# RECORD

## Baseline

实现了一个简单的卷积神经网络。

Train loss可以接近为0，Train f2-score可用达到99.5%

用于验证算法的正确性（loss函数、代码框架等）

## ResNet50

### Model-1~6

分阶段迁移学习：一开始只训练最后两层，然后逐步打开预训练层的权重

阈值搜索：新增了基于BFGS的搜索和Greedy搜索，可以大幅提高准确率，但是不知道阈值的泛化能力如何（参考Kaggle比赛中的两支冠军队伍，均是在Validation集上搜索阈值）

图片随机增强：horizontal flip、random shift、random rotation

结果：最好可达到87.4%（训练12个Epoch达到最优，然后下降）

### Model-7

1. 取消了图像的mean、std预处理: 之前使用基于像素的图像mean、std预处理，从生成的图片来看有问题（Keras动态生成图片导出），后面可尝试改为基于通道的均值。
2. 使用include top=False预训练参数

#### Evaluate

weights.007.hdf5  
####### Smooth F2-Score is 0.752615 #######  
####### F2-Score with threshold 0.2 is 0.861973 #######  
####### F2-Score with threshold 0.1 is 0.860249 #######  
####### Basonhopping F2-Score is 0.872198 #######  
####### Greedy F2-Score is 0.873286 #######  
  
weights.009.hdf5  
####### Smooth F2-Score is 0.741987 #######  
####### F2-Score with threshold 0.2 is 0.848438 #######  
####### F2-Score with threshold 0.1 is 0.850239 #######  
####### Basonhopping F2-Score is 0.872164 #######  
####### Greedy F2-Score is 0.874792 #######  
  
weights.010.hdf5  
####### Smooth F2-Score is 0.794807 #######  
####### F2-Score with threshold 0.2 is 0.869044 #######  
####### F2-Score with threshold 0.1 is 0.872603 #######  
####### Basonhopping F2-Score is 0.876129 #######  
####### Greedy F2-Score is 0.877365 #######  
  
weights.011.hdf5  
####### Smooth F2-Score is 0.789265 #######  
####### F2-Score with threshold 0.2 is 0.860144 #######  
####### F2-Score with threshold 0.1 is 0.862353 #######  
####### Basonhopping F2-Score is 0.870077 #######  
####### Greedy F2-Score is 0.873587 #######  
  
weights.012.hdf5  
####### Smooth F2-Score is 0.800313 #######  
####### F2-Score with threshold 0.2 is 0.869751 #######  
####### F2-Score with threshold 0.1 is 0.874894 #######  
####### Basonhopping F2-Score is 0.878213 #######  
####### Greedy F2-Score is 0.879970 #######

[label 0] smooth-f2=0.153020 BFGS-f2=0.404412[0.062066] greedy-f2=0.401460[0.060000]

[label 1] smooth-f2=0.498293 BFGS-f2=0.634196[0.054479] greedy-f2=0.633372[0.070000]

[label 2] smooth-f2=0.945747 BFGS-f2=0.980983[0.019290] greedy-f2=0.981002[0.020000]

[label 3] smooth-f2=0.222902 BFGS-f2=0.324074[0.082953] greedy-f2=0.320122[0.080000]

[label 4] smooth-f2=0.598736 BFGS-f2=0.816145[0.077905] greedy-f2=0.815349[0.080000]

[label 5] smooth-f2=0.551574 BFGS-f2=0.741818[0.140408] greedy-f2=0.741306[0.140000]

[label 6] smooth-f2=0.185681 BFGS-f2=0.265957[0.337496] greedy-f2=0.265957[0.340000]

[label 7] smooth-f2=0.284397 BFGS-f2=0.438641[0.040893] greedy-f2=0.438287[0.040000]

[label 8] smooth-f2=0.943996 BFGS-f2=0.979409[0.013240] greedy-f2=0.979199[0.010000]

[label 9] smooth-f2=0.363826 BFGS-f2=0.613208[0.080324] greedy-f2=0.613213[0.090000]

[label 10] smooth-f2=0.400007 BFGS-f2=0.715000[0.054791] greedy-f2=0.712041[0.040000]

[label 11] smooth-f2=0.306027 BFGS-f2=0.496162[0.054027] greedy-f2=0.493492[0.050000]

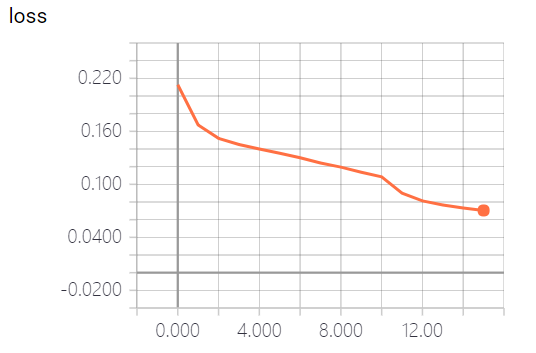
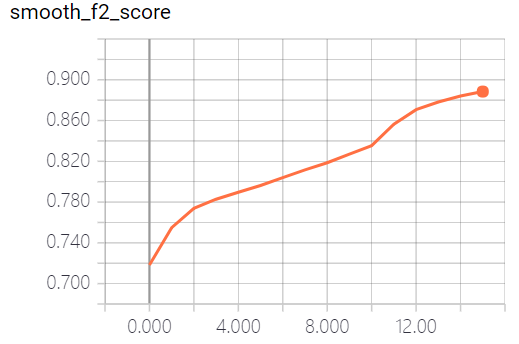
[label 12] smooth-f2=0.238251 BFGS-f2=0.348028[0.139986] greedy-f2=0.348028[0.140000]

####### Greedy F2-Score by single label is 0.877764 #######

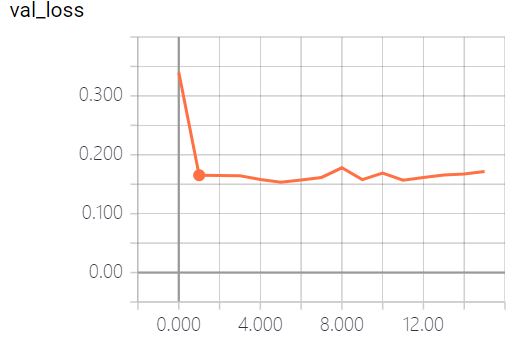
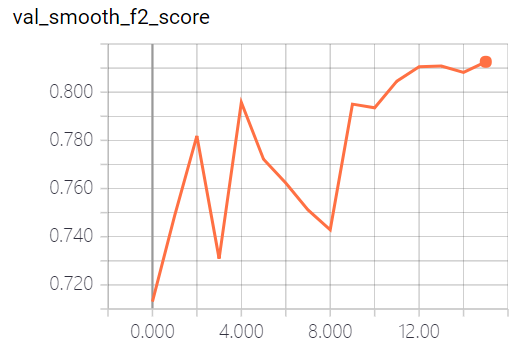
标签的评估结果存在极大的不均匀  
  
weights.013.hdf5  
####### F2-Score with threshold 0.2 is 0.867209 #######  
####### F2-Score with threshold 0.1 is 0.873079 #######  
####### Basonhopping F2-Score is 0.876897 #######  
####### Greedy F2-Score is 0.878053 #######  
  
weights.014.hdf5  
####### Smooth F2-Score is 0.804727 #######  
####### F2-Score with threshold 0.2 is 0.866394 #######  
####### F2-Score with threshold 0.1 is 0.871515 #######  
####### Basonhopping F2-Score is 0.875239 #######  
####### Greedy F2-Score is 0.876984 #######  
  
weights.015.hdf5  
####### Smooth F2-Score is 0.802782 #######  
####### F2-Score with threshold 0.2 is 0.863338 #######  
####### F2-Score with threshold 0.1 is 0.870111 #######  
####### Basonhopping F2-Score is 0.874347 #######  
####### Greedy F2-Score is 0.876150 #######

较之前模型，最优值提高约0.5%。均值提高约1%

#### Curve

Loss、smooth f2-Score在epoch=10时有一个加速，此时是打开了所有的层的权重进行训练，并降低学习率到0.00001

Train loss最低值为0.07，而Val 最低值为0.15。说明存在泛化问题。而Val smooth f2-score前期的波动性可能是由于只训练最后两层导致的。

Val loss前期降低非常快，然后趋于饱和，在epoch=10左右，开始出现上升倾向，可能是过拟合了。

结合Evaluation的结果，epoch 7~16变化不大，其中12最优，之后逐渐下降基本符合曲线中12之后loss缓慢上升的趋势。

还有一点是，从7~16，smooth f2-score 增加了几个百分点，但是阈值搜索后的f2-score只变化了零点几个百分点。

### Model-8

1. 去掉图像旋转：AlexNet、ResNet、DenseNet等论文中均为做图像旋转
2. 增大Val batch size为512：希望减少Val smooth f2-score的抖动

结果：

1. 取消掉image rotation几乎没有影响
2. Val batch size增大后，Val smooth f2-score曲线的确变得平滑了

#### Evaluate

weights.011.hdf5

####### Smooth F2-Score is 0.803181 #######

####### F2-Score with threshold 0.2 is 0.863644 #######

####### F2-Score with threshold 0.1 is 0.863083 #######

####### Greedy F2-Score is 0.874964 #######

weights.012.hdf5

####### Smooth F2-Score is 0.802437 #######

####### F2-Score with threshold 0.2 is 0.869768 #######

####### F2-Score with threshold 0.1 is 0.873220 #######

####### Greedy F2-Score is 0.879088 #######

weights.013.hdf5

####### Smooth F2-Score is 0.806060 #######

####### F2-Score with threshold 0.2 is 0.867854 #######

####### F2-Score with threshold 0.1 is 0.871998 #######

####### Greedy F2-Score is 0.877431 #######

weights.014.hdf5

####### Smooth F2-Score is 0.807866 #######

####### F2-Score with threshold 0.2 is 0.865808 #######

####### F2-Score with threshold 0.1 is 0.870474 #######

####### Greedy F2-Score is 0.876441 #######

weights.015.hdf5

####### Smooth F2-Score is 0.808137 #######

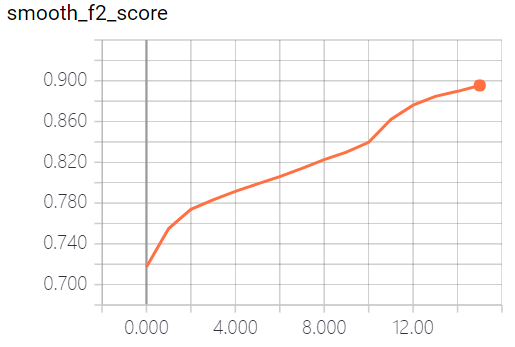
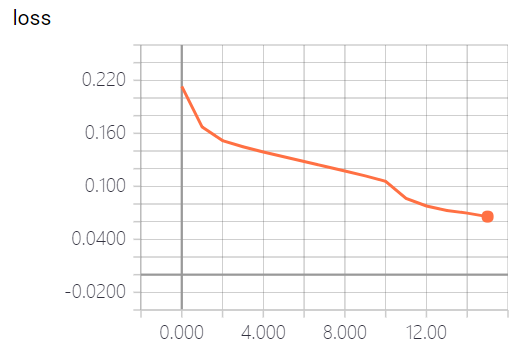
####### F2-Score with threshold 0.2 is 0.864625 #######

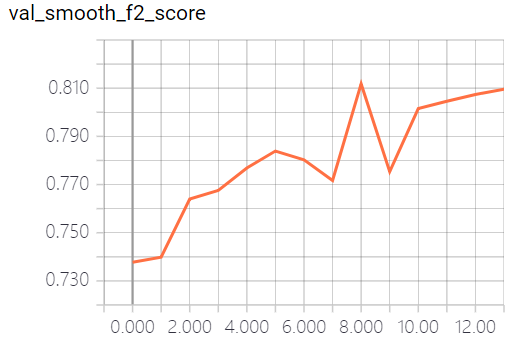
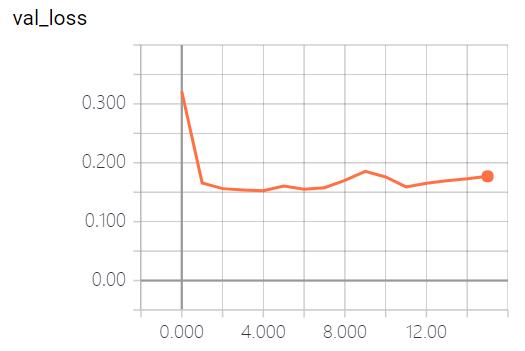
####### F2-Score with threshold 0.1 is 0.869519 #######

####### Greedy F2-Score is 0.876153 #######

与Model 7相比，差异不大

#### Curve





和Model 7差异不大

### Model 9

1. 第一个epoch只训练新增的层，然后直接开放所有参数
2. Epoch 1使用128作为batch size，学习率0.01
3. Epoch 2~10 使用128作为batch size，学习率为0.001（使用256内存申请失败）
4. Epoch 10~20 使用128作为batch size，学习率为0.0001（使用512内存申请失败）
5. 使用SGD，momentum=0.9，decay=0.0005

由于训练的太慢，因此只训练了8个epoch就停止了，准备尝试新的思路

#### Evaluate

weights.006.hdf5

####### Smooth F2-Score is 0.748128 #######

####### F2-Score with threshold 0.2 is 0.852397 #######

####### F2-Score with threshold 0.1 is 0.848662 #######

####### Greedy F2-Score is 0.858137 #######

weights.007.hdf5

####### Smooth F2-Score is 0.748561 #######

####### F2-Score with threshold 0.2 is 0.856167 #######

####### F2-Score with threshold 0.1 is 0.848487 #######

####### Greedy F2-Score is 0.859564 #######

weights.008.hdf5

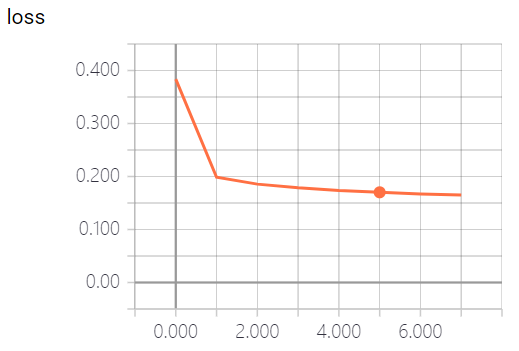
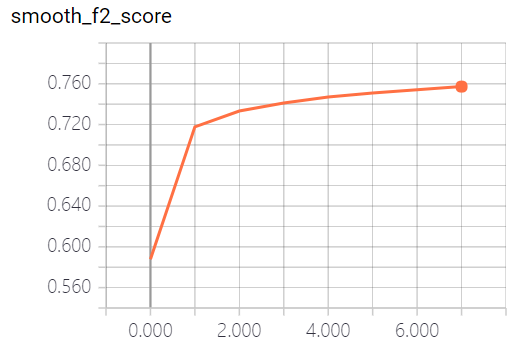
####### Smooth F2-Score is 0.746094 #######

