

1. 数据目录结构

[1-80]	# 人员标签		
├─ multi/	# 多光谱		
│ └─ illum[1-3]/, normal/	# 干扰 `1-3`, 无干扰		
│ └─ Multi_[1-7]_W1_1/	# 位置 `1-7`	无眼镜	每个位置目录下包括四个照片目录
│ └─ [1-4]/	#		每个目录下包括25张图片文件
│ └─ [1-25].jpg			
│ └─ Multi_4_W1_6	# 位置 `4`	墨镜	目录下包括四个照片目录
│ └─ [1-4]/	#		每个目录下包括25张图片文件
│ └─ [1-25].jpg			
│ └─ Multi_[1-7]_W1_5	# 位置 `1-7`	眼镜	每个目录下包括25张图片文件, 部分人员无眼镜, 即无该目录
│ └─ [1-25].jpg			
└─ rgb	# 可见光		
└─ illum[1-3]/, normal/	# 干扰 `1-3`, 无干扰		
└─ RGB_[1-7]_W1_1/	# 位置 `1-7`	无眼镜	每个位置目录下包括四张照片文件
└─ [1-4].jpg			
└─ RGB_4_W1_6/	# 位置 `4`	墨镜	目录下包括四张照片文件
└─ [1-4].jpg			
└─ RGB_[1-7]_W1_5.jpg	# 位置 `1-7`	眼镜	部分人员无眼镜, 即无该图片

2. 实验

```
def get_configer(n_epoch=150, stepsize=120, batchsize=2*5, lrbase=5e-4, gamma=0.2, cuda=True,
                 dsize=(112//2, 96//2), n_channel=25, n_class=80,
                 datatype='Multi', usedChannels=[i+1 for i in range(25)],
                 splitratio=[0.6, 0.2, 0.2], splitcount=1,
                 modelbase='recognize_resnet34',
                 datapath='/datasets/Indoordetect', savepath='checkpoints',
                 hist=False, training_no_glass=True):
```

- 图片尺寸为 (112//2, 96//2) ;
- 无直方图均衡化 ;
- 训练数据仅包含无眼镜数据 ;

3.1 划分比例的确定

确定在何种划分下进行实验, 后续实验均以此结果为标准。

- 划分方式与上阶段一致, 在每人的数据中, 保留Multi与RGB同时检测出的图片路径, 打乱后按一定比例划分 ;
- 本次实验划分时不做特殊处理, 若需要其中指定条件的数据, 可在RecognizeDataset中指定筛选条件condition ;

运行

```
python gen_split.py

[split_112x96_[0.10:0.70:0.20]_[1]] n_items: 3288, n_train: 318, n_valid: 2280, n_test: 690, ratio: 0.097: 0.693: 0.210
...
[split_112x96_[0.10:0.70:0.20]_[10]] n_items: 3288, n_train: 318, n_valid: 2280, n_test: 690, ratio: 0.097: 0.693: 0.210
[split_112x96_[0.20:0.60:0.20]_[1]] n_items: 3288, n_train: 636, n_valid: 1962, n_test: 690, ratio: 0.193: 0.597: 0.210
...
[split_112x96_[0.20:0.60:0.20]_[10]] n_items: 3288, n_train: 636, n_valid: 1962, n_test: 690, ratio: 0.193: 0.597: 0.210
[split_112x96_[0.30:0.50:0.20]_[1]] n_items: 3288, n_train: 954, n_valid: 1644, n_test: 690, ratio: 0.290: 0.500: 0.210
...
[split_112x96_[0.30:0.50:0.20]_[10]] n_items: 3288, n_train: 954, n_valid: 1644, n_test: 690, ratio: 0.290: 0.500: 0.210
[split_112x96_[0.40:0.40:0.20]_[1]] n_items: 3288, n_train: 1272, n_valid: 1272, n_test: 744, ratio: 0.387: 0.387: 0.226
...
[split_112x96_[0.40:0.40:0.20]_[10]] n_items: 3288, n_train: 1272, n_valid: 1272, n_test: 744, ratio: 0.387: 0.387: 0.226
[split_112x96_[0.50:0.30:0.20]_[1]] n_items: 3288, n_train: 1644, n_valid: 954, n_test: 690, ratio: 0.500: 0.290: 0.210
...
[split_112x96_[0.50:0.30:0.20]_[10]] n_items: 3288, n_train: 1644, n_valid: 954, n_test: 690, ratio: 0.500: 0.290: 0.210
```

```
[split_112x96_[0.60:0.20:0.20]_[1]] n_items: 3288, n_train: 1962, n_valid: 610, n_test: 716, ratio: 0.597: 0.186: 0.218
...
[split_112x96_[0.60:0.20:0.20]_[10]] n_items: 3288, n_train: 1962, n_valid: 610, n_test: 716, ratio: 0.597: 0.186: 0.218
[split_112x96_[0.70:0.10:0.20]_[1]] n_items: 3288, n_train: 2280, n_valid: 292, n_test: 716, ratio: 0.693: 0.089: 0.218
...
[split_112x96_[0.70:0.10:0.20]_[10]] n_items: 3288, n_train: 2280, n_valid: 292, n_test: 716, ratio: 0.693: 0.089: 0.218
```

在当前目录下，生成文件夹split，其目录结构如下

```
split
├── split_112x96_[比例]_[划分计数]
│   ├── note.txt
│   ├── test_Multi.txt
│   ├── test_RGB.txt
│   ├── train_Multi.txt
│   ├── train_RGB.txt
│   ├── valid_Multi.txt
│   └── valid_RGB.txt
```

其中比例形式为训练集：验证集：测试集，划分计数为1~10。

- 各比例下进行10次随机划分，依次在比例为以下情况时进行实验；
- 统计各情况下10次准确率、损失值，并计算均值；
- 做出曲线；

```
cd Ecust/louishsu/recognize_stage_2
python
>>> from main_update_config import main_3_1
>>> main_3_1() # 训练、测试
>>> main_3_1(True) # 输出文件到`images`
```

