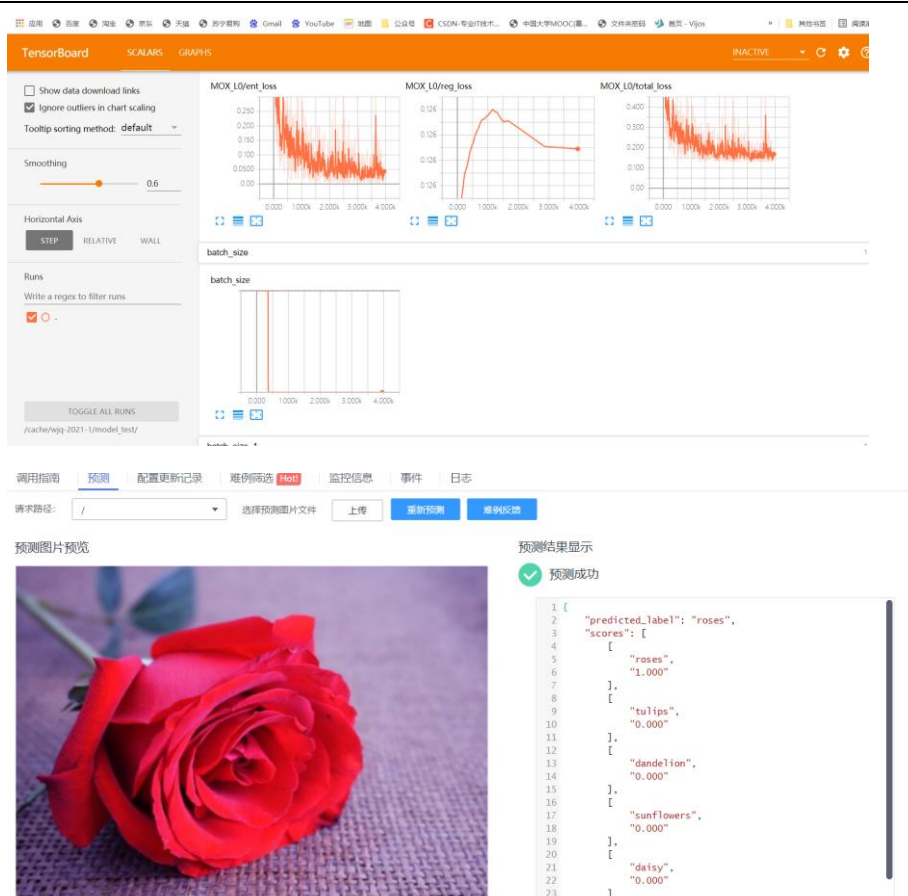


# 计算机科学与技术学院神经网络与深度学习课程实验报告

| 实验题目：华为云使用  |              | 学号：201900130143   |               |              |                   |               |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |    |    |   |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|---|--------------|-------------------|---------------|--------------|-------------------|---------------|--------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|----|----|---|---|----|----|----|----|---|----|----|----|----|---|----|----|----|----|---|----|----|----|----|---|----|----|----|----|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 日期：9/16   | 班级：智能        | 姓名：吴家麒            |               |              |                   |               |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |    |    |   |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Email：996362192@qq.com  |              |                   |               |              |                   |               |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |    |    |   |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| <p>实验目的：</p> <ol style="list-style-type: none"><li>1. 熟悉华为云 ModelArts</li><li>2. 参考官网例子，使用 TensorFlow 实现手写数字识别</li></ol>  |              |                   |               |              |                   |               |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |    |    |   |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| <p>实验软件和硬件环境：</p> <p>华为云 ModelArts</p>  |              |                   |               |              |                   |               |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |    |    |   |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| <p>实验原理和方法：</p> <ol style="list-style-type: none"><li>1. 完成账号的访问授权配置，在 OBS 服务中创建桶，用于存放样例数据集以及模型。在桶中新建文件夹用于保存数据集、脚本和训练输出的模型和文件。</li><li>2. 将数据集上传至桶内对应的文件夹内，在 ModelArts 管理控制台，进入“训练管理 &gt; 训练作业”页面创建新的训练作业。</li><li>3. 模型训练完成后，可以通过创建可视化作业了解此模型的具体训练过程。</li><li>4. 然后可以创建训练预测作业，将模型部署为在线预测服务。完成模型部署后，等待服务部署完成，当服务状态显示为“运行中”，表示服务已部署成功，可以上传需要预测的图片进行预测。</li><li>5. 如果不再需要使用此模型及在线服务，建议清除相关资源，避免产生不必要的费用。</li><li>6. 使用 NoteBook 构建模型时，在 OBS 服务中创建桶及相关文件夹，上传代码文件、训练数据集和预测样本到文件夹中。</li><li>7. 在 ModelArts 管理控制台，进入“开发环境&gt;Notebook”页面，单击左上角的“创建”，即可通过 jupyter notebook 构建自己的模型。</li></ol>  |              |                   |               |              |                   |               |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |    |    |   |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| <p>实验步骤：（不要求罗列完整源代码）</p> <ol style="list-style-type: none"><li>1. 构建花卉预测模型：</li></ol> <div><div>2021/09/16 10:08:42 当前版本: V0001 状态: 运行成功 运行时间: 00:11:14 C</div><div>创建可视化作业 创建模型 创建训练识别作业 修改 更多操作</div><div>配置信息 日志 资源占用情况 评估结果</div><div>容器标识 job-trainjob-flowers.0</div><div>资源占用率</div><div><table border="1"><caption>资源占用率数据 (估算值)</caption><thead><tr><th>时间 (min)</th><th>CPUUsage (%)</th><th>gpuMemUsage-0 (%)</th><th>gpuUtil-0 (%)</th><th>memUsage (%)</th></tr></thead><tbody><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>2</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>3</td><td>10</td><td>20</td><td>10</td><td>5</td></tr><tr><td>4</td><td>30</td><td>60</td><td>60</td><td>10</td></tr><tr><td>5</td><td>40</td><td>80</td><td>70</td><td>10</td></tr><tr><td>6</td><td>40</td><td>80</td><td>70</td><td>10</td></tr><tr><td>7</td><td>40</td><td>80</td><td>70</td><td>10</td></tr><tr><td>8</td><td>40</td><td>80</td><td>70</td><td>10</td></tr><tr><td>9</td><td>40</td><td>80</td><td>70</td><td>10</td></tr><tr><td>10</td><td>40</td><td>80</td><td>70</td><td>10</td></tr><tr><td>11</td><td>40</td><td>80</td><td>70</td><td>10</td></tr><tr><td>12</td><td>40</td><td>80</td><td>70</td><td>10</td></tr></tbody></table></div></div> |              |                   | 时间 (min)      | CPUUsage (%) | gpuMemUsage-0 (%) | gpuUtil-0 (%) | memUsage (%) | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 3 | 10 | 20 | 10 | 5 | 4 | 30 | 60 | 60 | 10 | 5 | 40 | 80 | 70 | 10 | 6 | 40 | 80 | 70 | 10 | 7 | 40 | 80 | 70 | 10 | 8 | 40 | 80 | 70 | 10 | 9 | 40 | 80 | 70 | 10 | 10 | 40 | 80 | 70 | 10 | 11 | 40 | 80 | 70 | 10 | 12 | 40 | 80 | 70 | 10 |