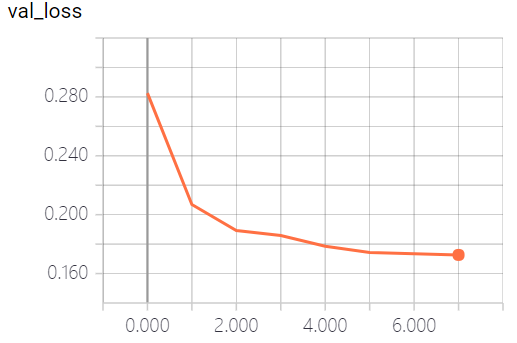
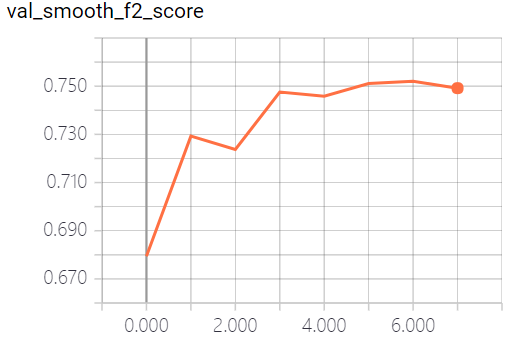
####### F2-Score with threshold 0.2 is 0.857209 #######

####### F2-Score with threshold 0.1 is 0.849872 #######

####### Greedy F2-Score is 0.860626 #######

#### Curve

增大了batch size后收敛速度很慢

### Model 10

#### Evaluate

weights.006.hdf5

####### Smooth F2-Score is 0.768315 #######

####### F2-Score with threshold 0.2 is 0.870065 #######

####### F2-Score with threshold 0.1 is 0.864232 #######

####### Greedy F2-Score is 0.871998 #######

weights.010.hdf5

####### Smooth F2-Score is 0.780512 #######

####### F2-Score with threshold 0.2 is 0.871787 #######

####### F2-Score with threshold 0.1 is 0.867698 #######

####### Greedy F2-Score is 0.875324 #######

weights.014.hdf5

####### Smooth F2-Score is 0.784361 #######

####### F2-Score with threshold 0.2 is 0.871372 #######

####### F2-Score with threshold 0.1 is 0.869048 #######

####### Greedy F2-Score is 0.875777 #######

weights.018.hdf5

####### Smooth F2-Score is 0.783561 #######

####### F2-Score with threshold 0.2 is 0.871234 #######

####### F2-Score with threshold 0.1 is 0.868395 #######

####### Greedy F2-Score is 0.875027 #######

weights.022.hdf5

####### Smooth F2-Score is 0.785808 #######

####### F2-Score with threshold 0.2 is 0.870984 #######

####### F2-Score with threshold 0.1 is 0.869028 #######

####### Greedy F2-Score is 0.875416 #######

weights.026.hdf5

####### Smooth F2-Score is 0.785669 #######

####### F2-Score with threshold 0.2 is 0.870956 #######

####### F2-Score with threshold 0.1 is 0.868817 #######

####### Greedy F2-Score is 0.875473 #######

weights.030.hdf5

####### Smooth F2-Score is 0.786300 #######

####### F2-Score with threshold 0.2 is 0.870822 #######

####### F2-Score with threshold 0.1 is 0.868854 #######

####### Greedy F2-Score is 0.875334 #######

weights.034.hdf5

####### Smooth F2-Score is 0.787065 #######

####### F2-Score with threshold 0.2 is 0.870771 #######

####### F2-Score with threshold 0.1 is 0.868913 #######

####### Greedy F2-Score is 0.875361 #######

weights.038.hdf5

####### Smooth F2-Score is 0.786137 #######

####### F2-Score with threshold 0.2 is 0.870796 #######

####### F2-Score with threshold 0.1 is 0.869084 #######

####### Greedy F2-Score is 0.875385 #######

weights.040.hdf5

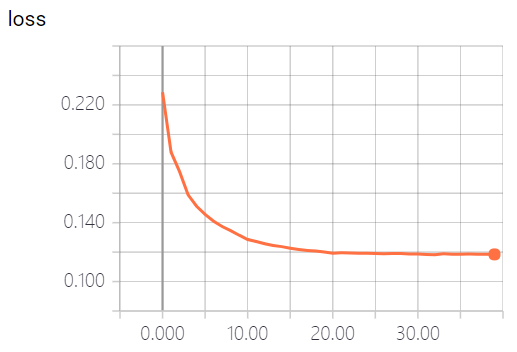
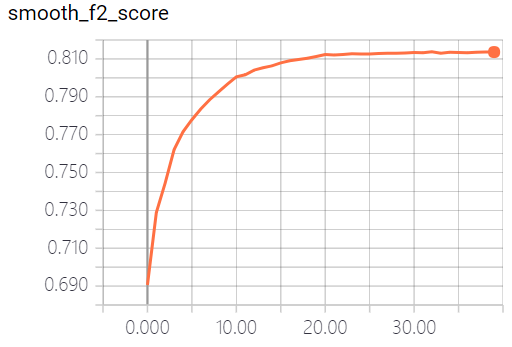
####### Smooth F2-Score is 0.786290 #######

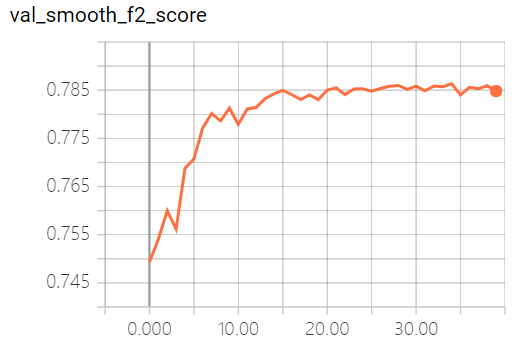
####### F2-Score with threshold 0.2 is 0.870632 #######

####### F2-Score with threshold 0.1 is 0.868842 #######

####### Greedy F2-Score is 0.875236 #######

#### Curve

### Model 11

#### Evaluate

weights.022.hdf5

####### Smooth F2-Score is 0.785086 #######

####### F2-Score with threshold 0.2 is 0.870941 #######

####### F2-Score with threshold 0.1 is 0.868952 #######

####### Greedy F2-Score is 0.875337 #######

weights.024.hdf5

####### Smooth F2-Score is 0.785687 #######

####### F2-Score with threshold 0.2 is 0.870882 #######

####### F2-Score with threshold 0.1 is 0.868859 #######

####### Greedy F2-Score is 0.875384 #######

weights.026.hdf5

####### Smooth F2-Score is 0.785537 #######

####### F2-Score with threshold 0.2 is 0.870536 #######

####### F2-Score with threshold 0.1 is 0.868837 #######

####### Greedy F2-Score is 0.875452 #######

weights.030.hdf5

####### Smooth F2-Score is 0.784935 #######

####### F2-Score with threshold 0.2 is 0.870876 #######

####### F2-Score with threshold 0.1 is 0.868908 #######

####### Greedy F2-Score is 0.875265 #######

### Model 13

#### Evaluate

####### predict 10981 images spend 97 seconds ######

####### search greedy threshold spend 14 seconds ######

####### Smooth F2-Score is 0.753498 #######

####### F2-Score with threshold 0.2 is 0.858552 #######

####### F2-Score with threshold 0.1 is 0.852350 #######

####### Greedy F2-Score is 0.862159 #######

Load image mean: ['[0.8372988 0.84012526 0.8637541 ]']

Load image std: ['[0.00499635 0.00508581 0.0047855 ]']

1/21 [>.............................] - ETA: 1:57

2/21 [=>............................] - ETA: 1:39

3/21 [===>..........................] - ETA: 1:30

4/21 [====>.........................] - ETA: 1:23

5/21 [=====>........................] - ETA: 1:18

6/21 [=======>......................] - ETA: 1:12

7/21 [========>.....................] - ETA: 1:07

8/21 [==========>...................] - ETA: 1:02

9/21 [===========>..................] - ETA: 57s

10/21 [============>.................] - ETA: 52s

11/21 [==============>...............] - ETA: 48s

12/21 [===============>..............] - ETA: 43s

13/21 [=================>............] - ETA: 38s

14/21 [==================>...........] - ETA: 34s

15/21 [===================>..........] - ETA: 29s

16/21 [=====================>........] - ETA: 24s

17/21 [======================>.......] - ETA: 20s

18/21 [========================>.....] - ETA: 15s

19/21 [=========================>....] - ETA: 11s

20/21 [==========================>...] - ETA: 6s

21/21 [============================>.] - ETA: 2s

22/21 [==============================] - 97s 4s/step

####### predict 10981 images spend 96 seconds ######

####### search greedy threshold spend 14 seconds ######

####### Smooth F2-Score is 0.755647 #######

####### F2-Score with threshold 0.2 is 0.860472 #######

####### F2-Score with threshold 0.1 is 0.854606 #######

####### Greedy F2-Score is 0.863495 #######

Load image mean: ['[0.8372988 0.84012526 0.8637541 ]']

Load image std: ['[0.00499635 0.00508581 0.0047855 ]']

1/21 [>.............................] - ETA: 1:58

2/21 [=>............................] - ETA: 1:40

3/21 [===>..........................] - ETA: 1:31

4/21 [====>.........................] - ETA: 1:24

5/21 [=====>........................] - ETA: 1:18

6/21 [=======>......................] - ETA: 1:12

7/21 [========>.....................] - ETA: 1:07

8/21 [==========>...................] - ETA: 1:02

9/21 [===========>..................] - ETA: 57s

10/21 [============>.................] - ETA: 53s

11/21 [==============>...............] - ETA: 48s

12/21 [===============>..............] - ETA: 43s

13/21 [=================>............] - ETA: 38s

14/21 [==================>...........] - ETA: 34s

15/21 [===================>..........] - ETA: 29s

16/21 [=====================>........] - ETA: 24s

17/21 [======================>.......] - ETA: 20s

18/21 [========================>.....] - ETA: 15s

19/21 [=========================>....] - ETA: 11s

20/21 [==========================>...] - ETA: 6s

21/21 [============================>.] - ETA: 2s

22/21 [==============================] - 97s 4s/step

####### predict 10981 images spend 97 seconds ######

####### search greedy threshold spend 14 seconds ######

####### Smooth F2-Score is 0.756007 #######

####### F2-Score with threshold 0.2 is 0.860677 #######

####### F2-Score with threshold 0.1 is 0.854341 #######

####### Greedy F2-Score is 0.863855 #######

Load image mean: ['[0.8372988 0.84012526 0.8637541 ]']

Load image std: ['[0.00499635 0.00508581 0.0047855 ]']

1/21 [>.............................] - ETA: 1:58

2/21 [=>............................] - ETA: 1:40

3/21 [===>..........................] - ETA: 1:31

4/21 [====>.........................] - ETA: 1:24

5/21 [=====>........................] - ETA: 1:18

6/21 [=======>......................] - ETA: 1:13

7/21 [========>.....................] - ETA: 1:07

8/21 [==========>...................] - ETA: 1:02

9/21 [===========>..................] - ETA: 58s

10/21 [============>.................] - ETA: 53s

11/21 [==============>...............] - ETA: 48s

12/21 [===============>..............] - ETA: 43s

13/21 [=================>............] - ETA: 39s

14/21 [==================>...........] - ETA: 34s

15/21 [===================>..........] - ETA: 29s

16/21 [=====================>........] - ETA: 25s

17/21 [======================>.......] - ETA: 20s

18/21 [========================>.....] - ETA: 15s

19/21 [=========================>....] - ETA: 11s

20/21 [==========================>...] - ETA: 6s

21/21 [============================>.] - ETA: 2s

22/21 [==============================] - 98s 4s/step

####### predict 10981 images spend 97 seconds ######

####### search greedy threshold spend 14 seconds ######

####### Smooth F2-Score is 0.755004 #######

####### F2-Score with threshold 0.2 is 0.861654 #######

####### F2-Score with threshold 0.1 is 0.854440 #######

####### Greedy F2-Score is 0.863999 #######

Load image mean: ['[0.8372988 0.84012526 0.8637541 ]']

Load image std: ['[0.00499635 0.00508581 0.0047855 ]']

1/21 [>.............................] - ETA: 1:58

2/21 [=>............................] - ETA: 1:41

3/21 [===>..........................] - ETA: 1:32

4/21 [====>.........................] - ETA: 1:25

5/21 [=====>........................] - ETA: 1:19

6/21 [=======>......................] - ETA: 1:13

7/21 [========>.....................] - ETA: 1:08

8/21 [==========>...................] - ETA: 1:03

9/21 [===========>..................] - ETA: 58s

10/21 [============>.................] - ETA: 53s

11/21 [==============>...............] - ETA: 48s

12/21 [===============>..............] - ETA: 44s

13/21 [=================>............] - ETA: 39s

14/21 [==================>...........] - ETA: 34s

15/21 [===================>..........] - ETA: 29s

16/21 [=====================>........] - ETA: 25s

17/21 [======================>.......] - ETA: 20s

18/21 [========================>.....] - ETA: 15s

19/21 [=========================>....] - ETA: 11s

20/21 [==========================>...] - ETA: 6s

21/21 [============================>.] - ETA: 2s

22/21 [==============================] - 98s 4s/step

####### predict 10981 images spend 98 seconds ######

####### search greedy threshold spend 14 seconds ######

####### Smooth F2-Score is 0.757308 #######

####### F2-Score with threshold 0.2 is 0.861029 #######

####### F2-Score with threshold 0.1 is 0.855101 #######

####### Greedy F2-Score is 0.864139 #######

Load image mean: ['[0.8372988 0.84012526 0.8637541 ]']

Load image std: ['[0.00499635 0.00508581 0.0047855 ]']

1/21 [>.............................] - ETA: 1:57

2/21 [=>............................] - ETA: 1:39

3/21 [===>..........................] - ETA: 1:30

4/21 [====>.........................] - ETA: 1:24

5/21 [=====>........................] - ETA: 1:18

6/21 [=======>......................] - ETA: 1:12

7/21 [========>.....................] - ETA: 1:07

8/21 [==========>...................] - ETA: 1:02

9/21 [===========>..................] - ETA: 57s

10/21 [============>.................] - ETA: 52s

11/21 [==============>...............] - ETA: 48s

12/21 [===============>..............] - ETA: 43s

13/21 [=================>............] - ETA: 38s

14/21 [==================>...........] - ETA: 34s

15/21 [===================>..........] - ETA: 29s

16/21 [=====================>........] - ETA: 24s

17/21 [======================>.......] - ETA: 20s

18/21 [========================>.....] - ETA: 15s

19/21 [=========================>....] - ETA: 11s

20/21 [==========================>...] - ETA: 6s

21/21 [============================>.] - ETA: 2s

22/21 [==============================] - 97s 4s/step

####### predict 10981 images spend 97 seconds ######

####### search greedy threshold spend 14 seconds ######

####### Smooth F2-Score is 0.756295 #######

####### F2-Score with threshold 0.2 is 0.861827 #######

####### F2-Score with threshold 0.1 is 0.855025 #######

####### Greedy F2-Score is 0.864382 #######

Load image mean: ['[0.8372988 0.84012526 0.8637541 ]']