Multi

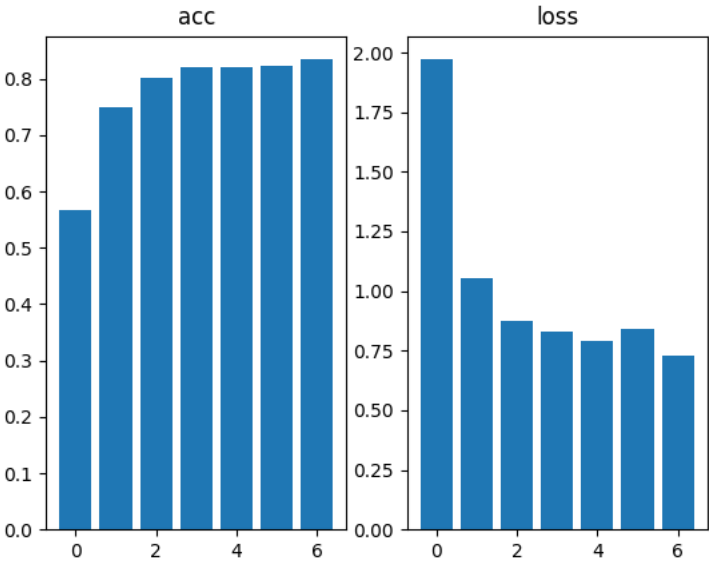
acc

count/ 比例	0.10: 0.70: 0.2	0.20: 0.60: 0.2	0.30: 0.50: 0.2	0.40: 0.40: 0.2	0.50: 0.30: 0.2	0.60: 0.20: 0.2
1	0.5446653962135315	0.6993371248245239	0.7365846037864685	0.8151041865348816	0.8259153962135315	0.8297101855278015
2	0.5909090638160706	0.7626262903213501	0.8028724789619446	0.84375	0.7935606241226196	0.7993659377098083
3	0.553661584854126	0.7623106241226196	0.7694129347801208	0.8424479365348816	0.8522727489471436	0.8260869383811951
4	0.5083649158477783	0.759311854839325	0.8199179172515869	0.8216145634651184	0.8492740392684937	0.842391312122345
5	0.559974730014801	0.7697286009788513	0.834438145160675	0.7994791865348816	0.8128156661987305	0.86277174949646
6	0.5333017706871033	0.7552083730697632	0.8159722685813904	0.83203125	0.8058711886405945	0.842391312122345
7	0.6311553120613098	0.7605745196342468	0.7821969985961914	0.8098958134651184	0.8131313323974609	0.8079710602760315
8	0.5639204382896423	0.7157512307167053	0.8128156661987305	0.8138020634651184	0.8085542917251587	0.8197463750839233
9	0.5579229593276978	0.7703598141670227	0.8053977489471436	0.8216145634651184	0.8227588534355164	0.7916666865348816
10	0.6144254803657532	0.7402145862579346	0.8454861044883728	0.796875	0.8095012903213501	0.8007246255874634
average	0.5658301651477814	0.7495423018932342	0.8025094866752625	0.8196614563465119	0.8193655431270599	0.8222826182842254

loss

count/ 比例	0.10: 0.70: 0.2	0.20: 0.60: 0.2	0.30: 0.50: 0.2	0.40: 0.40: 0.2	0.50: 0.30: 0.2	0.60: 0.20: 0.2
1	2.287714958190918	1.6751939058303833	1.1720304489135742	0.6914577484130859	0.6623198986053467	0.8587173223495483
2	1.8478299379348755	1.0134958028793335	0.9187774062156677	0.7317314147949219	1.1394630670547485	1.1501743793487549
3	1.9083579778671265	0.9957714080810547	1.1725398302078247	0.6826112866401672	0.5893224477767944	0.7177633047103882
4	2.2569613456726074	0.8688408136367798	0.7649378180503845	0.7168734669685364	0.6398410201072693	0.6650376915931702
5	2.2243845462799072	0.920697033405304	0.6849094033241272	1.070229411125183	0.8203393816947937	0.5730327367782593

count/ 比例	0.10: 0.70: 0.2	0.20: 0.60: 0.2	0.30: 0.50: 0.2	0.40: 0.40: 0.2	0.50: 0.30: 0.2	0.60: 0.20: 0.2	
6	1.9357078075408936	0.9431273937225342	0.7954552173614502	0.7927412986755371	0.8186224102973938	0.729717493057251	0.634
7	1.7179073095321655	1.0284892320632935	1.0774773359298706	0.9228398203849792	0.719675600528717	0.8570528626441956	0.764
8	1.79410982131958	1.1469866037368774	0.6933750510215759	0.9826084971427917	0.8658885359764099	0.9581443667411804	0.698
9	1.968733310699463	0.8746358752250671	0.7897955179214478	0.7886516451835632	0.7618501782417297	0.9367732405662537	0.53
10	1.7690150737762451	1.0964210033416748	0.6587896943092346	0.8968705534934998	0.8644641637802124	0.9543319940567017	0.625
average	1.9710722088813781	1.0563659071922302	0.8728087723255158	0.8276615142822266	0.7881786704063416	0.8400745391845703	0.727



