile
label:2  confidence: 0.000003, class: bird
label:3  confidence: 0.000000, class: cat
label:8  confidence: 0.000000, class: ship
[INFO]  acl resource release all resource
[INFO]  AclLiteModel release source success
[INFO]  acl resource release stream
[INFO]  acl resource release context
[INFO]  Reset acl device 0
```

数据记录和计算	由训练结果中可以看出，对于汽车图片，分类标签的概率预测为“aoto mobile:1.0”；对于飞机图片，分类标签的概率预测为“airplane:0.9999”。均正确识别了对应图片。
结　论（结　果）	通过本次实验，我们成功地在华为云 Atlas 200 DK 开发套件上实现了基于 ResNet50 模型的图像分类识别功能。实验过程中，我们首先在华为云平台上完成了 ResNet50 模型的加载与配置，然后将模型部署到 Atlas 200 DK 上，确保其能够在边缘设备上高效运行。经过测试，系统展示出了出色的图像分类性能。实验还证明了 Atlas 200 DK 在处理复杂深度学习任务时的稳定性和高效性，尤其适合应用于资源受限的边缘计算环境。
小　结	在这次基于华为云 Atlas 200 DK 和 ResNet50 模型的实验中，通过实际操作，我对深度学习模型的部署流程有了更深入的理解，尤其是如何在边缘设备上高效运行复杂的神经网络。华为云平台提供的丰富工具和服务极大地简化了模型的训练和部署过程，使得即使是初学者也能快速上手。此外，Atlas 200 DK 的强大性能给我留下了深刻印象，它不仅能够快速处理大量数据，而且功耗极低，非常适合边缘计算的应用场景。这次实验不仅提升了我的技术能力，也增强了我对人工智能领域未来发展的信心。
指导老师评　议	成绩评定：　　指导教师签名：

实验报告说明

专业实验中心

实验名称　要用最简练的语言反映实验的内容。如验证某程序、定律、算法，可写成“验证×××”；分析×××。

实验目的　目的要明确，要抓住重点，可以从理论和实践两个方面考虑。在理论上，验证定理、公式、算法，并使实验者获得深刻和系统的理解，在实践上，掌握使用实验设备的技能技巧和程序的调试方法。一般需说明是验证型实验还是设计型实验，是创新型实验还是综合型实验。

实验环境　实验用的软硬件环境（配置）。

实验内容（算法、程序、步骤和方法）　这是实验报告极其重要的内容。这部分要写明依据何种原理、定律算法、或操作方法进行实验，要写明经过哪几个步骤。还应该画出流程图（实验装置的结构示意图），再配以相应的文字说明，这样既可以节省许多文字说明，又能使实验报告简明扼要，清楚明白。

数据记录和计算　指从实验中测出的数据以及计算结果。

结论（结果）　即根据实验过程中所见到的现象和测得的数据，作出结论。

小结　对本次实验的体会、思考和建议。

备注或说明　可写上实验成功或失败的原因，实验后的心得体会、建议等。

注意：

- 实验报告将记入实验成绩；
- 每次实验开始时，交上一次的实验报告，否则将扣除此次实验成绩。