Load image std: ['[0.00499635 0.00508581 0.0047855 ]']

1/21 [>.............................] - ETA: 1:58

2/21 [=>............................] - ETA: 1:40

3/21 [===>..........................] - ETA: 1:31

4/21 [====>.........................] - ETA: 1:24

5/21 [=====>........................] - ETA: 1:18

6/21 [=======>......................] - ETA: 1:13

7/21 [========>.....................] - ETA: 1:07

8/21 [==========>...................] - ETA: 1:02

9/21 [===========>..................] - ETA: 58s

10/21 [============>.................] - ETA: 53s

11/21 [==============>...............] - ETA: 48s

12/21 [===============>..............] - ETA: 43s

13/21 [=================>............] - ETA: 39s

14/21 [==================>...........] - ETA: 34s

15/21 [===================>..........] - ETA: 29s

16/21 [=====================>........] - ETA: 25s

17/21 [======================>.......] - ETA: 20s

18/21 [========================>.....] - ETA: 15s

19/21 [=========================>....] - ETA: 11s

20/21 [==========================>...] - ETA: 6s

21/21 [============================>.] - ETA: 2s

22/21 [==============================] - 97s 4s/step

####### predict 10981 images spend 97 seconds ######

####### search greedy threshold spend 14 seconds ######

####### Smooth F2-Score is 0.757422 #######

####### F2-Score with threshold 0.2 is 0.861641 #######

####### F2-Score with threshold 0.1 is 0.855132 #######

####### Greedy F2-Score is 0.864436 #######

Load image mean: ['[0.8372988 0.84012526 0.8637541 ]']

Load image std: ['[0.00499635 0.00508581 0.0047855 ]']

1/21 [>.............................] - ETA: 1:58

2/21 [=>............................] - ETA: 1:39

3/21 [===>..........................] - ETA: 1:30

4/21 [====>.........................] - ETA: 1:24

5/21 [=====>........................] - ETA: 1:18

6/21 [=======>......................] - ETA: 1:12

7/21 [========>.....................] - ETA: 1:07

8/21 [==========>...................] - ETA: 1:02

9/21 [===========>..................] - ETA: 57s

10/21 [============>.................] - ETA: 53s

11/21 [==============>...............] - ETA: 48s

12/21 [===============>..............] - ETA: 43s

13/21 [=================>............] - ETA: 38s

14/21 [==================>...........] - ETA: 34s

15/21 [===================>..........] - ETA: 29s

16/21 [=====================>........] - ETA: 25s

17/21 [======================>.......] - ETA: 20s

18/21 [========================>.....] - ETA: 15s

19/21 [=========================>....] - ETA: 11s

20/21 [==========================>...] - ETA: 6s

21/21 [============================>.] - ETA: 2s

22/21 [==============================] - 97s 4s/step

####### predict 10981 images spend 97 seconds ######

####### search greedy threshold spend 14 seconds ######

####### Smooth F2-Score is 0.757484 #######

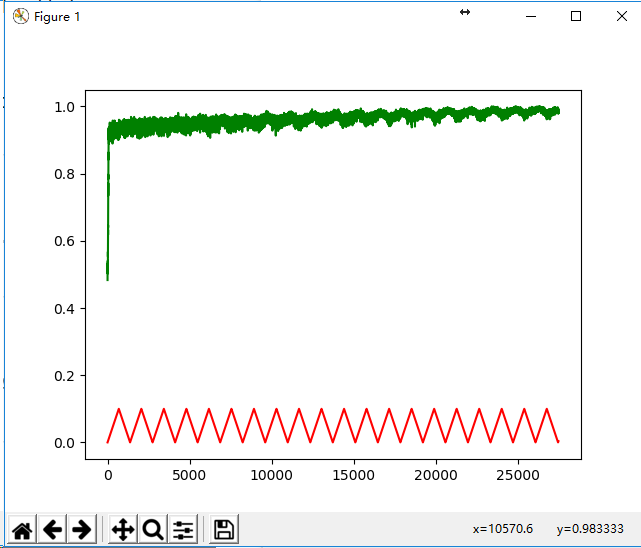
####### F2-Score with threshold 0.2 is 0.861325 #######

####### F2-Score with threshold 0.1 is 0.855021 #######

####### Greedy F2-Score is 0.864495 #######

### Model 14

Circle Learning Rate



## InceptionResNetV2

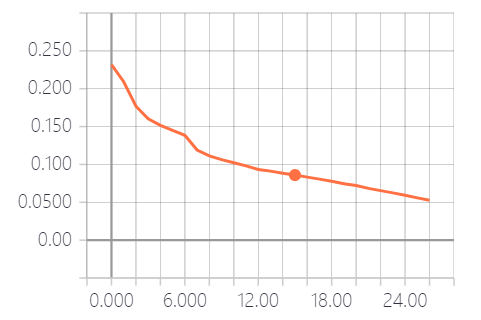
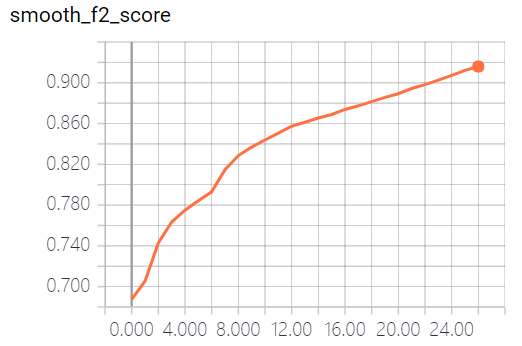
### Model 1

1. 分三阶段训练（参考ResNet50-6）
2. 并只使用Segmented数据。

#### Evaluate

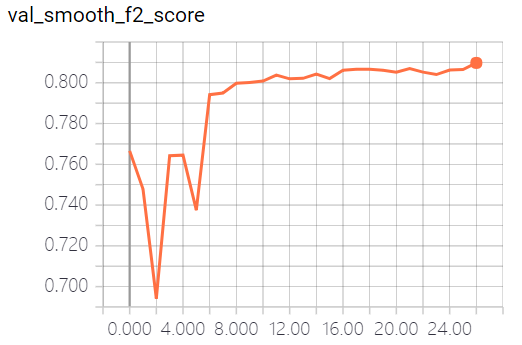
weights.007-0.7941.hdf5  
####### Smooth F2-Score is 0.790636 #######  
####### F2-Score with threshold 0.2 is 0.866281 #######  
####### F2-Score with threshold 0.1 is 0.866940 #######  
####### Best F2-Score is 0.873407 #######  
  
weights.008-0.7950.hdf5  
####### Smooth F2-Score is 0.791793 #######  
####### F2-Score with threshold 0.2 is 0.875534 #######  
####### F2-Score with threshold 0.1 is 0.874893 #######  
####### Best F2-Score is 0.880257 #######  
####### Greedy F2-Score is 0.880922 #######  
  
weights.009-0.7997.hdf5  
####### Smooth F2-Score is 0.797159 #######  
####### F2-Score with threshold 0.2 is 0.873654 #######  
####### F2-Score with threshold 0.1 is 0.875024 #######  
####### Best F2-Score is 0.878666 #######  
  
weights.010-0.8001.hdf5  
####### Smooth F2-Score is 0.799078 #######  
####### F2-Score with threshold 0.2 is 0.872105 #######  
####### F2-Score with threshold 0.1 is 0.873831 #######  
####### Best F2-Score is 0.878785 #######  
  
weights.012-0.8037.hdf5  
####### Smooth F2-Score is 0.802418 #######  
####### F2-Score with threshold 0.2 is 0.869890 #######  
####### F2-Score with threshold 0.1 is 0.873247 #######  
####### Best F2-Score is 0.877468 #######  
  
weights.014-0.8022.hdf5  
####### Smooth F2-Score is 0.800883 #######  
####### F2-Score with threshold 0.2 is 0.865996 #######  
####### F2-Score with threshold 0.1 is 0.870569 #######  
####### Best F2-Score is 0.876376 #######  
  
weights.016-0.8020.hdf5  
####### Smooth F2-Score is 0.800570 #######  
####### F2-Score with threshold 0.2 is 0.862637 #######  
####### F2-Score with threshold 0.1 is 0.868953 #######  
####### Best F2-Score is 0.874761 #######  
  
weights.018-0.8066.hdf5  
####### Smooth F2-Score is 0.805234 #######  
####### F2-Score with threshold 0.2 is 0.861564 #######  
####### F2-Score with threshold 0.1 is 0.867174 #######  
####### Best F2-Score is 0.872355 #######  
  
weights.020-0.8062.hdf5  
####### Smooth F2-Score is 0.805389 #######  
####### F2-Score with threshold 0.2 is 0.858621 #######  
####### F2-Score with threshold 0.1 is 0.864675 #######  
####### Best F2-Score is 0.870093 #######  
  
weights.022-0.8069.hdf5  
####### Smooth F2-Score is 0.805923 #######  
####### F2-Score with threshold 0.2 is 0.856163 #######  
####### F2-Score with threshold 0.1 is 0.861924 #######  
####### Best F2-Score is 0.868724 #######  
  
weights.024-0.8040.hdf5  
####### Smooth F2-Score is 0.803246 #######  
####### F2-Score with threshold 0.2 is 0.850858 #######  
####### F2-Score with threshold 0.1 is 0.859847 #######  
####### Best F2-Score is 0.867560 #######

#### Curve

在epoch=6是有一个加速，此时打开了400层以后的所有层。

随着迭代增加，模型loss持续下降，说明模型的能力足够

在epoch=8时到达loss到达最小值，然后持续增加。

从evaluate的结果来看，epoch=8处也是最优点。说明模型在8以后，过拟合了。

为什么才训练8个epoch就过拟合？

可能是因为batch size太小，相当于batch size 128训练了40个epoch

### Model 2

在Model 1的基础上做了如下修改

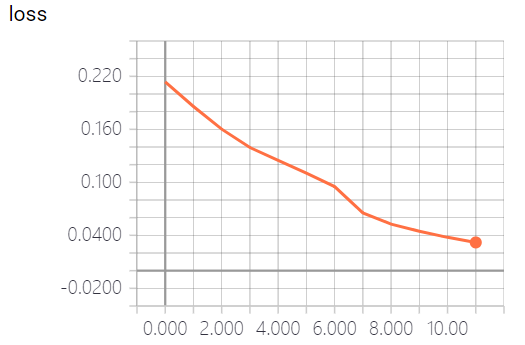
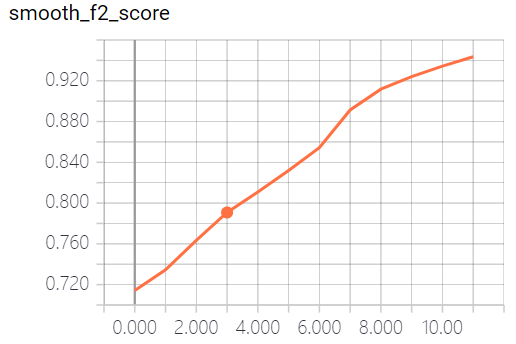
1. 使用Original数据集
2. 降低第二阶段和第三阶段的学习率（从0.0003降低到0.0001）

#### Evaluate

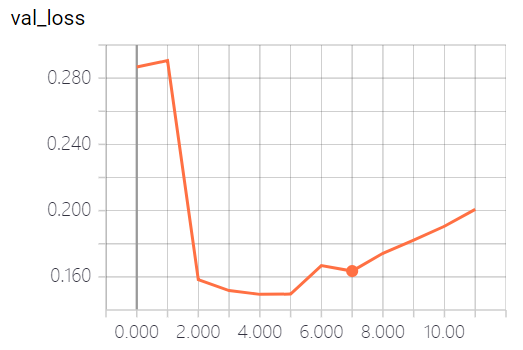
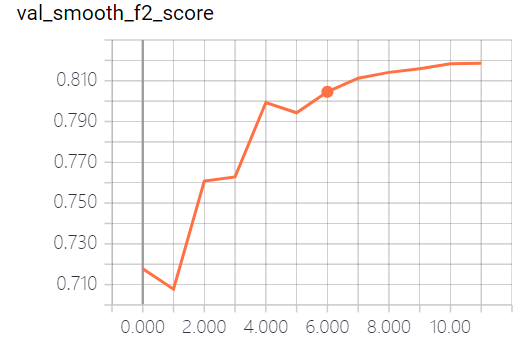
weights.006-0.7943.hdf5  
####### Smooth F2-Score is 0.787251 #######  
####### F2-Score with threshold 0.2 is 0.872325 #######  
####### F2-Score with threshold 0.1 is 0.874269 #######  
####### Basonhopping F2-Score is 0.880834 #######  
####### Greedy F2-Score is 0.882155 #######  
  
weights.007-0.8046.hdf5  
####### Smooth F2-Score is 0.802835 #######  
####### F2-Score with threshold 0.2 is 0.868019 #######  
####### F2-Score with threshold 0.1 is 0.870146 #######  
####### Basonhopping F2-Score is 0.874825 #######  
####### Greedy F2-Score is 0.876044 #######  
  
weights.008-0.8113.hdf5  
####### Smooth F2-Score is 0.806350 #######  
####### F2-Score with threshold 0.2 is 0.866478 #######  
####### F2-Score with threshold 0.1 is 0.873523 #######  
####### Basonhopping F2-Score is 0.876679 #######  
####### Greedy F2-Score is 0.878148 #######  
  
weights.009-0.8141.hdf5  
####### Smooth F2-Score is 0.809962 #######  
####### F2-Score with threshold 0.2 is 0.863204 #######  
####### F2-Score with threshold 0.1 is 0.871368 #######  
####### Basonhopping F2-Score is 0.875752 #######  
####### Greedy F2-Score is 0.877035 #######  
  
weights.010-0.8158.hdf5  
####### Smooth F2-Score is 0.812641 #######  
####### F2-Score with threshold 0.2 is 0.860696 #######  
####### F2-Score with threshold 0.1 is 0.868685 #######  
####### Basonhopping F2-Score is 0.872806 #######  
####### Greedy F2-Score is 0.875487 #######  
  
weights.011-0.8183.hdf5  
####### Smooth F2-Score is 0.813565 #######  
####### F2-Score with threshold 0.2 is 0.857980 #######  
####### F2-Score with threshold 0.1 is 0.866266 #######  
####### Basonhopping F2-Score is 0.872017 #######  
####### Greedy F2-Score is 0.873634 #######  
  
weights.012-0.8186.hdf5  
####### Smooth F2-Score is 0.813736 #######  
####### F2-Score with threshold 0.2 is 0.855675 #######  
####### F2-Score with threshold 0.1 is 0.864909 #######  
####### Basonhopping F2-Score is 0.868818 #######  
####### Greedy F2-Score is 0.872800 #######