作图如下

RGB

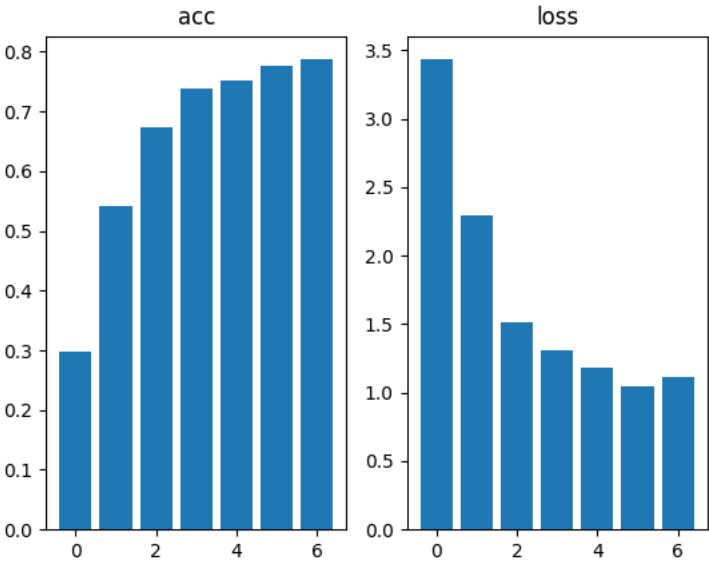
acc

count/ 比例	0.10: 0.70: 0.2	0.20: 0.60: 0.2	0.30: 0.50: 0.2	0.40: 0.40: 0.2	0.50: 0.30: 0.2	0.60: 0.20: 0.2	
1	0.26972854137420654	0.44633838534355164	0.6747159361839294	0.7526041865348816	0.7458963990211487	0.7531702518463135	0.6
2	0.31234216690063477	0.5462436676025391	0.6748737692832947	0.7760416865348816	0.7395833730697632	0.7604166865348816	0.7
3	0.32796716690063477	0.5571338534355164	0.6827651262283325	0.7890625	0.7209596037864685	0.7925724387168884	0.7
4	0.26925504207611084	0.5727588534355164	0.6458333134651184	0.73046875	0.7498422265052795	0.7821558117866516	0.7
5	0.32354795932769775	0.549400269985199	0.6761363744735718	0.7213541865348816	0.743686854839325	0.7862319350242615	0.8
6	0.2507891356945038	0.5419822931289673	0.6868686676025391	0.7252604365348816	0.7621527314186096	0.7866848111152649	0.
7	0.3142361342906952	0.5973800420761108	0.6780303120613098	0.74609375	0.7618370652198792	0.7685688734054565	0.
8	0.3023989796638489	0.5323547720909119	0.676294207572937	0.6979166865348816	0.7927713990211487	0.79347825050354	0.8
9	0.3162878751754761	0.5315656661987305	0.6570391058921814	0.71875	0.7495265603065491	0.7785326242446899	0.7
10	0.297821968793869	0.5422979593276978	0.689393937587738	0.7317708134651184	0.7555240392684937	0.7712862491607666	0.8
average	0.29843749701976774	0.5417455762624741	0.6741950750350952	0.7389322996139527	0.7521780252456665	0.7773097932338715	0.7

loss

count/ 比例	0.10: 0.70: 0.2	0.20: 0.60: 0.2	0.30: 0.50: 0.2	0.40: 0.40: 0.2	0.50: 0.30: 0.2	0.60: 0.20: 0.2	
1	3.613088369369507	3.991544485092163	1.5019370317459106	1.0401458740234375	1.0702478885650635	1.3552169799804688	2.537
2	3.5732200145721436	2.161693811416626	1.2591090202331543	0.9512038230895996	1.7436214685440063	1.1541885137557983	0.975
3	3.2642736434936523	1.9850417375564575	1.7725398540496826	0.8798849582672119	1.3451577425003052	1.024081826210022	0.98
4	3.6011362075805664	2.124483585357666	1.8060946464538574	1.2897820472717285	1.0700503587722778	0.9564675092697144	1.029
5	3.4947731494903564	2.222670316696167	1.4393234252929688	1.264577031135559	1.1215094327926636	1.0719794034957886	0.848

count/ 比例	0.10: 0.70: 0.2	0.20: 0.60: 0.2	0.30: 0.50: 0.2	0.40: 0.40: 0.2	0.50: 0.30: 0.2	0.60: 0.20: 0.2	
6	3.38114857673645	2.077460765838623	1.3681212663650513	1.1846281290054321	1.254339337348938	0.86368328332901	0.898
7	3.2527964115142822	1.7298861742019653	1.4552241563796997	1.8721901178359985	0.929996907711029	1.0905592441558838	0.889
8	3.2515180110931396	2.1049704551696777	1.4412060976028442	1.925615906715393	0.9189132452011108	0.9486509561538696	0.823
9	3.3216843605041504	2.2910726070404053	1.8296455144882202	1.4293404817581177	1.234427809715271	0.980363667011261	1.150
10	3.569934844970703	2.2546591758728027	1.3049665689468384	1.2174286842346191	1.1121662855148315	0.9803547859191895	0.981
average	3.432357358932495	2.2943483114242555	1.5178167581558228	1.3054797053337097	1.1800430476665498	1.0425546169281006	1.11



作图如下

可知比例为0.60：0.20：0.2时，效果最佳。

3.2 波段对比实验

- 根据实验3.1得到的最优划分，在10次随机划分进行实验；
- 依次选择单个波段的数据进行实验；
- 统计各情况下10次准确率、损失值，并计算均值；
- 做出曲线；

```
cd Ecust/louishsu/recognize_stage_2
python
>>> from main_update_config import main_3_2
>>> main_3_2()      # 训练、测试
>>> main_3_2(True)  # 输出文件到`images`
```

