

# Caffe

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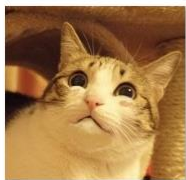
01

A Classification Demo

任务描述:

进行分类任务，将图片分为指定的类别。

在本Demo中，将图片分类为“真猫”和“表情猫”



01.jpg



02.jpg



03.jpg



06.jpg



07.jpg



08.jpg

“真猫”



01.jpg



02.jpg



03.jpg



06.jpg



07.jpg



08.jpg

“表情猫”

## 数据准备:

- 下载图片<http://sc.chinaz.com/biaoqing/>
- 将猫的图片随机分为train/test(去掉gif, 只保留jpg)
  - cat\_data
    - test
      - cat0 ( “真猫” 30张)
      - cat1 ( “表情猫” 26张)
    - train
      - cat0 ( “真猫” 121张)
      - cat1 ( “表情猫” 106张)
- 数据增强
  - 可以参考<https://github.com/aleju/imgaug>
  - 本分类问题较为简单, 没有进行数据增强

## 生成LMDB:

- LMDB简介: Lightning Memory-Mapped Database, 主要目的是加快读取数据速度
- 生成 img->label 的list文件
  - `python get_list.py cat_data`
- 生成LMDB
  - 更改相关的路径, 修改相关参数
  - `./gen_lmdb.sh`

```
train/cat0/144.jpg 0
train/cat0/02.jpg 0
train/cat0/42.jpg 0
train/cat0/67.jpg 0
train/cat0/24.jpg 0
train/cat0/101.jpg 0
train/cat0/124.jpg 0
train/cat0/48.jpg 0
train/cat0/18.jpg 0
train/cat0/52.jpg 0
train/cat0/55.jpg 0
train/cat0/127.jpg 0
```

```
data ./gen_lmdb.sh
Creating train lmdb...
I0413 11:16:10.470095 62374 convert_imageset.cpp:86] Shuffling data
I0413 11:16:11.470010 62374 convert_imageset.cpp:89] A total of 203 images.
I0413 11:16:11.483741 62374 db_lmdb.cpp:35] Opened lmdb ./cat_data/train_lmdb
I0413 11:16:12.844216 62374 convert_imageset.cpp:153] Processed 203 files.
Creating test lmdb...
I0413 11:16:13.283368 62404 convert_imageset.cpp:86] Shuffling data
I0413 11:16:14.140939 62404 convert_imageset.cpp:89] A total of 45 images.
I0413 11:16:14.141340 62404 db_lmdb.cpp:35] Opened lmdb ./cat_data/test_lmdb
I0413 11:16:14.488807 62404 convert_imageset.cpp:153] Processed 45 files.
Done.
```

## 生成LMDB:

- LMDB简介: Lightning Memory-Mapped Database, 主要目的是加快读取数据速度
- 生成 img->label 的list文件
  - `python get_list.py cat_data`
- 生成LMDB
  - 更改相关的路径, 修改相关参数
  - `./gen_lmdb.sh`
- 计算训练数据均值
  - `./cal_mean.sh`

```
data ./cal_mean.sh
I0413 12:15:42.599298 8002 db_lmdb.cpp:35] Opened lmdb ./cat_data/train_lmdb
I0413 12:15:42.602283 8002 compute_image_mean.cpp:70] Starting iteration
I0413 12:15:42.668512 8002 compute_image_mean.cpp:101] Processed 203 files.
I0413 12:15:42.669176 8002 compute_image_mean.cpp:108] Write to ./cat_data/mean.binaryproto
I0413 12:15:42.671239 8002 compute_image_mean.cpp:114] Number of channels: 3
I0413 12:15:42.671357 8002 compute_image_mean.cpp:119] mean_value channel [0]: 149.973
I0413 12:15:42.671491 8002 compute_image_mean.cpp:119] mean_value channel [1]: 169.798
I0413 12:15:42.671596 8002 compute_image_mean.cpp:119] mean_value channel [2]: 188.114
Done.
```

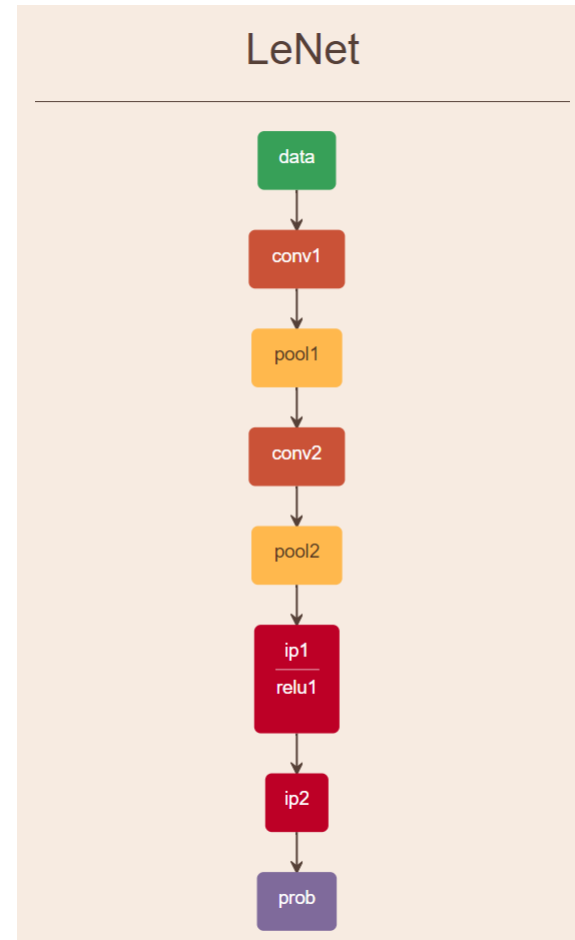
选取网络结构:

- 网络结构的定义: prototxt
- 网络结构的可视化: <http://ethereon.github.io/netscope/#/editor>
- 修改网络结构相关参数
  - 以ResNet18为例

```
layer {  
  bottom: "pool5"  
  top: "fc1000"  
  name: "fc1000"  
  type: "InnerProduct"  
  inner_product_param {  
    num_output: 1000  
    weight_filler {  
      type: "xavier"  
    }  
    bias_filler {  
      type: "constant"  
      value: 0  
    }  
  }  
}
```



```
layer {  
  bottom: "pool5"  
  top: "fc1000"  
  name: "fc1000_1"  
  type: "InnerProduct"  
  inner_product_param {  
    num_output: 2  
    weight_filler {  
      type: "xavier"  
    }  
    bias_filler {  
      type: "constant"  
      value: 0  
    }  
  }  
}
```



训练与微调:

- 修改solver.prototxt
  - solver相关参数的设置

```
net: "models/resnet18/train_val.prototxt"
test_iter: 10
test_interval: 1000
test_initialization: false
display: 40
base_lr: 0.01
lr_policy: "step"
stepsize: 1000
gamma: 0.96
max_iter: 4500
momentum: 0.9
weight_decay: 0.0001
snapshot: 1000
snapshot_prefix: "models/resnet18/cat-demo"
solver_mode: GPU
```



## 训练与微调:

- 修改solver.prototxt
  - solver相关参数的设置
- 训练
  - `./train_cat_demo_resnet18.sh`

```
#!/usr/bin/env sh
set -e

HOME=/home/zhaoxiandong
TOOLS=$HOME/caffe/build/tools
cur_date=`date +%Y:%m:%d-%H:%M:%S`
cur_dir="$( cd "$( dirname "${BASH_SOURCE[0]}" )" && pwd )"
log_file_name="$cur_dir/log/cat_demo_resnet18-${cur_date}.log"

solver=models/resnet18/solver.prototxt
$TOOLS/caffe train \
  --solver=$solver \
  --weights=$1 \
  --gpu=1 2>&1 | tee -a ${log_file_name}
```

## 训练与微调:

- 修改solver.prototxt
  - solver相关参数的设置
- 训练
  - `./train_cat_demo_resnet18.sh`
- 微调
  - `./train_cat_demo_resnet18.sh resnet_baseline.caffemodel`
  - 权重的存储方式类似key-value方式，之前修改layer name是为了能够微调
- 日志分析
  - 训练时将log写到了log文件夹下，可以通过简单的文本处理操作绘制精度变化曲线

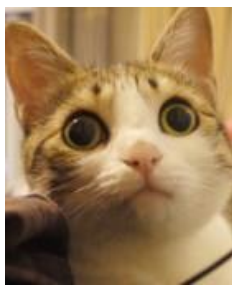
## 精度评估与测试:

- 精度评估
  - `./val_cat_demo_resnet18.sh models/resnet18/cat-demo_iter_1000.caffemodel`

```
I0413 13:00:20.609079 22913 caffe.cpp:281] Running for 10 iterations: fetching from start.
I0413 13:00:20.945900 22913 caffe.cpp:304] Batch0, acc/top-1 = 1 prefetching from start.
I0413 13:00:20.945941 22913 caffe.cpp:304] Batch0, loss = 7.21972e-06 prefetching from start.
I0413 13:00:20.988958 22913 caffe.cpp:304] Batch1, acc/top-1 = 1 prefetching from start.
I0413 13:00:20.988983 22913 caffe.cpp:304] Batch1, loss = 2.57047e-06 prefetching from start.
I0413 13:00:21.017592 22932 data_layer.cpp:73] Restarting data prefetching from start.
I0413 13:00:21.032510 22913 caffe.cpp:304] Batch 2, acc/top-1 = 1
I0413 13:00:21.032546 22913 caffe.cpp:304] Batch 2, loss = 1.6747e-05
I0413 13:00:21.072258 22913 caffe.cpp:304] Batch3, acc/top-1 = 1 demo_resnet18.sh
I0413 13:00:21.072288 22913 caffe.cpp:304] Batch 3, loss = 7.20482e-06
I0413 13:00:21.125491 22913 caffe.cpp:304] Batch 4, acc/top-1 = 1
I0413 13:00:21.125517 22913 caffe.cpp:304] Batch 4, loss = 2.86104e-06
I0413 13:00:21.144472 22932 data_layer.cpp:73] Restarting data prefetching from start.
I0413 13:00:21.178144 22913 caffe.cpp:304] Batch 5, acc/top-1 = 1
I0413 13:00:21.178169 22913 caffe.cpp:304] Batch5, loss = 1.64638e-05 no_iter_3000.caffemodel so
I0413 13:00:21.233348 22913 caffe.cpp:304] Batch06, acc/top-1 = 1 at-demo_iter_3000.solverstate tr
I0413 13:00:21.233371 22913 caffe.cpp:304] Batch 6, loss = 8.69495e-06
I0413 13:00:21.286178 22913 caffe.cpp:304] Batch07, acc/top-1 = 1 at-demo_iter_3000.caffemodel so
I0413 13:00:21.286201 22913 caffe.cpp:304] Batch07, loss = 1.50502e-06 no_iter_3000.solverstate tr
I0413 13:00:21.304996 22932 data_layer.cpp:73] Restarting data prefetching from start.
I0413 13:00:21.338855 22913 caffe.cpp:304] Batch 8, acc/top-1 = 1
I0413 13:00:21.338877 22913 caffe.cpp:304] Batch 8, loss = 1.81551e-05
I0413 13:00:21.391585 22913 caffe.cpp:304] Batch 9, acc/top-1 = 1
I0413 13:00:21.391607 22913 caffe.cpp:304] Batch 9, loss = 7.07816e-06
I0413 13:00:21.391614 22913 caffe.cpp:309] Loss: 8.85001e-06 _cat_demo_resnet18.sh
I0413 13:00:21.391631 22913 caffe.cpp:321] acc/top-1 = 1 models/resnet18/cat-demo_iter_1000.caffemodel
I0413 13:00:21.391649 22913 caffe.cpp:321] loss = 8.85001e-06 (* 1 = 8.85001e-06 loss)
```

## 精度评估与测试:

- 精度评估
  - `./val_cat_demo_resnet18.sh models/resnet18/cat-demo_iter_1000.caffemodel`
- 单张图片测试
  - 使用caffe的python接口来进行单张图片测试
  - 注意与训练时的数据预处理一致
  - `python pred_a_cat.py models/resnet18/deploy.prototxt models/resnet18/cat-demo_iter_1000.caffemodel data/cat_data/test/cat0/05.jpg`



```
image_name: data/cat_data/test/cat0/05.jpg
Predict_result: cat0(real)
time: 2.88254785538s
```



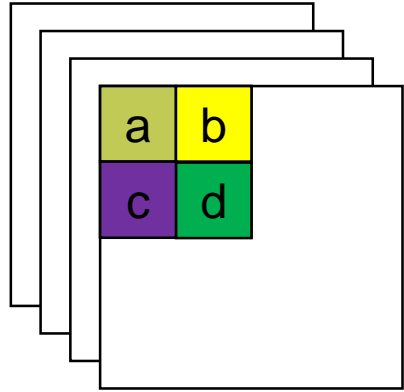
```
image_name: data/cat_data/test/cat1/42.jpg
Predict_result: cat1(not real)
time: 1.05800700188s
```

# 02

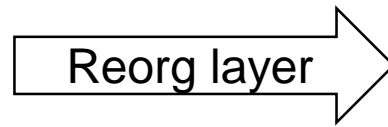
## Add Custom Layers

## 02 Add Custom Layers

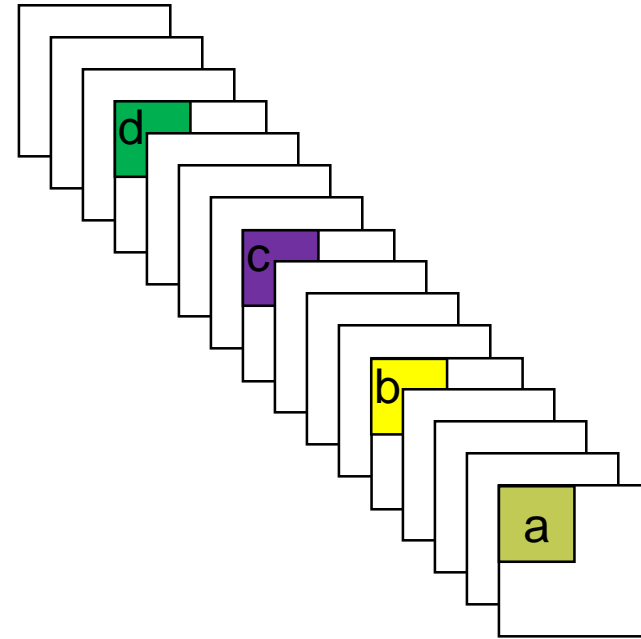
Reorg layer



4x4x4



Stride:2



2x2x16

- Caffe.prototxt
- Add reorg\_layer.cpp and reorg\_layer.hpp
- LayerSetUp
- Reshape
- forward\_cpu and backward\_cpu
- forward\_gpu and backward\_gpu

# 03

## Caffe's Abstract Framework



- Blob
- Layer
- Net
- Solver