最优值提前了几个epoch

#### Curve

和Model 1没有太大差异

在epoch=5时，loss开始反弹，而f2-score持续上升

Evaluate中epoch=6处最优，与Model 1相比，提前进入了过拟合

## DensNet121

### Model 1

使用分级transfer learning

1：仅训练最后两层，lr=0.001

2~6：训练100层之后的权重，lr=0.0001

7~20：训练所有层，lr=0.00001

#### Evaluate

weights.006.hdf5

####### predict 10981 images spend 99 seconds ######

####### search greedy threshold spend 15 seconds ######

####### Smooth F2-Score is 0.775151 #######

####### F2-Score with threshold 0.2 is 0.871815 #######

####### F2-Score with threshold 0.1 is 0.870598 #######

####### Greedy F2-Score is 0.877627 #######

weights.007.hdf5

####### Smooth F2-Score is 0.786137 #######

####### F2-Score with threshold 0.2 is 0.880634 #######

####### F2-Score with threshold 0.1 is 0.877516 #######

####### Greedy F2-Score is 0.885350 #######

weights.008.hdf5

####### Smooth F2-Score is 0.793202 #######

####### F2-Score with threshold 0.2 is 0.880199 #######

####### F2-Score with threshold 0.1 is 0.879286 #######

####### Greedy F2-Score is 0.885232 #######

weights.009.hdf5

####### Smooth F2-Score is 0.791803 #######

####### F2-Score with threshold 0.2 is 0.879592 #######

####### F2-Score with threshold 0.1 is 0.878887 #######

####### Greedy F2-Score is 0.885013 #######

weights.010.hdf5

####### Smooth F2-Score is 0.791281 #######

####### F2-Score with threshold 0.2 is 0.878118 #######

####### F2-Score with threshold 0.1 is 0.878272 #######

####### Greedy F2-Score is 0.883909 #######

weights.011.hdf5

####### Smooth F2-Score is 0.791499 #######

####### F2-Score with threshold 0.2 is 0.875889 #######

####### F2-Score with threshold 0.1 is 0.877018 #######

####### Greedy F2-Score is 0.882867 #######

weights.012.hdf5

####### Smooth F2-Score is 0.799399 #######

####### F2-Score with threshold 0.2 is 0.876372 #######

####### F2-Score with threshold 0.1 is 0.876772 #######

####### Greedy F2-Score is 0.882706 #######

Load image mean: ['[0.8372988 0.84012526 0.8637541 ]']

Load image std: ['[0.00499635 0.00508581 0.0047855 ]']

weights.013.hdf5

####### Smooth F2-Score is 0.797504 #######

####### F2-Score with threshold 0.2 is 0.874816 #######

####### F2-Score with threshold 0.1 is 0.877803 #######

####### Greedy F2-Score is 0.883175 #######

weights.014.hdf5

####### Smooth F2-Score is 0.798624 #######

####### F2-Score with threshold 0.2 is 0.874295 #######

####### F2-Score with threshold 0.1 is 0.876805 #######

####### Greedy F2-Score is 0.882275 #######

weights.015.hdf5

####### Smooth F2-Score is 0.799785 #######

####### F2-Score with threshold 0.2 is 0.873373 #######

####### F2-Score with threshold 0.1 is 0.876170 #######

####### Greedy F2-Score is 0.881740 #######

weights.016.hdf5

####### Smooth F2-Score is 0.802412 #######

####### F2-Score with threshold 0.2 is 0.872065 #######

####### F2-Score with threshold 0.1 is 0.874351 #######

####### Greedy F2-Score is 0.879751 #######

weights.017.hdf5

####### Smooth F2-Score is 0.802762 #######

####### F2-Score with threshold 0.2 is 0.871442 #######

####### F2-Score with threshold 0.1 is 0.875009 #######

####### Greedy F2-Score is 0.879854 #######

weights.018.hdf5

####### Smooth F2-Score is 0.799736 #######

####### F2-Score with threshold 0.2 is 0.870077 #######

####### F2-Score with threshold 0.1 is 0.873717 #######

####### Greedy F2-Score is 0.879753 #######

weights.019.hdf5

####### Smooth F2-Score is 0.797830 #######

####### F2-Score with threshold 0.2 is 0.869414 #######

####### F2-Score with threshold 0.1 is 0.873306 #######

####### Greedy F2-Score is 0.879036 #######

weights.020.hdf5

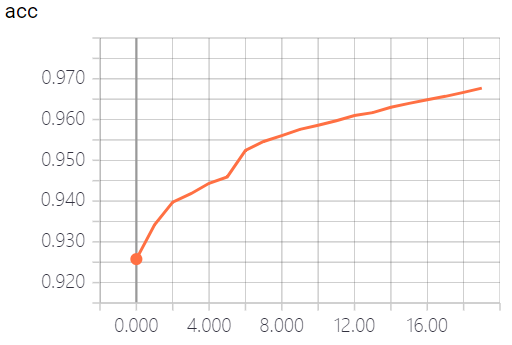
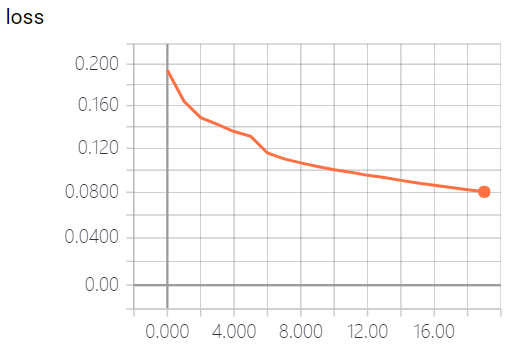
####### Smooth F2-Score is 0.801643 #######

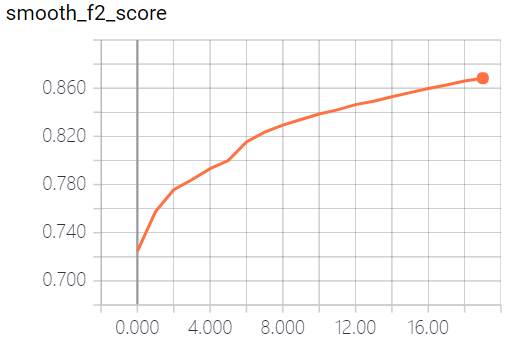
####### F2-Score with threshold 0.2 is 0.870481 #######

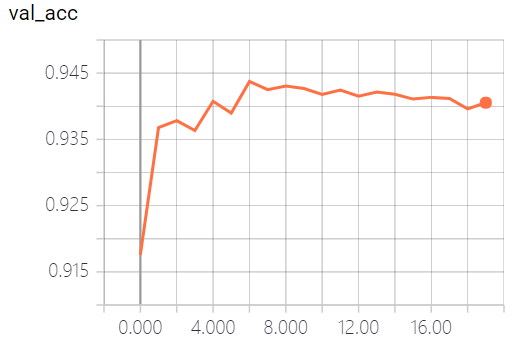
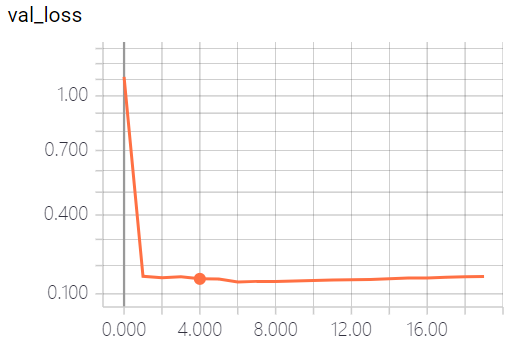
####### F2-Score with threshold 0.1 is 0.874482 #######

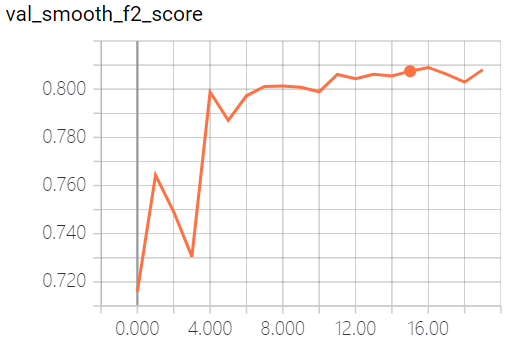
####### Greedy F2-Score is 0.879349 #######

#### Curve





### Model 2

1. 使用clr动态调整学习率
   1. 2：lr=0.001
   2. 3~20：lr=[0.00001, 0.0001](周期为2个epoch)，使用exp\_range（指数衰减）
2. 前2个epoch训练新增层，然后直接训练所有层

#### Evaluate

weights.006.hdf5

####### Smooth F2-Score is 0.764830 #######

####### F2-Score with threshold 0.2 is 0.873045 #######

####### F2-Score with threshold 0.1 is 0.864882 #######

####### Greedy F2-Score is 0.874814 #######

[label 0] smooth-f2=0.021921 BFGS-f2=0.000000[0.200000] greedy-f2=0.274725[0.050000]

[label 1] smooth-f2=0.402968 BFGS-f2=0.635272[0.148748] greedy-f2=0.634598[0.150000]

[label 2] smooth-f2=0.923979 BFGS-f2=0.980311[0.139411] greedy-f2=0.980311[0.140000]

[label 3] smooth-f2=0.098055 BFGS-f2=0.299145[0.061257] greedy-f2=0.295775[0.060000]

[label 4] smooth-f2=0.570869 BFGS-f2=0.806547[0.178961] greedy-f2=0.806304[0.180000]

[label 5] smooth-f2=0.463279 BFGS-f2=0.707613[0.121686] greedy-f2=0.706770[0.120000]

[label 6] smooth-f2=0.027199 BFGS-f2=0.000000[0.200000] greedy-f2=0.159151[0.040000]

[label 7] smooth-f2=0.186198 BFGS-f2=0.427694[0.077649] greedy-f2=0.429293[0.090000]

[label 8] smooth-f2=0.919612 BFGS-f2=0.978792[0.139711] greedy-f2=0.978747[0.150000]

[label 9] smooth-f2=0.326368 BFGS-f2=0.606839[0.113823] greedy-f2=0.604176[0.120000]

[label 10] smooth-f2=0.419470 BFGS-f2=0.724569[0.087151] greedy-f2=0.721823[0.100000]

[label 11] smooth-f2=0.240134 BFGS-f2=0.493440[0.111382] greedy-f2=0.492669[0.120000]

[label 12] smooth-f2=0.070487 BFGS-f2=0.278373[0.075100] greedy-f2=0.269151[0.070000]

####### Greedy F2-Score by single label is 0.870015 #######

weights.007.hdf5

####### Smooth F2-Score is 0.767617 #######

####### F2-Score with threshold 0.2 is 0.873982 #######

####### F2-Score with threshold 0.1 is 0.867332 #######

####### Greedy F2-Score is 0.876225 #######

[label 0] smooth-f2=0.024461 BFGS-f2=0.000000[0.200000] greedy-f2=0.247525[0.040000]

[label 1] smooth-f2=0.420514 BFGS-f2=0.641158[0.108181] greedy-f2=0.641447[0.110000]

[label 2] smooth-f2=0.927002 BFGS-f2=0.980533[0.166640] greedy-f2=0.980508[0.180000]

[label 3] smooth-f2=0.111839 BFGS-f2=0.269886[0.056378] greedy-f2=0.263930[0.060000]

[label 4] smooth-f2=0.567866 BFGS-f2=0.807305[0.174939] greedy-f2=0.806282[0.180000]

[label 5] smooth-f2=0.466767 BFGS-f2=0.713585[0.164298] greedy-f2=0.712492[0.150000]

[label 6] smooth-f2=0.028037 BFGS-f2=0.000000[0.200000] greedy-f2=0.150000[0.050000]

[label 7] smooth-f2=0.201477 BFGS-f2=0.441099[0.108959] greedy-f2=0.439852[0.110000]

[label 8] smooth-f2=0.922407 BFGS-f2=0.979036[0.174654] greedy-f2=0.978934[0.180000]

[label 9] smooth-f2=0.315906 BFGS-f2=0.612339[0.116681] greedy-f2=0.609912[0.120000]

[label 10] smooth-f2=0.402363 BFGS-f2=0.720471[0.098271] greedy-f2=0.721003[0.100000]

[label 11] smooth-f2=0.259063 BFGS-f2=0.502762[0.115179] greedy-f2=0.500572[0.130000]

[label 12] smooth-f2=0.071713 BFGS-f2=0.297030[0.095062] greedy-f2=0.288462[0.090000]

####### Greedy F2-Score by single label is 0.873149 #######

weights.007.hdf5

####### Smooth F2-Score is 0.767116 #######

####### F2-Score with threshold 0.2 is 0.873095 #######

####### F2-Score with threshold 0.1 is 0.868238 #######

####### Greedy F2-Score is 0.876627 #######

[label 0] smooth-f2=0.023070 BFGS-f2=0.000000[0.200000] greedy-f2=0.218978[0.030000]

[label 1] smooth-f2=0.443505 BFGS-f2=0.641840[0.191294] greedy-f2=0.641100[0.190000]

[label 2] smooth-f2=0.922947 BFGS-f2=0.980439[0.125051] greedy-f2=0.980342[0.120000]

[label 3] smooth-f2=0.105550 BFGS-f2=0.264798[0.060529] greedy-f2=0.263975[0.060000]

[label 4] smooth-f2=0.589173 BFGS-f2=0.810076[0.167327] greedy-f2=0.808773[0.190000]

[label 5] smooth-f2=0.443817 BFGS-f2=0.716727[0.108676] greedy-f2=0.715373[0.110000]

[label 6] smooth-f2=0.032226 BFGS-f2=0.202703[0.064176] greedy-f2=0.191489[0.060000]

[label 7] smooth-f2=0.213023 BFGS-f2=0.450611[0.106982] greedy-f2=0.448207[0.100000]

[label 8] smooth-f2=0.919020 BFGS-f2=0.979153[0.150962] greedy-f2=0.979133[0.150000]

[label 9] smooth-f2=0.325326 BFGS-f2=0.614055[0.107549] greedy-f2=0.611711[0.110000]

[label 10] smooth-f2=0.386224 BFGS-f2=0.707925[0.053710] greedy-f2=0.704082[0.060000]

[label 11] smooth-f2=0.265576 BFGS-f2=0.489606[0.116837] greedy-f2=0.486037[0.110000]

[label 12] smooth-f2=0.080539 BFGS-f2=0.290557[0.095140] greedy-f2=0.285360[0.100000]

####### Greedy F2-Score by single label is 0.872371 #######

weights.008.hdf5

####### Smooth F2-Score is 0.773684 #######

####### F2-Score with threshold 0.2 is 0.874726 #######

####### F2-Score with threshold 0.1 is 0.869551 #######

####### Greedy F2-Score is 0.877628 #######

[label 0] smooth-f2=0.023917 BFGS-f2=0.000000[0.200000] greedy-f2=0.229358[0.040000]

[label 1] smooth-f2=0.449014 BFGS-f2=0.649833[0.140586] greedy-f2=0.649230[0.140000]