Multi

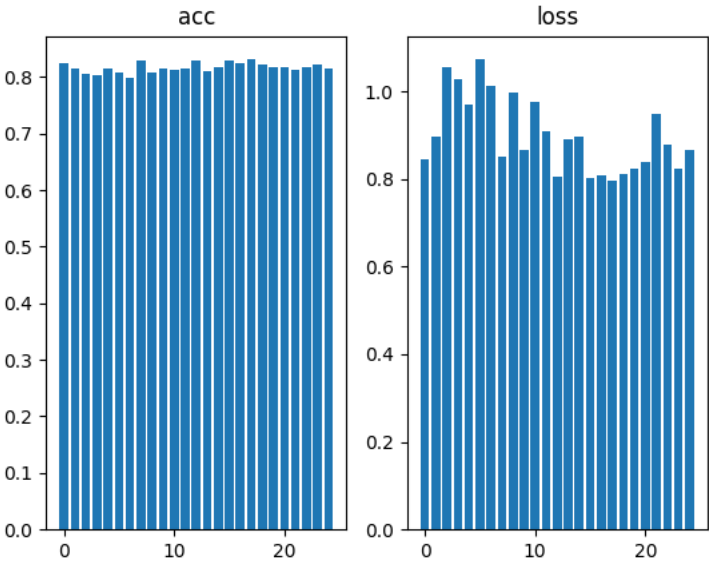
acc

count/ 波段索引	1	2	3	4	5	6	
1	0.8211050629615784	0.7971014976501465	0.8242753744125366	0.8134058117866516	0.7871376276016235	0.8256340622901917	0.786
2	0.7980071902275085	0.7712862491607666	0.75951087474823	0.792119562625885	0.7454710602760315	0.7631340622901917	0.78
3	0.8387680649757385	0.8192934989929199	0.79076087474823	0.82472825050354	0.8586956262588501	0.85597825050354	0.77
4	0.813858687877655	0.8152173757553101	0.7943840622901917	0.80027174949646	0.84375	0.7839673757553101	0.803
5	0.8383151888847351	0.8102355003356934	0.8586956262588501	0.8505434989929199	0.8523550629615784	0.8577898144721985	0.800
6	0.8387680649757385	0.8618659377098083	0.8147644996643066	0.8052536249160767	0.8106884360313416	0.811141312122345	0.814
7	0.8211050629615784	0.8179348111152649	0.7807971239089966	0.7681159377098083	0.8020833134651184	0.7672101855278015	0.798
8	0.8115941882133484	0.8143115639686584	0.8401268124580383	0.7966485023498535	0.8120471239089966	0.8306159377098083	0.789

count/ 波段索引	1	2	3	4	5	6	
9	0.8306159377098083	0.8147644996643066	0.7930253744125366	0.7948369383811951	0.823369562625885	0.7749093770980835	0.800
10	0.8274456262588501	0.83152174949646	0.7880434989929199	0.7776268124580383	0.8097826242446899	0.820652186870575	0.819
average	0.8239583075046539	0.8153532683849335	0.8044384121894836	0.8023550689220429	0.8145380437374115	0.8091032564640045	0.79

loss

count/ 波段索引	1	2	3	4	5	6	
1	0.9496657252311707	0.9936584830284119	1.0085945129394531	0.8737303018569946	1.1915991306304932	0.7549974322319031	1.159
2	1.2795754671096802	1.7465345859527588	1.830418586730957	1.8558013439178467	2.205235242843628	2.407104969024658	1.437
3	0.8315631151199341	0.8159720301628113	1.0985441207885742	0.7954025268554688	0.5746778249740601	0.6210147142410278	1.22
4	0.9319937229156494	0.8062987327575684	0.9103023409843445	0.8219806551933289	0.737668514251709	1.3106982707977295	0.925
5	0.6808422803878784	0.837618887424469	0.5920705199241638	0.6943956613540649	0.7070990800857544	0.5867810845375061	0.953
6	0.6737629771232605	0.5739679932594299	0.8309633135795593	0.8729063272476196	0.8236556649208069	1.006982684135437	0.827
7	0.755231499671936	0.8371277451515198	1.2652111053466797	1.110723853111267	0.8687099814414978	1.3129419088363647	0.904
8	0.7927396893501282	0.7792322039604187	0.7234867811203003	1.1481454372406006	0.8247290253639221	0.7329584956169128	0.912
9	0.728750467300415	0.8394255638122559	0.8886951804161072	0.9989979863166809	0.8263247013092041	1.2322441339492798	0.869
10	0.811479926109314	0.7295910120010376	1.4044800996780396	1.1081490516662598	0.9447125792503357	0.7628629207611084	0.903
average	0.8435604870319366	0.8959427237510681	1.0552766561508178	1.0280233144760131	0.9704411745071411	1.0728586614131927	1.012



作图如下

RGB

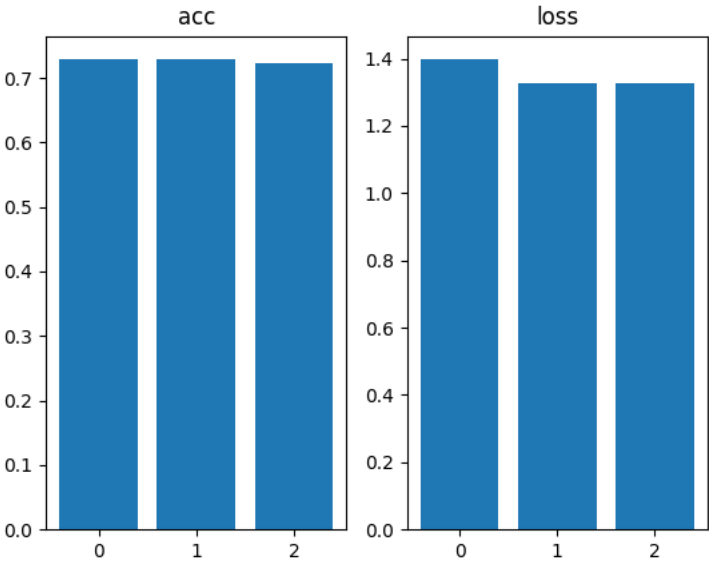
acc

count/波段索引	R	G	B
1	0.7477355003356934	0.7278079986572266	0.710597813129425
2	0.6847826242446899	0.7083333134651184	0.6571558117866516
3	0.7364130616188049	0.7336956262588501	0.7359601855278015
4	0.720108687877655	0.7038043737411499	0.741847813129425
5	0.7436593770980835	0.7368659377098083	0.7314311265945435
6	0.70923912525177	0.7558876276016235	0.7332428097724915
7	0.7264493107795715	0.6843296885490417	0.6802536249160767

count/波段索引	R	G	B
8	0.7540760636329651	0.7522644996643066	0.77173912525177
9	0.7146739363670349	0.7323369383811951	0.7228260636329651
10	0.7459239363670349	0.7504528760910034	0.7395833134651184
average	0.7283061623573304	0.7285778880119324	0.7224637687206268

loss

count/波段索引	R	G	B
1	1.2130966186523438	1.3774745464324951	1.6279478073120117
2	2.8342859745025635	1.9354972839355469	2.1175944805145264
3	1.30509614944458	1.1482808589935303	1.1036685705184937
4	1.490304708480835	1.3626549243927002	1.210271954536438
5	1.146216630935669	1.260554313659668	1.224961280822754
6	1.1802077293395996	1.1459215879440308	1.2335355281829834
7	1.232132077217102	1.6595314741134644	1.3966267108917236
8	1.158766746520996	1.0269274711608887	0.9756036996841431
9	1.2059093713760376	1.2053521871566772	1.1858423948287964
10	1.2067344188690186	1.1394603252410889	1.1762553453445435
average	1.3972750425338745	1.326165497303009	1.3252307772636414