| 时间 (min)  | CPUUsage (%) | gpuMemUsage-0 (%) | gpuUtil-0 (%) | memUsage (%) |                   |               |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |    |    |   |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 0   | 0            | 0                 | 0             | 0            |                   |               |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |    |    |   |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 1   | 0            | 0                 | 0             | 0            |                   |               |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |    |    |   |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 2   | 0            | 0                 | 0             | 0            |                   |               |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |    |    |   |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 3   | 10           | 20                | 10            | 5            |                   |               |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |    |    |   |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 4   | 30           | 60                | 60            | 10           |                   |               |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |    |    |   |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 5   | 40           | 80                | 70            | 10           |                   |               |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |    |    |   |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 6   | 40           | 80                | 70            | 10           |                   |               |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |    |    |   |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 7   | 40           | 80                | 70            | 10           |                   |               |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |    |    |   |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 8   | 40           | 80                | 70            | 10           |                   |               |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |    |    |   |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 9   | 40           | 80                | 70            | 10           |                   |               |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |    |    |   |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 10  | 40           | 80                | 70            | 10           |                   |               |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |    |    |   |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 11  | 40           | 80                | 70            | 10           |                   |               |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |    |    |   |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 12  | 40           | 80                | 70            | 10           |                   |               |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |    |    |   |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |



## 2. 使用 Notebook 构建模型，利用 TensorFlow 实现手写数字识别。 模型训练：

```
INFO:tensorflow:Running local_init_op.
INFO:tensorflow:Done running local_init_op.
INFO:tensorflow:Running will end at step: 50
INFO:tensorflow:Saving checkpoints for 1 into ./cache/log/model.ckpt.
INFO:tensorflow:step: 0(global step: 0) sample/sec: 196.987 loss: 2.303 accuracy: 0.060
INFO:tensorflow:step: 10(global step: 10) sample/sec: 45129.159 loss: 2.192 accuracy: 0.460
INFO:tensorflow:step: 20(global step: 20) sample/sec: 48522.721 loss: 2.135 accuracy: 0.460
INFO:tensorflow:step: 30(global step: 30) sample/sec: 28810.991 loss: 1.985 accuracy: 0.760
INFO:tensorflow:step: 40(global step: 40) sample/sec: 52051.427 loss: 1.978 accuracy: 0.620
INFO:tensorflow:Sync to send FPS to non-chief workers.
INFO:tensorflow:Saving checkpoints for 50 into ./cache/log/model.ckpt.
INFO:tensorflow>Create CheckpointSaverHook.
INFO:tensorflow:Graph was finalized.
INFO:tensorflow:Restoring parameters from ./cache/log/model.ckpt-50
INFO:tensorflow:Running local_init_op.
INFO:tensorflow:Done running local_init_op.
INFO:tensorflow:Running will end at step: 100
INFO:tensorflow:Saving checkpoints for 51 into ./cache/log/model.ckpt.
INFO:tensorflow:step: 50(global step: 50) sample/sec: 276.132 loss: 1.840 accuracy: 0.780
INFO:tensorflow:step: 60(global step: 60) sample/sec: 49090.637 loss: 1.795 accuracy: 0.780
```

### 预测结果

```
INFO:tensorflow:Graph was finalized.
INFO:tensorflow:Restoring parameters from ./cache/log/model.ckpt-1000
INFO:tensorflow:Running local_init_op.
INFO:tensorflow:Done running local_init_op.
INFO:tensorflow: [1 examples]
```

The result: [7]

通过预测，我们能够看到结果输出。

### 部署上线：

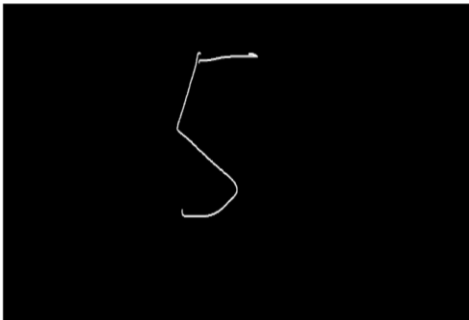
| 名称              | 状态   | 版本数量 | 运行时长     | 创建时间                          | 描述 | 创建者                 | 操作    |
|-----------------|------|------|----------|-------------------------------|----|---------------------|-------|
| trainjob-mnist2 | 运行成功 | 1    | 00:00:43 | 2021/09/23 08:52:26 GMT+08:00 | -- | hid_7tf7m3hu6epd1u3 | 停止 删除 |

调用指南 预测 配置更新记录 难例筛选 test 监控信息 事件 日志

请求路径: / 选择预测图片文件 上传 重新预测 难例反馈

预测图片预览



预测结果显示  
 预测成功
 

```

1 {
2   "predicted_label": "5",
3   "scores": [
4     [
5       "5",
6       "1.078"
7     ],
8     [
9       "1",
10      "-0.608"
11     ],
12     [
13      "0",
14      "-0.597"
15     ],
16     [
17      "6",
18      "-0.539"
19     ],
20     [
21      "2",
22      "-0.456"
23     ]
24   ]
25 }
```

结论分析与体会：

- 通过本次实验,熟悉了利用华为云 ModelArts 平台进行深度学习的操作方式与过程,熟悉了 OBS 服务、模型训练、可视化作业、部署上线及在线预测等多种服务操作方式。
- 还了解了通过平台内置 Jupyter Notebook 来构建自己所需要的模型并预测,实现了手写数字识别的模型。

就实验过程中遇到和出现的问题,你是如何解决和处理的,自拟 1—3 道问答题:

- 为什么在模型训练时看不到已经建立的桶?  
需要注意的是,模型训练的所需的桶要保证平台与训练时所选择的服务器相同,建立在同一个地区下才能找到。
- 使用 Notebook 构建模型时,数据文件存放在哪里?  
在 notebook 中使用的数据来自于在 OBS 对象服务中建立的桶,代码内的地址需要确保对应桶中的位置。