[label 2] smooth-f2=0.927898 BFGS-f2=0.980164[0.090714] greedy-f2=0.980317[0.110000]

[label 3] smooth-f2=0.111608 BFGS-f2=0.246154[0.063759] greedy-f2=0.282486[0.050000]

[label 4] smooth-f2=0.587237 BFGS-f2=0.811863[0.168133] greedy-f2=0.811652[0.170000]

[label 5] smooth-f2=0.489834 BFGS-f2=0.719052[0.137698] greedy-f2=0.718992[0.140000]

[label 6] smooth-f2=0.031586 BFGS-f2=0.211640[0.071145] greedy-f2=0.209424[0.070000]

[label 7] smooth-f2=0.210963 BFGS-f2=0.435459[0.096875] greedy-f2=0.433071[0.100000]

[label 8] smooth-f2=0.922875 BFGS-f2=0.978706[0.078882] greedy-f2=0.978684[0.080000]

[label 9] smooth-f2=0.340408 BFGS-f2=0.606446[0.094369] greedy-f2=0.603922[0.100000]

[label 10] smooth-f2=0.417325 BFGS-f2=0.732282[0.068806] greedy-f2=0.730297[0.070000]

[label 11] smooth-f2=0.272058 BFGS-f2=0.510783[0.123488] greedy-f2=0.507328[0.120000]

[label 12] smooth-f2=0.074907 BFGS-f2=0.254237[0.046294] greedy-f2=0.254386[0.050000]

####### Greedy F2-Score by single label is 0.872872 #######

weights.009.hdf5

####### Smooth F2-Score is 0.785624 #######

####### F2-Score with threshold 0.2 is 0.873654 #######

####### F2-Score with threshold 0.1 is 0.871722 #######

####### Greedy F2-Score is 0.877881 #######

[label 0] smooth-f2=0.022759 BFGS-f2=0.000000[0.200000] greedy-f2=0.204082[0.040000]

[label 1] smooth-f2=0.413666 BFGS-f2=0.647683[0.118584] greedy-f2=0.648722[0.120000]

[label 2] smooth-f2=0.941126 BFGS-f2=0.980644[0.151556] greedy-f2=0.980622[0.160000]

[label 3] smooth-f2=0.107216 BFGS-f2=0.247191[0.026397] greedy-f2=0.246212[0.150000]

[label 4] smooth-f2=0.591874 BFGS-f2=0.814141[0.160355] greedy-f2=0.813916[0.160000]

[label 5] smooth-f2=0.502397 BFGS-f2=0.717569[0.125215] greedy-f2=0.716654[0.160000]

[label 6] smooth-f2=0.026522 BFGS-f2=0.000000[0.200000] greedy-f2=0.201613[0.040000]

[label 7] smooth-f2=0.190196 BFGS-f2=0.435606[0.059837] greedy-f2=0.436019[0.060000]

[label 8] smooth-f2=0.937784 BFGS-f2=0.978936[0.162216] greedy-f2=0.978882[0.150000]

[label 9] smooth-f2=0.345017 BFGS-f2=0.612404[0.102401] greedy-f2=0.610561[0.110000]

[label 10] smooth-f2=0.437340 BFGS-f2=0.732453[0.102055] greedy-f2=0.731070[0.080000]

[label 11] smooth-f2=0.242642 BFGS-f2=0.505383[0.097753] greedy-f2=0.505415[0.100000]

[label 12] smooth-f2=0.080664 BFGS-f2=0.287234[0.073064] greedy-f2=0.289352[0.090000]

####### Greedy F2-Score by single label is 0.875267 #######

####### Smooth F2-Score is 0.778880 #######

####### F2-Score with threshold 0.2 is 0.874237 #######

####### F2-Score with threshold 0.1 is 0.870424 #######

####### Greedy F2-Score is 0.877727 #######

[label 0] smooth-f2=0.029724 BFGS-f2=0.000000[0.200000] greedy-f2=0.258065[0.030000]

[label 1] smooth-f2=0.431304 BFGS-f2=0.642764[0.119342] greedy-f2=0.642432[0.120000]

[label 2] smooth-f2=0.932749 BFGS-f2=0.980731[0.090165] greedy-f2=0.980731[0.090000]

[label 3] smooth-f2=0.116529 BFGS-f2=0.275000[0.036051] greedy-f2=0.275591[0.040000]

[label 4] smooth-f2=0.585225 BFGS-f2=0.812853[0.190282] greedy-f2=0.812815[0.190000]

[label 5] smooth-f2=0.491781 BFGS-f2=0.717105[0.115965] greedy-f2=0.716494[0.140000]

[label 6] smooth-f2=0.028421 BFGS-f2=0.182927[0.047895] greedy-f2=0.172414[0.050000]

[label 7] smooth-f2=0.204402 BFGS-f2=0.430598[0.078832] greedy-f2=0.429152[0.080000]

[label 8] smooth-f2=0.930569 BFGS-f2=0.978829[0.065999] greedy-f2=0.978734[0.060000]

[label 9] smooth-f2=0.342550 BFGS-f2=0.607549[0.105045] greedy-f2=0.606604[0.100000]

[label 10] smooth-f2=0.434932 BFGS-f2=0.723511[0.087051] greedy-f2=0.723591[0.080000]

[label 11] smooth-f2=0.264802 BFGS-f2=0.501627[0.084298] greedy-f2=0.496946[0.090000]

[label 12] smooth-f2=0.085715 BFGS-f2=0.277778[0.096079] greedy-f2=0.277108[0.110000]

####### Greedy F2-Score by single label is 0.873193 #######

####### Smooth F2-Score is 0.780509 #######

####### F2-Score with threshold 0.2 is 0.872899 #######

####### F2-Score with threshold 0.1 is 0.870122 #######

####### Greedy F2-Score is 0.876869 #######

[label 0] smooth-f2=0.031448 BFGS-f2=0.000000[0.200000] greedy-f2=0.234899[0.030000]

[label 1] smooth-f2=0.427541 BFGS-f2=0.635969[0.115917] greedy-f2=0.633290[0.110000]

[label 2] smooth-f2=0.934730 BFGS-f2=0.980882[0.101540] greedy-f2=0.980953[0.120000]

[label 3] smooth-f2=0.129081 BFGS-f2=0.265018[0.130932] greedy-f2=0.265957[0.050000]

[label 4] smooth-f2=0.594318 BFGS-f2=0.812650[0.153737] greedy-f2=0.812380[0.160000]

[label 5] smooth-f2=0.486331 BFGS-f2=0.719708[0.160160] greedy-f2=0.719637[0.160000]

[label 6] smooth-f2=0.033036 BFGS-f2=0.222222[0.052881] greedy-f2=0.210970[0.050000]

[label 7] smooth-f2=0.207177 BFGS-f2=0.432203[0.116102] greedy-f2=0.430328[0.130000]

[label 8] smooth-f2=0.932488 BFGS-f2=0.979079[0.110638] greedy-f2=0.979079[0.110000]

[label 9] smooth-f2=0.322026 BFGS-f2=0.608765[0.078069] greedy-f2=0.607191[0.090000]

[label 10] smooth-f2=0.439732 BFGS-f2=0.727294[0.083778] greedy-f2=0.725235[0.080000]

[label 11] smooth-f2=0.273682 BFGS-f2=0.481394[0.113353] greedy-f2=0.480657[0.110000]

[label 12] smooth-f2=0.093929 BFGS-f2=0.332512[0.112309] greedy-f2=0.329949[0.120000]

####### Greedy F2-Score by single label is 0.873889 #######

####### Smooth F2-Score is 0.783771 #######

####### F2-Score with threshold 0.2 is 0.873532 #######

####### F2-Score with threshold 0.1 is 0.872179 #######

####### Greedy F2-Score is 0.877821 #######

[label 0] smooth-f2=0.027046 BFGS-f2=0.000000[0.200000] greedy-f2=0.196078[0.050000]

[label 1] smooth-f2=0.431877 BFGS-f2=0.639381[0.110966] greedy-f2=0.638538[0.110000]

[label 2] smooth-f2=0.937959 BFGS-f2=0.980806[0.094895] greedy-f2=0.980674[0.080000]

[label 3] smooth-f2=0.130822 BFGS-f2=0.285714[0.068482] greedy-f2=0.285714[0.070000]

[label 4] smooth-f2=0.582978 BFGS-f2=0.813953[0.136018] greedy-f2=0.813878[0.170000]

[label 5] smooth-f2=0.529580 BFGS-f2=0.721848[0.158803] greedy-f2=0.721103[0.160000]

[label 6] smooth-f2=0.030842 BFGS-f2=0.219780[0.066531] greedy-f2=0.218750[0.080000]

[label 7] smooth-f2=0.192094 BFGS-f2=0.444333[0.068975] greedy-f2=0.442721[0.070000]

[label 8] smooth-f2=0.933847 BFGS-f2=0.978988[0.099498] greedy-f2=0.978988[0.100000]

[label 9] smooth-f2=0.329470 BFGS-f2=0.606538[0.080941] greedy-f2=0.605519[0.080000]

[label 10] smooth-f2=0.431243 BFGS-f2=0.733100[0.069375] greedy-f2=0.731308[0.070000]

[label 11] smooth-f2=0.258882 BFGS-f2=0.482385[0.076539] greedy-f2=0.475436[0.070000]

[label 12] smooth-f2=0.081528 BFGS-f2=0.320088[0.067173] greedy-f2=0.312500[0.070000]

####### Greedy F2-Score by single label is 0.873715 #######

####### Smooth F2-Score is 0.783339 #######

####### F2-Score with threshold 0.2 is 0.873003 #######

####### F2-Score with threshold 0.1 is 0.871715 #######

####### Greedy F2-Score is 0.878466 #######

[label 0] smooth-f2=0.029294 BFGS-f2=0.253165[0.026979] greedy-f2=0.218447[0.020000]

[label 1] smooth-f2=0.459274 BFGS-f2=0.650352[0.124140] greedy-f2=0.648328[0.140000]

[label 2] smooth-f2=0.936559 BFGS-f2=0.980959[0.063584] greedy-f2=0.980882[0.060000]

[label 3] smooth-f2=0.114429 BFGS-f2=0.264151[0.125326] greedy-f2=0.262172[0.110000]

[label 4] smooth-f2=0.593890 BFGS-f2=0.812599[0.188952] greedy-f2=0.812474[0.190000]

[label 5] smooth-f2=0.480521 BFGS-f2=0.718701[0.128771] greedy-f2=0.718143[0.130000]

[label 6] smooth-f2=0.034029 BFGS-f2=0.222772[0.062455] greedy-f2=0.213270[0.060000]

[label 7] smooth-f2=0.232287 BFGS-f2=0.446898[0.086185] greedy-f2=0.444802[0.090000]

[label 8] smooth-f2=0.932985 BFGS-f2=0.979171[0.051147] greedy-f2=0.979074[0.050000]

[label 9] smooth-f2=0.334024 BFGS-f2=0.606008[0.104925] greedy-f2=0.603688[0.110000]

[label 10] smooth-f2=0.425460 BFGS-f2=0.723363[0.089702] greedy-f2=0.722317[0.090000]

[label 11] smooth-f2=0.291447 BFGS-f2=0.502143[0.128500] greedy-f2=0.500922[0.130000]

[label 12] smooth-f2=0.093440 BFGS-f2=0.317259[0.110605] greedy-f2=0.316456[0.110000]

####### Greedy F2-Score by single label is 0.876393 #######

####### Smooth F2-Score is 0.786078 #######

####### F2-Score with threshold 0.2 is 0.872145 #######

####### F2-Score with threshold 0.1 is 0.871293 #######

####### Greedy F2-Score is 0.877762 #######

[label 0] smooth-f2=0.036720 BFGS-f2=0.235294[0.076885] greedy-f2=0.235294[0.080000]

[label 1] smooth-f2=0.441108 BFGS-f2=0.638771[0.125133] greedy-f2=0.641675[0.130000]

[label 2] smooth-f2=0.937282 BFGS-f2=0.980673[0.047007] greedy-f2=0.980651[0.050000]

[label 3] smooth-f2=0.130366 BFGS-f2=0.257353[0.112166] greedy-f2=0.257353[0.110000]

[label 4] smooth-f2=0.605685 BFGS-f2=0.811443[0.157003] greedy-f2=0.811177[0.160000]

[label 5] smooth-f2=0.485387 BFGS-f2=0.719833[0.092579] greedy-f2=0.718328[0.090000]

[label 6] smooth-f2=0.032791 BFGS-f2=0.193237[0.056360] greedy-f2=0.176991[0.050000]

[label 7] smooth-f2=0.205846 BFGS-f2=0.419068[0.078974] greedy-f2=0.420610[0.080000]

[label 8] smooth-f2=0.934079 BFGS-f2=0.979080[0.049386] greedy-f2=0.979080[0.050000]

[label 9] smooth-f2=0.370607 BFGS-f2=0.606982[0.107142] greedy-f2=0.606164[0.110000]

[label 10] smooth-f2=0.456478 BFGS-f2=0.729542[0.090349] greedy-f2=0.729192[0.090000]

[label 11] smooth-f2=0.261264 BFGS-f2=0.484678[0.117162] greedy-f2=0.485589[0.120000]

[label 12] smooth-f2=0.091721 BFGS-f2=0.313225[0.091643] greedy-f2=0.310345[0.090000]

####### Greedy F2-Score by single label is 0.874275 #######

####### Smooth F2-Score is 0.781523 #######

####### F2-Score with threshold 0.2 is 0.871451 #######

####### F2-Score with threshold 0.1 is 0.870954 #######

####### Greedy F2-Score is 0.877043 #######

[label 0] smooth-f2=0.054903 BFGS-f2=0.296296[0.037683] greedy-f2=0.272727[0.030000]

[label 1] smooth-f2=0.450658 BFGS-f2=0.627075[0.099483] greedy-f2=0.625622[0.160000]

[label 2] smooth-f2=0.933511 BFGS-f2=0.980537[0.056526] greedy-f2=0.980595[0.060000]

[label 3] smooth-f2=0.133287 BFGS-f2=0.271318[0.153500] greedy-f2=0.269231[0.150000]

[label 4] smooth-f2=0.580668 BFGS-f2=0.811867[0.140630] greedy-f2=0.811648[0.140000]

[label 5] smooth-f2=0.496866 BFGS-f2=0.722743[0.110660] greedy-f2=0.721991[0.110000]

[label 6] smooth-f2=0.034946 BFGS-f2=0.191571[0.040418] greedy-f2=0.191571[0.040000]

[label 7] smooth-f2=0.215698 BFGS-f2=0.426293[0.091519] greedy-f2=0.425532[0.090000]

[label 8] smooth-f2=0.929913 BFGS-f2=0.979223[0.034021] greedy-f2=0.978911[0.030000]

[label 9] smooth-f2=0.366436 BFGS-f2=0.609572[0.126161] greedy-f2=0.608350[0.110000]

[label 10] smooth-f2=0.467260 BFGS-f2=0.735673[0.076156] greedy-f2=0.733934[0.070000]