作图如下

根据图3.2.1.1，按准确率将波段排序，降序排序如下：

```
Generating tables and figures [Multi]...
Best:  [19 16 18 11 12  8 15 24 21  9 14 20 13 23 25 22  1  2  6 10  7 17  3  4
5]
Generating tables and figures [RGB]...
Best:  [1 2 3]
```

3.3 波段组合实验

该部分实验仅针对多光谱数据。

- 根据实验3.1得到的最优划分，在10次随机划分进行实验；
- 根据实验3.2得到的最优排序，依次选择最前1, 2, ..., 25个波段进行组合实验；
- 统计各情况下10次准确率、损失值，并计算均值；
- 做出曲线；

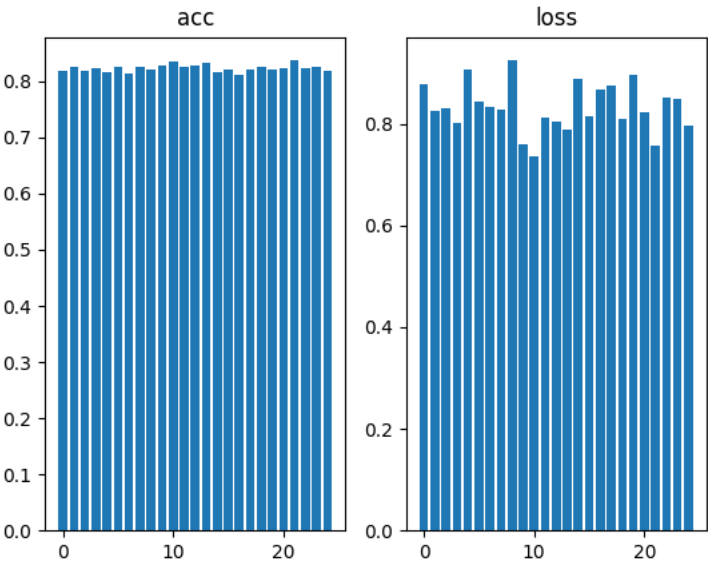
```
cd Ecust/louishsu/recognize_stage_2
python
>>> from main_update_config import main_3_3
>>> main_3_3()          # 训练、测试
>>> main_3_3(True)      # 输出文件到`images`
```

acc

count/ 组合数	1	2	3	4	5	6	
1	0.8101999999999999	0.8192934989929199	0.8383151888847351	0.8251811265945435	0.8106884360313416	0.8274456262588501	0.8361
2	0.8016	0.8310688734054565	0.8048006892204285	0.8038949370384216	0.7604166865348816	0.8011775612831116	0.7721
3	0.8519	0.8387680649757385	0.8297101855278015	0.813858687877655	0.8410326242446899	0.813858687877655	0.821
4	0.8111	0.8125	0.8075180649757385	0.8224637508392334	0.8057065010070801	0.8709239363670349	0.818
5	0.8234	0.8478260636329651	0.8537137508392334	0.842391312122345	0.854619562625885	0.8491848111152649	0.821
6	0.8356	0.8256340622901917	0.8260869383811951	0.8396739363670349	0.8410326242446899	0.854619562625885	0.816
7	0.7672	0.83152174949646	0.7930253744125366	0.7989130616188049	0.8211050629615784	0.7780797481536865	0.83
8	0.8301999999999999	0.85326087474823	0.820652186870575	0.8093297481536865	0.8224637508392334	0.8478260636329651	0.800
9	0.851	0.7943840622901917	0.7930253744125366	0.8600543737411499	0.7939311265945435	0.8052536249160767	0.821
10	0.7966	0.8057065010070801	0.8197463750839233	0.8265398144721985	0.8192934989929199	0.8088768124580383	0.807
average	0.81788	0.8259963750839233	0.8186594128608704	0.8242300748825073	0.8170289874076844	0.8257246434688568	0.814

loss

count/ 组合数	1		2		3		4		5		6	
1	1.0346	0.8257575035095215	0.7210565805435181	0.7294606566429138	1.085425853729248	0.9142743945121765	0.7031251036251036	0.8257575035095215	0.7210565805435181	0.7294606566429138	1.085425853729248	0.9142743945121765
2	1.1545	0.8027451634407043	0.972329318523407	1.1382558345794678	1.7719314098358154	1.4696083068847656	1.3612510362510362	0.8027451634407043	0.972329318523407	1.1382558345794678	1.7719314098358154	1.4696083068847656
3	0.6504	0.6558364629745483	0.6721540689468384	0.8908988237380981	0.7073768973350525	0.9460994601249695	0.7821251036251036	0.6558364629745483	0.6721540689468384	0.8908988237380981	0.7073768973350525	0.9460994601249695
4	0.7963	0.7915062308311462	0.9791322946548462	0.7210754752159119	0.785041332244873	0.4877428114414215	0.7112510362510362	0.7915062308311462	0.7915062308311462	0.7915062308311462	0.7915062308311462	0.7915062308311462
5	0.8678	0.6342611312866211	0.6403124332427979	0.6750491857528687	0.531612753868103	0.7514663934707642	0.8051251036251036	0.6342611312866211	0.6342611312866211	0.6342611312866211	0.6342611312866211	0.6342611312866211
6	0.6839	0.8986688852310181	0.9376347661018372	0.8140369057655334	0.6824079751968384	0.6695643067359924	0.8921251036251036	0.8986688852310181	0.8986688852310181	0.8986688852310181	0.8986688852310181	0.8986688852310181
7	1.2123	0.6734341979026794	0.9471309781074524	0.8910963535308838	0.6799125075340271	0.9589447379112244	0.7331251036251036	0.6734341979026794	0.6734341979026794	0.6734341979026794	0.6734341979026794	0.6734341979026794
8	0.7776	0.7073320150375366	0.7954148650169373	0.8774189949035645	0.8942155241966248	0.6326645016670227	0.8121251036251036	0.7073320150375366	0.7073320150375366	0.7073320150375366	0.7073320150375366	0.7073320150375366
9	0.6685	1.2781312465667725	0.8088684678077698	0.6069954037666321	1.1711345911026	0.852872908115387	0.7971251036251036	1.2781312465667725	1.2781312465667725	1.2781312465667725	1.2781312465667725	1.2781312465667725
10	0.9268	0.9912732839584351	0.8242212533950806	0.6647418737411499	0.7601375579833984	0.765872061252594	0.7341251036251036	0.9912732839584351	0.9912732839584351	0.9912732839584351	0.9912732839584351	0.9912732839584351
average	0.8772699999999999	0.8258946120738984	0.8298255026340484	0.8009029507637024	0.906919640302658	0.8449109882116318	0.8341251036251036	0.8772699999999999	0.8772699999999999	0.8772699999999999	0.8772699999999999	0.8772699999999999



作图如下

3.4 光谱分辨率实验

该部分实验仅针对多光谱数据。

- 根据实验3.1得到的最优划分，在10次随机划分进行实验；
- 依次选择步长为1, 2, ..., 25，进行组合波段实验
- 统计各情况下10次准确率、损失值，并计算均值；
- 做出曲线；

```
cd Ecust/louishsu/recognize_stage_2
python
>>> from main_update_config import main_3_4
>>> main_3_4()      # 训练、测试
>>> main_3_4(True)  # 输出文件到`images`
```

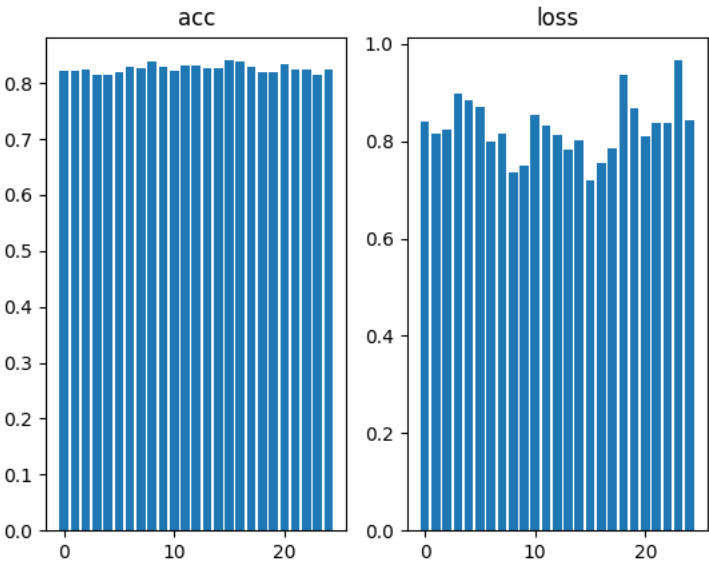
acc

count/ 波段步 长	1	2	3	4	5	6	
1	0.8297	0.8496376276016235	0.8614130616188049	0.8066123723983765	0.789402186870575	0.8215579986572266	0.8197
2	0.7994	0.8134058117866516	0.83152174949646	0.8115941882133484	0.7943840622901917	0.8066123723983765	0.8047
3	0.8261	0.8020833134651184	0.8020833134651184	0.8129528760910034	0.8414855003356934	0.8238224387168884	0.8369
4	0.8423999999999999	0.8215579986572266	0.8061593770980835	0.8523550629615784	0.83152174949646	0.8432971239089966	0.8276
5	0.8628	0.8197463750839233	0.8491848111152649	0.8224637508392334	0.8165760636329651	0.8260869383811951	0.8603
6	0.8423999999999999	0.8269928097724915	0.8378623723983765	0.8134058117866516	0.8283514976501465	0.7925724387168884	0.8292
7	0.8079999999999999	0.7848731875419617	0.8369565010070801	0.7780797481536865	0.8188406229019165	0.8238224387168884	0.7992
8	0.8197	0.8491848111152649	0.811141312122345	0.8170289397239685	0.8093297481536865	0.8387680649757385	0.8387
9	0.7917000000000001	0.8414855003356934	0.8093297481536865	0.8238224387168884	0.8188406229019165	0.80298912525177	0.8307
10	0.8007	0.8066123723983765	0.7948369383811951	0.8097826242446899	0.7898550629615784	0.8292571902275085	0.8476
average	0.82229	0.8215579807758331	0.8240489184856414	0.8148097813129425	0.813858711719513	0.8208786129951477	0.8292

loss

count/ 波段步 长	1	2	3	4	5	6	
1	0.8587	0.5985684990882874	0.5356584787368774	1.0011874437332153	1.1101607084274292	0.9441021680831909	0.931
2	1.1502	1.0176540613174438	0.8618543744087219	1.2693684101104736	1.1564364433288574	1.2409414052963257	1.393
3	0.7178	0.9402275085449219	1.1427124738693237	0.9478744268417358	0.6723776459693909	0.9153621792793274	0.78

count/ 波段步 长	1	2	3	4	5	6	
4	0.665	0.7311530113220215	1.0224937200546265	0.6190547943115234	0.7222946286201477	0.6287878751754761	0.6190547943115234
5	0.573	0.7554605603218079	0.6758705377578735	0.8230921030044556	0.854537308216095	0.8027995824813843	0.6287878751754761
6	0.7297	0.7536693811416626	0.737503707408905	0.9463911652565002	0.7441673874855042	1.036614179611206	0.7851169662481384
7	0.8571	0.9622517228126526	0.7290322780609131	1.0553905963897705	0.8217887282371521	0.6315202116966248	0.8931169662481384
8	0.9581	0.6242732405662537	0.8240231871604919	0.7591571807861328	0.9774377346038818	0.6543126106262207	0.6641169662481384
9	0.9368	0.6579684019088745	0.862577497959137	0.7779151201248169	0.8178852796554565	1.10133695602417	0.6561169662481384
10	0.9543	1.1027634143829346	0.8598230481147766	0.7933375239372253	0.979127049446106	0.7439116835594177	0.5831169662481384
average	0.8400700000000001	0.814398980140686	0.8251549303531647	0.899276876449585	0.885621291399002	0.8699688851833344	0.7991169662481384