[label 11] smooth-f2=0.268803 BFGS-f2=0.490919[0.080352] greedy-f2=0.490641[0.080000]

[label 12] smooth-f2=0.096586 BFGS-f2=0.311005[0.113472] greedy-f2=0.306818[0.100000]

####### Greedy F2-Score by single label is 0.873471 #######

####### Smooth F2-Score is 0.783294 #######

####### F2-Score with threshold 0.2 is 0.871116 #######

####### F2-Score with threshold 0.1 is 0.871433 #######

####### Greedy F2-Score is 0.877968 #######

[label 0] smooth-f2=0.044162 BFGS-f2=0.000000[0.200000] greedy-f2=0.283019[0.030000]

[label 1] smooth-f2=0.456810 BFGS-f2=0.640216[0.105062] greedy-f2=0.638915[0.110000]

[label 2] smooth-f2=0.934681 BFGS-f2=0.980998[0.051548] greedy-f2=0.980959[0.050000]

[label 3] smooth-f2=0.139215 BFGS-f2=0.269231[0.134489] greedy-f2=0.268199[0.130000]

[label 4] smooth-f2=0.592105 BFGS-f2=0.812916[0.157060] greedy-f2=0.812257[0.150000]

[label 5] smooth-f2=0.497731 BFGS-f2=0.724616[0.132457] greedy-f2=0.723479[0.130000]

[label 6] smooth-f2=0.039893 BFGS-f2=0.165816[0.029001] greedy-f2=0.170157[0.030000]

[label 7] smooth-f2=0.207411 BFGS-f2=0.429432[0.061223] greedy-f2=0.426647[0.060000]

[label 8] smooth-f2=0.930472 BFGS-f2=0.979114[0.026253] greedy-f2=0.978909[0.030000]

[label 9] smooth-f2=0.375964 BFGS-f2=0.607381[0.119366] greedy-f2=0.607143[0.120000]

[label 10] smooth-f2=0.440587 BFGS-f2=0.729243[0.080323] greedy-f2=0.728888[0.080000]

[label 11] smooth-f2=0.273994 BFGS-f2=0.491176[0.097602] greedy-f2=0.489034[0.100000]

[label 12] smooth-f2=0.098076 BFGS-f2=0.307125[0.126087] greedy-f2=0.303398[0.120000]

####### Greedy F2-Score by single label is 0.874664 #######

####### Smooth F2-Score is 0.790820 #######

####### F2-Score with threshold 0.2 is 0.870943 #######

####### F2-Score with threshold 0.1 is 0.871435 #######

####### Greedy F2-Score is 0.877352 #######

[label 0] smooth-f2=0.035301 BFGS-f2=0.000000[0.200000] greedy-f2=0.263158[0.020000]

[label 1] smooth-f2=0.442276 BFGS-f2=0.633240[0.076999] greedy-f2=0.631313[0.080000]

[label 2] smooth-f2=0.942501 BFGS-f2=0.980785[0.041038] greedy-f2=0.980814[0.060000]

[label 3] smooth-f2=0.136229 BFGS-f2=0.256917[0.175047] greedy-f2=0.257732[0.060000]

[label 4] smooth-f2=0.595075 BFGS-f2=0.810376[0.160941] greedy-f2=0.810471[0.160000]

[label 5] smooth-f2=0.518451 BFGS-f2=0.721718[0.113337] greedy-f2=0.720686[0.120000]

[label 6] smooth-f2=0.039171 BFGS-f2=0.179372[0.055057] greedy-f2=0.168067[0.050000]

[label 7] smooth-f2=0.219863 BFGS-f2=0.417559[0.074528] greedy-f2=0.414698[0.070000]

[label 8] smooth-f2=0.939347 BFGS-f2=0.979084[0.028706] greedy-f2=0.978992[0.040000]

[label 9] smooth-f2=0.357706 BFGS-f2=0.603411[0.079073] greedy-f2=0.603161[0.080000]

[label 10] smooth-f2=0.451646 BFGS-f2=0.731109[0.095798] greedy-f2=0.727848[0.090000]

[label 11] smooth-f2=0.285777 BFGS-f2=0.489097[0.117796] greedy-f2=0.485893[0.120000]

[label 12] smooth-f2=0.098630 BFGS-f2=0.317848[0.109063] greedy-f2=0.315421[0.100000]

####### Greedy F2-Score by single label is 0.872968 #######

####### Smooth F2-Score is 0.795908 #######

####### F2-Score with threshold 0.2 is 0.869016 #######

####### F2-Score with threshold 0.1 is 0.870946 #######

####### Greedy F2-Score is 0.877136 #######

[label 0] smooth-f2=0.040315 BFGS-f2=0.000000[0.200000] greedy-f2=0.217391[0.040000]

[label 1] smooth-f2=0.417027 BFGS-f2=0.626255[0.047541] greedy-f2=0.626297[0.060000]

[label 2] smooth-f2=0.948100 BFGS-f2=0.980752[0.032081] greedy-f2=0.980748[0.040000]

[label 3] smooth-f2=0.142795 BFGS-f2=0.242915[0.276194] greedy-f2=0.274725[0.100000]

[label 4] smooth-f2=0.608204 BFGS-f2=0.811596[0.169361] greedy-f2=0.811741[0.170000]

[label 5] smooth-f2=0.514307 BFGS-f2=0.717891[0.143925] greedy-f2=0.717049[0.140000]

[label 6] smooth-f2=0.039422 BFGS-f2=0.107143[0.200000] greedy-f2=0.202703[0.030000]

[label 7] smooth-f2=0.204912 BFGS-f2=0.436739[0.055078] greedy-f2=0.427793[0.060000]

[label 8] smooth-f2=0.945828 BFGS-f2=0.979184[0.032060] greedy-f2=0.979138[0.040000]

[label 9] smooth-f2=0.367386 BFGS-f2=0.604185[0.090025] greedy-f2=0.604185[0.090000]

[label 10] smooth-f2=0.458505 BFGS-f2=0.728606[0.098353] greedy-f2=0.727228[0.100000]

[label 11] smooth-f2=0.250686 BFGS-f2=0.487122[0.049613] greedy-f2=0.487942[0.050000]

[label 12] smooth-f2=0.111019 BFGS-f2=0.310945[0.123043] greedy-f2=0.307125[0.120000]

####### Greedy F2-Score by single label is 0.874113 #######

####### Smooth F2-Score is 0.794483 #######

####### F2-Score with threshold 0.2 is 0.870115 #######

####### F2-Score with threshold 0.1 is 0.871004 #######

####### Greedy F2-Score is 0.876403 #######

[label 0] smooth-f2=0.050748 BFGS-f2=0.277778[0.084002] greedy-f2=0.277778[0.080000]

[label 1] smooth-f2=0.416887 BFGS-f2=0.622638[0.069284] greedy-f2=0.621806[0.070000]

[label 2] smooth-f2=0.945514 BFGS-f2=0.980849[0.041901] greedy-f2=0.980810[0.040000]

[label 3] smooth-f2=0.154299 BFGS-f2=0.243902[0.267350] greedy-f2=0.269360[0.060000]

[label 4] smooth-f2=0.611398 BFGS-f2=0.811415[0.128599] greedy-f2=0.810910[0.140000]

[label 5] smooth-f2=0.509794 BFGS-f2=0.721565[0.116914] greedy-f2=0.720420[0.110000]

[label 6] smooth-f2=0.036790 BFGS-f2=0.201794[0.044813] greedy-f2=0.190476[0.050000]

[label 7] smooth-f2=0.201047 BFGS-f2=0.414049[0.072067] greedy-f2=0.412621[0.060000]

[label 8] smooth-f2=0.942505 BFGS-f2=0.979130[0.052575] greedy-f2=0.979126[0.060000]

[label 9] smooth-f2=0.368344 BFGS-f2=0.602955[0.079268] greedy-f2=0.602003[0.110000]

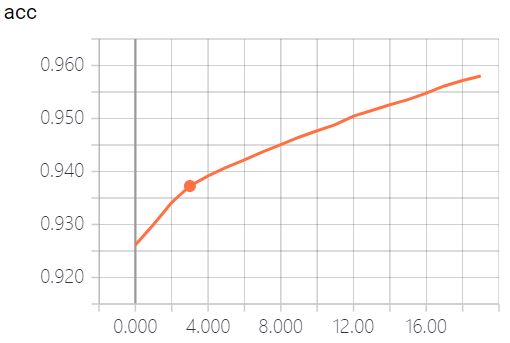
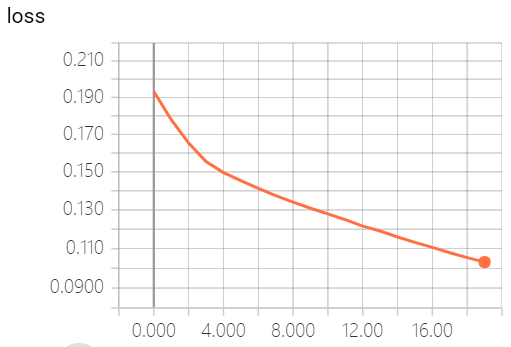
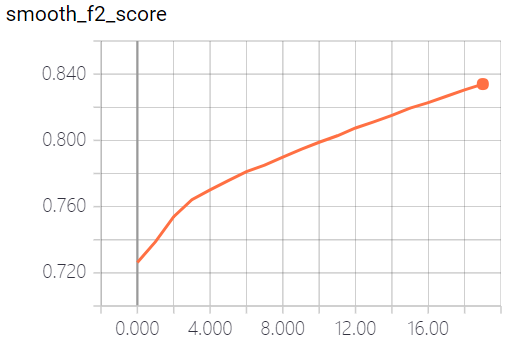
[label 10] smooth-f2=0.467302 BFGS-f2=0.725566[0.062067] greedy-f2=0.722919[0.060000]

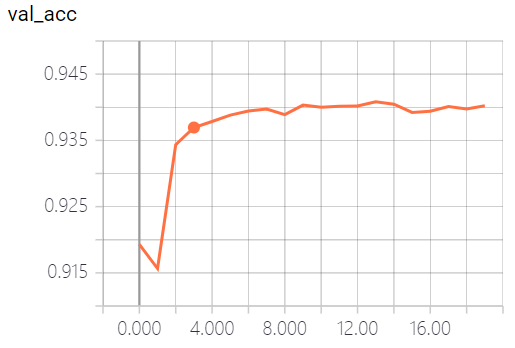
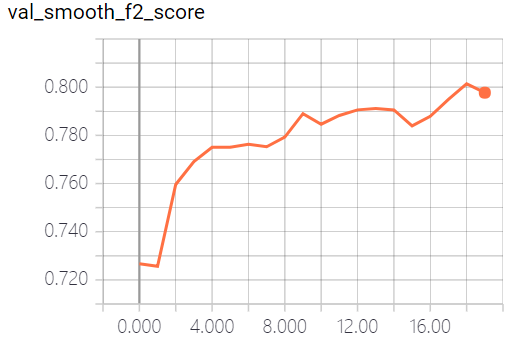
[label 11] smooth-f2=0.248343 BFGS-f2=0.484950[0.052511] greedy-f2=0.478938[0.060000]

[label 12] smooth-f2=0.111502 BFGS-f2=0.332512[0.125431] greedy-f2=0.327670[0.120000]

####### Greedy F2-Score by single label is 0.873343 #######

#### Curve

### Model 3

和Model1保持相同的学习率和Epoch，但是只训练新增的两层

结果：只训练新增的两层效果很差

#### Evaluate

weight: weights.006.hdf5

Smooth F2-Score: 0.726727  
F2-Score with threshold 0.2: 0.727746  
F2-Score with threshold 0.1: 0.729213  
Greedy F2-Score is: 0.783513  
Greedy threshold: 0.01,0.04,0.0,0.1,0.0,0.04,0.1,0.99,0.0,0.07,0.1,0.02,0.1  
[label 0] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.011745[0.000000]  
[label 1] smooth-f2=0.002049 BFGS-f2=0.307153[0.000000] greedy-f2=0.307153[0.000000]  
[label 2] smooth-f2=0.979032 BFGS-f2=0.979742[0.258675] greedy-f2=0.979804[0.000000]  
[label 3] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.034636[0.000000]  
[label 4] smooth-f2=0.033118 BFGS-f2=0.724327[0.000000] greedy-f2=0.724327[0.000000]  
[label 5] smooth-f2=0.025769 BFGS-f2=0.486991[0.000000] greedy-f2=0.486991[0.000000]  
[label 6] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.010871[0.000000]  
[label 7] smooth-f2=0.000024 BFGS-f2=0.000000[0.200000] greedy-f2=0.109520[0.000000]  
[label 8] smooth-f2=0.976871 BFGS-f2=0.977286[0.200000] greedy-f2=0.977746[0.000000]  
[label 9] smooth-f2=0.000271 BFGS-f2=0.001784[0.054976] greedy-f2=0.421749[0.000000]  
[label 10] smooth-f2=0.000000 BFGS-f2=0.284808[0.000000] greedy-f2=0.284808[0.000000]  
[label 11] smooth-f2=0.000134 BFGS-f2=0.000000[0.200000] greedy-f2=0.108553[0.000000]  
[label 12] smooth-f2=0.000000 BFGS-f2=0.036406[0.000000] greedy-f2=0.036406[0.000000]  
Greedy F2-Score by single label is: 0.602984  
  
weight: weights.007.hdf5

Smooth F2-Score: 0.727394  
F2-Score with threshold 0.2: 0.728305  
F2-Score with threshold 0.1: 0.731197  
Greedy F2-Score is: 0.783755  
Greedy threshold: 0.01,0.04,0.0,0.1,0.0,0.03,0.1,0.1,0.0,0.07,0.14,0.02,0.1  
[label 0] smooth-f2=0.000000 BFGS-f2=0.011647[0.000000] greedy-f2=0.011647[0.000000]  
[label 1] smooth-f2=0.001766 BFGS-f2=0.001396[0.200000] greedy-f2=0.307153[0.000000]  
[label 2] smooth-f2=0.979107 BFGS-f2=0.979722[0.200000] greedy-f2=0.979804[0.000000]  
[label 3] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.034060[0.000000]  
[label 4] smooth-f2=0.044864 BFGS-f2=0.724327[0.000000] greedy-f2=0.724327[0.000000]  
[label 5] smooth-f2=0.044484 BFGS-f2=0.486991[0.000000] greedy-f2=0.486991[0.000000]  
[label 6] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.010751[0.000000]  
[label 7] smooth-f2=0.000027 BFGS-f2=0.000000[0.200000] greedy-f2=0.109446[0.000000]  
[label 8] smooth-f2=0.976934 BFGS-f2=0.977366[0.145810] greedy-f2=0.977746[0.000000]  
[label 9] smooth-f2=0.000249 BFGS-f2=0.421749[0.000000] greedy-f2=0.421749[0.000000]  
[label 10] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.284351[0.000000]  
[label 11] smooth-f2=0.000137 BFGS-f2=0.108440[0.000000] greedy-f2=0.108440[0.000000]  
[label 12] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.035720[0.000000]  
Greedy F2-Score by single label is: 0.601865  
  