作图如下

3.5 鲁棒性实验

- 根据实验3.1得到的最优划分，在10次随机划分进行实验；
- 选用全部波段进行实验；
- 统计10次实验中，改变条件得到表格；
- 做出曲线

```
cd Ecust/louishsu/recognize_stage_2
python
>>> from main_update_config import main_3_5
>>> main_3_5()      # 训练、测试
>>> main_3_5(True)  # 输出文件到`images`
```

3.5.1 干扰种类

统计无干扰、干扰1、干扰2、干扰3下，每次实验的准确率、损失

仅包含position=4

Multi

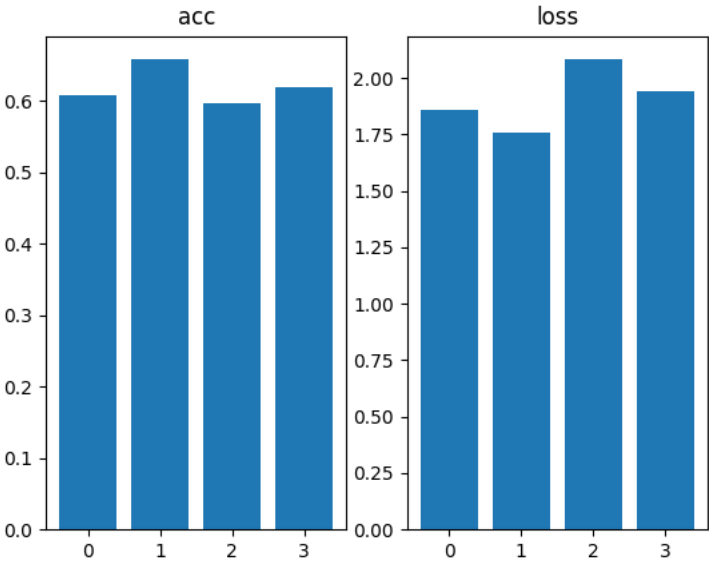
acc

count/光照	illum1	illum2	illum3	normal
1	0.6304348111152649	0.739130437374115	0.4193548262119293	0.6571428775787354
2	0.6000000238418579	0.625	0.6341463327407837	0.5277777910232544
3	0.4838709533214569	0.739130437374115	0.6000000238418579	0.6571428775787354
4	0.692307710647583	0.6444444465637207	0.6585366129875183	0.5609756112098694

count/光照	illum1		illum2		illum3	normal
5	0.666666665348816	0.6060606241226196	0.7096773982048035	0.71875		
6	0.6170212626457214	0.7027027010917664	0.6499999761581421	0.6511628031730652		
7	0.557692289352417	0.625	0.5306122303009033	0.6315789222717285		
8	0.6739130616188049	0.675000011920929	0.6279069781303406	0.6000000238418579		
9	0.5897436141967773	0.6136363744735718	0.54347825050354	0.5526315569877625		
10	0.5681818127632141	0.6111111044883728	0.6000000238418579	0.6363636255264282		
average	0.6079832226037979	0.6581216156482697	0.5973712652921677	0.6193526089191437		

loss

count/光照	illum1		illum2		illum3	normal
1	1.515424370765686	1.570702075958252	3.446721315383911	1.7715245485305786		
2	2.4775962829589844	2.6063427925109863	2.1741929054260254	3.840662717819214		
3	1.957628846168518	1.1124435663223267	1.6466648578643799	1.3283723592758179		
4	1.1659184694290161	1.4522491693496704	1.7395330667495728	1.9549607038497925		
5	1.5063660144805908	1.6744688749313354	1.2582175731658936	1.0710556507110596		
6	2.003814935684204	1.8102643489837646	1.4461162090301514	1.741736650466919		
7	2.2988457679748535	1.5332356691360474	2.295715093612671	1.514491319656372		
8	1.7690362930297852	1.9699580669403076	2.5678701400756836	2.0634379386901855		
9	1.9920358657836914	2.044135808944702	2.059256076812744	1.8723772764205933		
10	1.9202426671981812	1.7843023538589478	2.1929593086242676	2.2835447788238525		
average	1.860690951347351	1.755810272693634	2.08272465467453	1.9442163944244384		



作图如下

RGB

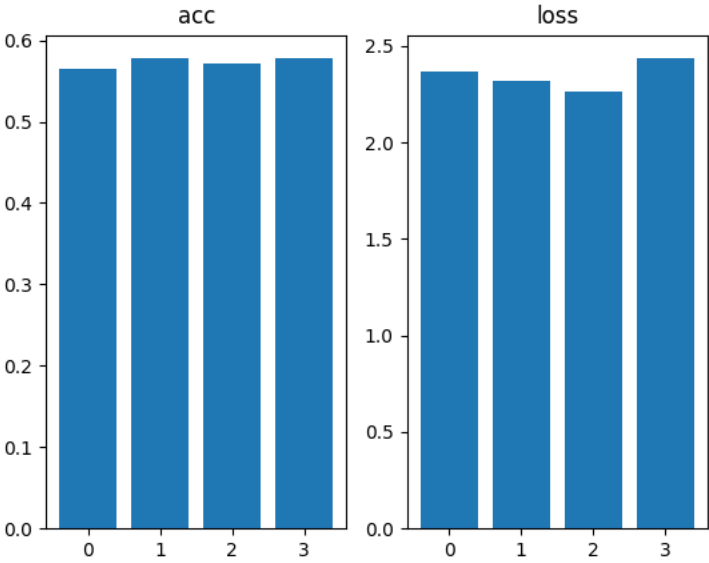
acc

count/光照	illum1		illum2		illum3	normal
1	0.5	0.5869565010070801	0.4193548262119293	0.5142857432365417		
2	0.6222222447395325	0.550000011920929	0.6829268336296082	0.5277777910232544		
3	0.4516128897666931	0.6304348111152649	0.6499999761581421	0.5428571701049805		
4	0.6153846383094788	0.5555555820465088	0.6341463327407837	0.5121951103210449		
5	0.5555555820465088	0.4848484992980957	0.7096773982048035	0.59375		
6	0.6170212626457214	0.5945945978164673	0.550000011920929	0.5116279125213623		