weight: weights.008.hdf5

Smooth F2-Score: 0.727324  
F2-Score with threshold 0.2: 0.728304  
F2-Score with threshold 0.1: 0.731185  
Greedy F2-Score is: 0.783612  
Greedy threshold: 0.01,0.03,0.0,0.1,0.0,0.03,0.1,0.1,0.0,0.05,0.17,0.01,0.1  
[label 0] smooth-f2=0.000000 BFGS-f2=0.011496[0.000000] greedy-f2=0.011496[0.000000]  
[label 1] smooth-f2=0.001886 BFGS-f2=0.307153[0.000000] greedy-f2=0.307153[0.000000]  
[label 2] smooth-f2=0.979012 BFGS-f2=0.979722[0.200000] greedy-f2=0.979804[0.000000]  
[label 3] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.034178[0.000000]  
[label 4] smooth-f2=0.044806 BFGS-f2=0.724327[0.000000] greedy-f2=0.724327[0.000000]  
[label 5] smooth-f2=0.047367 BFGS-f2=0.486991[0.000000] greedy-f2=0.486991[0.000000]  
[label 6] smooth-f2=0.000000 BFGS-f2=0.011351[0.000000] greedy-f2=0.011351[0.000000]  
[label 7] smooth-f2=0.000036 BFGS-f2=0.000000[0.200000] greedy-f2=0.109278[0.000000]  
[label 8] smooth-f2=0.976906 BFGS-f2=0.977286[0.200000] greedy-f2=0.977746[0.000000]  
[label 9] smooth-f2=0.000247 BFGS-f2=0.000893[0.107389] greedy-f2=0.421472[0.000000]  
[label 10] smooth-f2=0.000000 BFGS-f2=0.284648[0.000000] greedy-f2=0.284648[0.000000]  
[label 11] smooth-f2=0.000139 BFGS-f2=0.000000[0.200000] greedy-f2=0.108110[0.000000]  
[label 12] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.035617[0.000000]  
Greedy F2-Score by single label is: 0.601044  
  
weight: weights.009.hdf5

Smooth F2-Score: 0.726974  
F2-Score with threshold 0.2: 0.727982  
F2-Score with threshold 0.1: 0.730445  
Greedy F2-Score is: 0.783528  
Greedy threshold: 0.01,0.04,0.0,0.1,0.0,0.04,0.1,0.1,0.0,0.05,0.16,0.02,0.1  
[label 0] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.011436[0.000000]  
[label 1] smooth-f2=0.002018 BFGS-f2=0.001396[0.200000] greedy-f2=0.307153[0.000000]  
[label 2] smooth-f2=0.978980 BFGS-f2=0.979722[0.200000] greedy-f2=0.979804[0.000000]  
[label 3] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.034059[0.000000]  
[label 4] smooth-f2=0.038910 BFGS-f2=0.724327[0.000000] greedy-f2=0.724327[0.000000]  
[label 5] smooth-f2=0.055645 BFGS-f2=0.486991[0.000000] greedy-f2=0.486991[0.000000]  
[label 6] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.011320[0.000000]  
[label 7] smooth-f2=0.000038 BFGS-f2=0.109176[0.000000] greedy-f2=0.109176[0.000000]  
[label 8] smooth-f2=0.976844 BFGS-f2=0.977366[0.102452] greedy-f2=0.977746[0.000000]  
[label 9] smooth-f2=0.000262 BFGS-f2=0.000000[0.200000] greedy-f2=0.421196[0.000000]  
[label 10] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.284602[0.000000]  
[label 11] smooth-f2=0.000110 BFGS-f2=0.000000[0.200000] greedy-f2=0.108120[0.000000]  
[label 12] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.036139[0.000000]  
Greedy F2-Score by single label is: 0.600698  
  
weight: weights.010.hdf5

Smooth F2-Score: 0.727118  
F2-Score with threshold 0.2: 0.728288  
F2-Score with threshold 0.1: 0.730964  
Greedy F2-Score is: 0.783505  
Greedy threshold: 0.01,0.01,0.0,0.1,0.0,0.04,0.1,0.1,0.0,0.05,0.18,0.02,0.1  
[label 0] smooth-f2=0.000000 BFGS-f2=0.011354[0.000000] greedy-f2=0.011354[0.000000]  
[label 1] smooth-f2=0.002182 BFGS-f2=0.002791[0.200000] greedy-f2=0.307153[0.000000]  
[label 2] smooth-f2=0.978855 BFGS-f2=0.979722[0.144653] greedy-f2=0.979804[0.000000]  
[label 3] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.033806[0.000000]  
[label 4] smooth-f2=0.042684 BFGS-f2=0.724327[0.000000] greedy-f2=0.724327[0.000000]  
[label 5] smooth-f2=0.054545 BFGS-f2=0.487018[0.000000] greedy-f2=0.487018[0.000000]  
[label 6] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.011367[0.000000]  
[label 7] smooth-f2=0.000042 BFGS-f2=0.000000[0.200000] greedy-f2=0.109065[0.000000]  
[label 8] smooth-f2=0.976840 BFGS-f2=0.977366[0.108897] greedy-f2=0.977746[0.000000]  
[label 9] smooth-f2=0.000260 BFGS-f2=0.000000[0.200000] greedy-f2=0.421196[0.000000]  
[label 10] smooth-f2=0.000000 BFGS-f2=0.284991[0.000000] greedy-f2=0.284991[0.000000]  
[label 11] smooth-f2=0.000102 BFGS-f2=0.000000[0.200000] greedy-f2=0.108035[0.000000]  
[label 12] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.036134[0.000000]  
Greedy F2-Score by single label is: 0.600508  
  
weight: weights.011.hdf5

Smooth F2-Score: 0.727290  
F2-Score with threshold 0.2: 0.728258  
F2-Score with threshold 0.1: 0.731316  
Greedy F2-Score is: 0.783843  
Greedy threshold: 0.01,0.01,0.0,0.1,0.0,0.07,0.1,0.1,0.0,0.05,0.23,0.01,0.1  
[label 0] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.011259[0.000000]  
[label 1] smooth-f2=0.002138 BFGS-f2=0.002791[0.200000] greedy-f2=0.307280[0.000000]  
[label 2] smooth-f2=0.978875 BFGS-f2=0.979722[0.143629] greedy-f2=0.979804[0.000000]  
[label 3] smooth-f2=0.000000 BFGS-f2=0.033264[0.000000] greedy-f2=0.033264[0.000000]  
[label 4] smooth-f2=0.045097 BFGS-f2=0.724327[0.000000] greedy-f2=0.724327[0.000000]  
[label 5] smooth-f2=0.061124 BFGS-f2=0.487018[0.000000] greedy-f2=0.487018[0.000000]  
[label 6] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.011305[0.000000]  
[label 7] smooth-f2=0.000042 BFGS-f2=0.000000[0.200000] greedy-f2=0.109092[0.000000]  
[label 8] smooth-f2=0.976819 BFGS-f2=0.977366[0.082629] greedy-f2=0.977746[0.000000]  
[label 9] smooth-f2=0.000266 BFGS-f2=0.421196[0.000000] greedy-f2=0.421196[0.000000]  
[label 10] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.285394[0.000000]  
[label 11] smooth-f2=0.000083 BFGS-f2=0.000000[0.200000] greedy-f2=0.108204[0.000000]  
[label 12] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.035907[0.000000]  
Greedy F2-Score by single label is: 0.599886  
  
weight: weights.012.hdf5

Smooth F2-Score: 0.726977  
F2-Score with threshold 0.2: 0.727981  
F2-Score with threshold 0.1: 0.730551  
Greedy F2-Score is: 0.783892  
Greedy threshold: 0.01,0.01,0.0,0.1,0.0,0.07,0.1,0.1,0.0,0.05,0.15,0.01,0.1  
[label 0] smooth-f2=0.000000 BFGS-f2=0.011320[0.000000] greedy-f2=0.011320[0.000000]  
[label 1] smooth-f2=0.002420 BFGS-f2=0.002791[0.209304] greedy-f2=0.307280[0.000000]  
[label 2] smooth-f2=0.978742 BFGS-f2=0.979804[0.000000] greedy-f2=0.979804[0.000000]  
[label 3] smooth-f2=0.000000 BFGS-f2=0.032929[0.000000] greedy-f2=0.032929[0.000000]  
[label 4] smooth-f2=0.040574 BFGS-f2=0.724327[0.000000] greedy-f2=0.724327[0.000000]  
[label 5] smooth-f2=0.062055 BFGS-f2=0.487018[0.000000] greedy-f2=0.487018[0.000000]  
[label 6] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.011385[0.000000]  
[label 7] smooth-f2=0.000049 BFGS-f2=0.000000[0.200000] greedy-f2=0.109028[0.000000]  
[label 8] smooth-f2=0.976763 BFGS-f2=0.977206[0.200000] greedy-f2=0.977746[0.000000]  
[label 9] smooth-f2=0.000259 BFGS-f2=0.421196[0.000000] greedy-f2=0.421196[0.000000]  
[label 10] smooth-f2=0.000000 BFGS-f2=0.285922[0.000000] greedy-f2=0.285922[0.000000]  
[label 11] smooth-f2=0.000056 BFGS-f2=0.000000[0.200000] greedy-f2=0.108214[0.000000]  
[label 12] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.036292[0.000000]  
Greedy F2-Score by single label is: 0.600635  
  
weight: weights.013.hdf5

Smooth F2-Score: 0.726575  
F2-Score with threshold 0.2: 0.727354  
F2-Score with threshold 0.1: 0.729790  
Greedy F2-Score is: 0.783791  
Greedy threshold: 0.01,0.01,0.0,0.1,0.0,0.07,0.1,0.1,0.0,0.05,0.15,0.01,0.1  
[label 0] smooth-f2=0.000000 BFGS-f2=0.011101[0.000000] greedy-f2=0.011101[0.000000]  
[label 1] smooth-f2=0.002948 BFGS-f2=0.307259[0.000000] greedy-f2=0.307259[0.000000]  
[label 2] smooth-f2=0.978667 BFGS-f2=0.979622[0.305020] greedy-f2=0.979804[0.000000]  
[label 3] smooth-f2=0.000000 BFGS-f2=0.033173[0.000000] greedy-f2=0.033173[0.000000]  
[label 4] smooth-f2=0.034021 BFGS-f2=0.724327[0.000000] greedy-f2=0.724327[0.000000]  
[label 5] smooth-f2=0.064018 BFGS-f2=0.487018[0.000000] greedy-f2=0.487018[0.000000]  
[label 6] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.011306[0.000000]  
[label 7] smooth-f2=0.000057 BFGS-f2=0.000000[0.200000] greedy-f2=0.109266[0.000000]  
[label 8] smooth-f2=0.976648 BFGS-f2=0.977746[0.000000] greedy-f2=0.977746[0.000000]  
[label 9] smooth-f2=0.000265 BFGS-f2=0.000000[0.200000] greedy-f2=0.421196[0.000000]  
[label 10] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.285760[0.000000]  
[label 11] smooth-f2=0.000077 BFGS-f2=0.000000[0.200000] greedy-f2=0.107783[0.000000]  
[label 12] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.036210[0.000000]  
Greedy F2-Score by single label is: 0.599687  
  
weight: weights.014.hdf5

Smooth F2-Score: 0.727020  
F2-Score with threshold 0.2: 0.728108  
F2-Score with threshold 0.1: 0.730735  
Greedy F2-Score is: 0.783820  
Greedy threshold: 0.01,0.01,0.0,0.1,0.0,0.09,0.1,0.01,0.0,0.05,0.14,0.57,0.1  
[label 0] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.011086[0.000000]  
[label 1] smooth-f2=0.002957 BFGS-f2=0.006966[0.172145] greedy-f2=0.307549[0.000000]  
[label 2] smooth-f2=0.978596 BFGS-f2=0.979643[0.101505] greedy-f2=0.979804[0.000000]  
[label 3] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.033121[0.000000]  
[label 4] smooth-f2=0.038614 BFGS-f2=0.724355[0.000000] greedy-f2=0.724355[0.000000]  
[label 5] smooth-f2=0.088081 BFGS-f2=0.487018[0.000000] greedy-f2=0.487018[0.000000]  
[label 6] smooth-f2=0.000000 BFGS-f2=0.011480[0.000000] greedy-f2=0.011480[0.000000]  
[label 7] smooth-f2=0.000071 BFGS-f2=0.000000[0.200000] greedy-f2=0.110115[0.000000]  
[label 8] smooth-f2=0.976675 BFGS-f2=0.977366[0.089571] greedy-f2=0.977746[0.000000]  
[label 9] smooth-f2=0.000298 BFGS-f2=0.001783[0.057942] greedy-f2=0.421221[0.000000]  
[label 10] smooth-f2=0.000000 BFGS-f2=0.287142[0.000000] greedy-f2=0.287142[0.000000]  
[label 11] smooth-f2=0.000033 BFGS-f2=0.000000[0.200000] greedy-f2=0.108734[0.000000]  
[label 12] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.035955[0.000000]  
Greedy F2-Score by single label is: 0.601566  
  
weight: weights.015.hdf5

Smooth F2-Score: 0.726833  
F2-Score with threshold 0.2: 0.727768  
F2-Score with threshold 0.1: 0.730185  
Greedy F2-Score is: 0.783793  
Greedy threshold: 0.01,0.01,0.0,0.1,0.0,0.08,0.1,0.1,0.0,0.05,0.2,0.47,0.1  
[label 0] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.011027[0.000000]  
[label 1] smooth-f2=0.002777 BFGS-f2=0.307422[0.000000] greedy-f2=0.307422[0.000000]  
[label 2] smooth-f2=0.978656 BFGS-f2=0.979603[0.316371] greedy-f2=0.979804[0.000000]  
[label 3] smooth-f2=0.000000 BFGS-f2=0.032675[0.000000] greedy-f2=0.032675[0.000000]  
[label 4] smooth-f2=0.034485 BFGS-f2=0.724355[0.000000] greedy-f2=0.724355[0.000000]  
[label 5] smooth-f2=0.085436 BFGS-f2=0.487018[0.000000] greedy-f2=0.487018[0.000000]  
[label 6] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.011431[0.000000]  
[label 7] smooth-f2=0.000063 BFGS-f2=0.000000[0.200000] greedy-f2=0.109993[0.000000]  
[label 8] smooth-f2=0.976697 BFGS-f2=0.977226[0.234866] greedy-f2=0.977746[0.000000]  
[label 9] smooth-f2=0.000314 BFGS-f2=0.000000[0.200000] greedy-f2=0.421196[0.000000]  
[label 10] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.286361[0.000000]  
[label 11] smooth-f2=0.000038 BFGS-f2=0.000000[0.200000] greedy-f2=0.108487[0.000000]  
[label 12] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.036446[0.000000]  
Greedy F2-Score by single label is: 0.600719  
  
weight: weights.016.hdf5

Smooth F2-Score: 0.726982  
F2-Score with threshold 0.2: 0.728443  
F2-Score with threshold 0.1: 0.730474  
Greedy F2-Score is: 0.783832  
Greedy threshold: 0.01,0.01,0.0,0.1,0.0,0.12,0.1,0.1,0.0,0.04,0.2,0.01,0.1  
[label 0] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.011020[0.000000]  
[label 1] smooth-f2=0.003313 BFGS-f2=0.307974[0.000000] greedy-f2=0.307974[0.000000]  
[label 2] smooth-f2=0.978560 BFGS-f2=0.979804[0.000000] greedy-f2=0.979804[0.000000]  
[label 3] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.033703[0.000000]  
[label 4] smooth-f2=0.036325 BFGS-f2=0.724382[0.000000] greedy-f2=0.724382[0.000000]  
[label 5] smooth-f2=0.100830 BFGS-f2=0.486991[0.000000] greedy-f2=0.486991[0.000000]  
[label 6] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.011491[0.000000]  
[label 7] smooth-f2=0.000062 BFGS-f2=0.110244[0.000000] greedy-f2=0.110244[0.000000]  
[label 8] smooth-f2=0.976662 BFGS-f2=0.977286[0.113261] greedy-f2=0.977746[0.000000]  
[label 9] smooth-f2=0.000342 BFGS-f2=0.421196[0.000000] greedy-f2=0.421196[0.000000]  
[label 10] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.287075[0.000000]  
[label 11] smooth-f2=0.000065 BFGS-f2=0.000000[0.200000] greedy-f2=0.108696[0.000000]  
[label 12] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.036182[0.000000]  
Greedy F2-Score by single label is: 0.601885  
  
weight: weights.017.hdf5

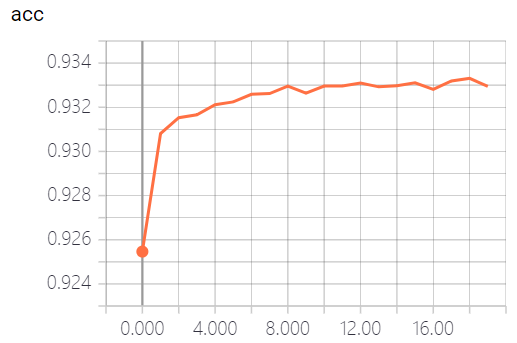
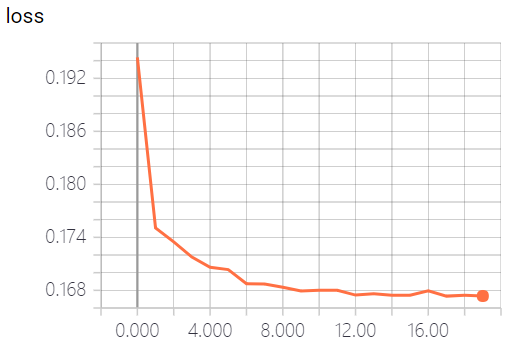
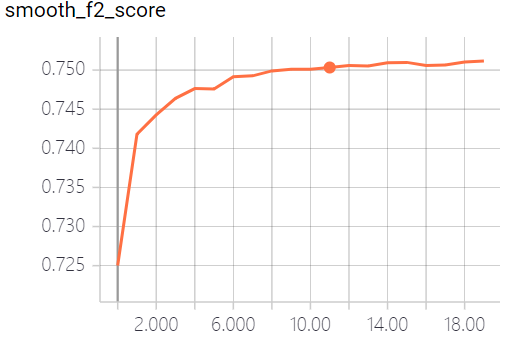
Smooth F2-Score: 0.726917  
F2-Score with threshold 0.2: 0.728237  
F2-Score with threshold 0.1: 0.730377  
Greedy F2-Score is: 0.783821  
Greedy threshold: 0.01,0.01,0.0,0.1,0.0,0.09,0.1,0.1,0.0,0.03,0.21,0.14,0.1  
[label 0] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.011099[0.000000]  
[label 1] smooth-f2=0.003363 BFGS-f2=0.307825[0.000000] greedy-f2=0.307825[0.000000]  
[label 2] smooth-f2=0.978553 BFGS-f2=0.979722[0.081618] greedy-f2=0.979804[0.000000]  
[label 3] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.033797[0.000000]  
[label 4] smooth-f2=0.035684 BFGS-f2=0.724355[0.000000] greedy-f2=0.724355[0.000000]  
[label 5] smooth-f2=0.095440 BFGS-f2=0.486991[0.000000] greedy-f2=0.486991[0.000000]  
[label 6] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.010892[0.000000]  
[label 7] smooth-f2=0.000052 BFGS-f2=0.000000[0.200000] greedy-f2=0.110587[0.000000]  
[label 8] smooth-f2=0.976614 BFGS-f2=0.977746[0.000000] greedy-f2=0.977746[0.000000]  
[label 9] smooth-f2=0.000330 BFGS-f2=0.000892[0.108565] greedy-f2=0.421472[0.000000]  
[label 10] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.288344[0.000000]  
[label 11] smooth-f2=0.000033 BFGS-f2=0.000000[0.200000] greedy-f2=0.109037[0.000000]  
[label 12] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.036372[0.000000]  
Greedy F2-Score by single label is: 0.602407  
  
weight: weights.018.hdf5

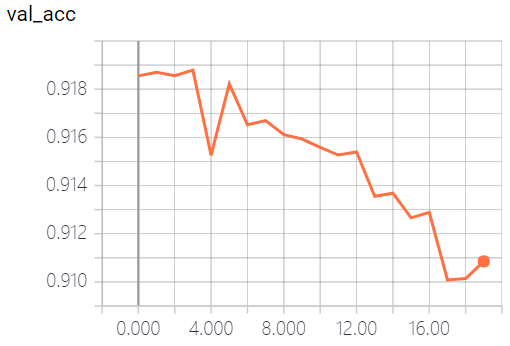
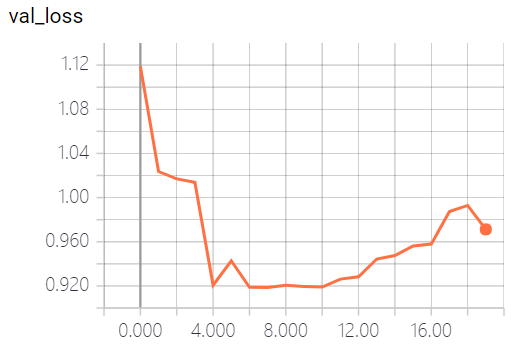
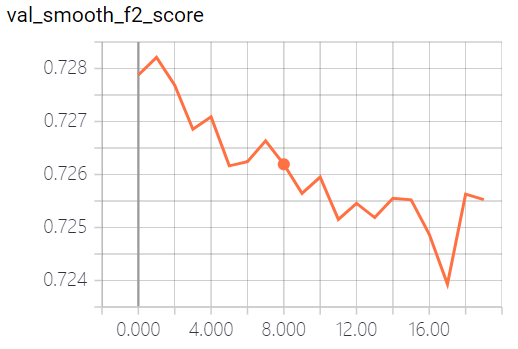
Smooth F2-Score: 0.726815  
F2-Score with threshold 0.2: 0.727971  
F2-Score with threshold 0.1: 0.729730  
Greedy F2-Score is: 0.783798  
Greedy threshold: 0.01,0.01,0.0,0.1,0.0,0.83,0.1,0.1,0.0,0.06,0.24,0.15,0.1  
[label 0] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.010919[0.000000]  
[label 1] smooth-f2=0.003245 BFGS-f2=0.006966[0.200000] greedy-f2=0.308219[0.000000]  
[label 2] smooth-f2=0.978573 BFGS-f2=0.979603[0.200000] greedy-f2=0.979804[0.000000]  
[label 3] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.033672[0.000000]  
[label 4] smooth-f2=0.033592 BFGS-f2=0.724466[0.000000] greedy-f2=0.724466[0.000000]  
[label 5] smooth-f2=0.125030 BFGS-f2=0.486991[0.000000] greedy-f2=0.486991[0.000000]  
[label 6] smooth-f2=0.000000 BFGS-f2=0.011007[0.000000] greedy-f2=0.011007[0.000000]  
[label 7] smooth-f2=0.000064 BFGS-f2=0.000000[0.200000] greedy-f2=0.111198[0.000000]  
[label 8] smooth-f2=0.976610 BFGS-f2=0.977366[0.051292] greedy-f2=0.977746[0.000000]  
[label 9] smooth-f2=0.000380 BFGS-f2=0.000000[0.200000] greedy-f2=0.421196[0.000000]  
[label 10] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.287328[0.000000]  
[label 11] smooth-f2=0.000013 BFGS-f2=0.000000[0.200000] greedy-f2=0.109832[0.000000]  
[label 12] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.037302[0.000000]  
Greedy F2-Score by single label is: 0.603382  
  
weight: weights.019.hdf5

Smooth F2-Score: 0.726877  
F2-Score with threshold 0.2: 0.728507  
F2-Score with threshold 0.1: 0.730519  
Greedy F2-Score is: 0.783879  
Greedy threshold: 0.01,0.01,0.0,0.1,0.0,0.92,0.1,0.13,0.0,0.11,0.21,0.14,0.1  
[label 0] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.010941[0.000000]  
[label 1] smooth-f2=0.003614 BFGS-f2=0.308535[0.000000] greedy-f2=0.308535[0.000000]  
[label 2] smooth-f2=0.978454 BFGS-f2=0.979703[0.066882] greedy-f2=0.979804[0.000000]  
[label 3] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.033503[0.000000]  
[label 4] smooth-f2=0.035815 BFGS-f2=0.724466[0.000000] greedy-f2=0.724466[0.000000]  
[label 5] smooth-f2=0.135411 BFGS-f2=0.486991[0.000000] greedy-f2=0.486991[0.000000]  
[label 6] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.010520[0.000000]  
[label 7] smooth-f2=0.000067 BFGS-f2=0.000000[0.200000] greedy-f2=0.112256[0.000000]  
[label 8] smooth-f2=0.976585 BFGS-f2=0.977366[0.036224] greedy-f2=0.977746[0.000000]  
[label 9] smooth-f2=0.000440 BFGS-f2=0.421196[0.000000] greedy-f2=0.421196[0.000000]  
[label 10] smooth-f2=0.000000 BFGS-f2=0.289096[0.000000] greedy-f2=0.289096[0.000000]  
[label 11] smooth-f2=0.000018 BFGS-f2=0.000000[0.200000] greedy-f2=0.109694[0.000000]  
[label 12] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.036549[0.000000]  
Greedy F2-Score by single label is: 0.605332  
  
weight: weights.020.hdf5

Smooth F2-Score: 0.727100  
F2-Score with threshold 0.2: 0.728599  
F2-Score with threshold 0.1: 0.731207  
Greedy F2-Score is: 0.783801  
Greedy threshold: 0.01,0.01,0.0,0.1,0.0,0.89,0.1,0.11,0.0,0.06,0.23,0.17,0.1  
[label 0] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.010946[0.000000]  
[label 1] smooth-f2=0.003799 BFGS-f2=0.308321[0.000000] greedy-f2=0.308321[0.000000]  
[label 2] smooth-f2=0.978430 BFGS-f2=0.979663[0.086959] greedy-f2=0.979804[0.000000]  
[label 3] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.033833[0.000000]  
[label 4] smooth-f2=0.040996 BFGS-f2=0.724466[0.000000] greedy-f2=0.724466[0.000000]  
[label 5] smooth-f2=0.125111 BFGS-f2=0.486991[0.000000] greedy-f2=0.486991[0.000000]  
[label 6] smooth-f2=0.000000 BFGS-f2=0.010349[0.000000] greedy-f2=0.010349[0.000000]  
[label 7] smooth-f2=0.000069 BFGS-f2=0.111729[0.000000] greedy-f2=0.111729[0.000000]  
[label 8] smooth-f2=0.976572 BFGS-f2=0.977226[0.200000] greedy-f2=0.977746[0.000000]  
[label 9] smooth-f2=0.000397 BFGS-f2=0.000000[0.200000] greedy-f2=0.421196[0.000000]  
[label 10] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.287855[0.000000]  
[label 11] smooth-f2=0.000025 BFGS-f2=0.000000[0.200000] greedy-f2=0.110310[0.000000]  
[label 12] smooth-f2=0.000000 BFGS-f2=0.000000[0.200000] greedy-f2=0.037447[0.000000]  
Greedy F2-Score by single label is: 0.604080

#### Curve

### Model 4

不使用预训练模型，从头训练

1. epoch=[10, 20, 30],
2. lr=[0.01, 0.001, 0.00001],
3. freeze\_layers=[0, 0, 0])

#### Evaluate

  
Best：  
weight: F:\Projects\competition\model\one-label\keras\densenet121\3\record\val1\['0', '1', '2', '3', '4', '5', '6', '7', '8', '9', '10', '11', '12']weights.019.hdf5  
Smooth F2-Score: 0.751573  
F2-Score with threshold 0.2: 0.854945  
Greedy F2-Score is: 0.857887  
Greedy threshold: 0.06,0.13,0.17,0.09,0.21,0.2,0.06,0.14,0.14,0.14,0.21,0.14,0.15  
[label 0] smooth-f2=0.007086 BFGS-f2=0.000000[0.200000] greedy-f2=0.049702[0.010000]  
[label 1] smooth-f2=0.306793 BFGS-f2=0.546779[0.120167] greedy-f2=0.546491[0.120000]  
[label 2] smooth-f2=0.923138 BFGS-f2=0.980182[0.168964] greedy-f2=0.980201[0.170000]  
[label 3] smooth-f2=0.029807 BFGS-f2=0.203390[0.056046] greedy-f2=0.209059[0.060000]  
[label 4] smooth-f2=0.549646 BFGS-f2=0.792877[0.158902] greedy-f2=0.792454[0.160000]  
[label 5] smooth-f2=0.452865 BFGS-f2=0.683917[0.171448] greedy-f2=0.683543[0.170000]  
[label 6] smooth-f2=0.014389 BFGS-f2=0.000000[0.200000] greedy-f2=0.109890[0.040000]  
[label 7] smooth-f2=0.145782 BFGS-f2=0.372861[0.115291] greedy-f2=0.369795[0.120000]  
[label 8] smooth-f2=0.919190 BFGS-f2=0.978319[0.135549] greedy-f2=0.978298[0.140000]  
[label 9] smooth-f2=0.257416 BFGS-f2=0.550318[0.081566] greedy-f2=0.549700[0.080000]  
[label 10] smooth-f2=0.309149 BFGS-f2=0.585898[0.094266] greedy-f2=0.585685[0.090000]  
[label 11] smooth-f2=0.161114 BFGS-f2=0.405405[0.064866] greedy-f2=0.402198[0.060000]  
[label 12] smooth-f2=0.027811 BFGS-f2=0.152047[0.025788] greedy-f2=0.140845[0.030000]

#### Curve