count/光照	illum1	illum2	illum3	normal
7	0.38461539149284363	0.5625	0.4693877696990967	0.6578947305679321
8	0.739130437374115	0.574999988079071	0.604651153087616	0.6000000238418579
9	0.6153846383094788	0.6818181872367859	0.5	0.6578947305679321
10	0.5454545617103577	0.5555555820465088	0.5	0.6590909361839294
average	0.5646381646394729	0.5777263760566711	0.5720144301652909	0.5777374148368836

loss

count/光照	illum1	illum2	illum3	normal
1	3.593595504760742	2.7178409099578857	4.190008640289307	3.5872862339019775
2	1.9419499635696411	2.4037115573883057	1.7698380947113037	3.2195451259613037
3	3.2914748191833496	2.7010130882263184	2.1117215156555176	2.950246810913086
4	1.8237746953964233	2.12752103805542	1.6611067056655884	2.3926022052764893
5	2.892038345336914	3.0712177753448486	1.7103261947631836	2.9145314693450928
6	1.5501741170883179	1.6328017711639404	2.220686197280884	2.030081033706665
7	3.0933737754821777	2.17620587348938	2.6157610416412354	1.6988818645477295
8	1.4030990600585938	2.2434380054473877	1.8901046514511108	2.0278263092041016
9	1.9779229164123535	1.9491314888000488	2.198361873626709	1.6200672388076782
10	2.0910019874572754	2.18280029296875	2.2615017890930176	1.9180973768234253
average	2.3658405184745788	2.3205681800842286	2.262941670417786	2.435916566848755



作图如下

3.5.2 偏转角度

统计各角度下，每次实验的准确率、损失

仅包含glass_type=1

Multi

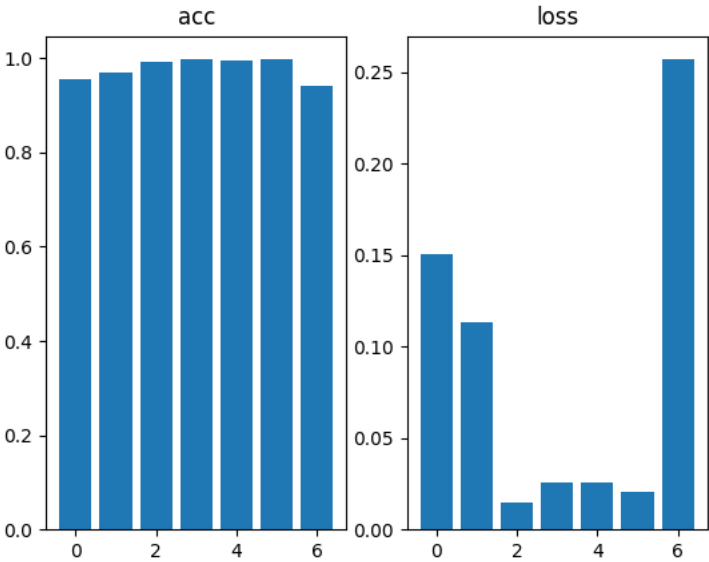
acc

count/ 位置	1	2	3	4	5	6
1	0.9583333134651184	1.0	1.0	1.0	1.0	1.0
2	0.8985507488250732	0.9285714030265808	0.9599999785423279	0.9714285731315613	0.9729729890823364	1.0
3	0.9736841917037964	0.96875	1.0	1.0	1.0	1.0
4	0.9577465057373047	1.0	1.0	1.0	1.0	0.9878048896789551

count/ 位置	1	2	3	4	5	6
5	0.9242424368858337	0.9878048896789551	1.0	1.0	1.0	1.0 0.928
6	0.9672130942344666	0.9733333587646484	0.9838709831237793	1.0	1.0	1.0 0.935
7	0.9696969985961914	0.9855072498321533	1.0	1.0	1.0 0.9855072498321533	0.98
8	0.9508196711540222	0.9402984976768494	1.0	1.0	1.0	1.0 0.93
9	0.9866666793823242	0.9605262875556946	1.0	1.0 0.9857142567634583		1.0 0.915
10	0.9692307710647583	0.9624999761581421	0.9861111044883728	1.0	1.0	1.0 0.925
average	0.9556184411048889	0.9707291662693024	0.992998206615448	0.9971428573131561	0.9958687245845794	0.9973312139511108 0.9411

loss

count/ 位置	1	2	3	4	5
1	0.19898250699043274	0.02499772422015667	0.007049409206956625	0.0037649008445441723	0.0040639853104949 0.0149740306660
2	0.19199441373348236	0.19658957421779633	0.06906949728727341	0.21194274723529816	0.16547316312789917 0.034229077398
3	0.10253102332353592	0.14476779103279114	0.004487256519496441	0.003204093314707279	0.003511018119752407 0.0170746203511
4	0.2049941122531891	0.04572002962231636	0.0033788681030273438	0.005698951426893473	0.003365857293829322 0.0263514351099
5	0.20320254564285278	0.03583088889718056	0.0025527894031256437	0.005912881810218096	0.01161274779587984 0.0246603731065
6	0.0854538232088089	0.09156231582164764	0.02263369783759117	0.004514952190220356	0.003601545002311468 0.013737476430
7	0.12244237214326859	0.060356415808200836	0.0035240943543612957	0.0043929205276072025	0.004844420589506626 0.025683278217
8	0.24023118615150452	0.24323534965515137	0.0037125430535525084	0.005198046565055847	0.0114912623539567 0.026746764779
9	0.05166596546769142	0.1321222484111786	0.002574262907728553	0.002430972410365939	0.04272856563329697 0.0096947215497
10	0.10178600996732712	0.15802006423473358	0.02926216460764408	0.008674707263708115	0.007332338485866785 0.014436063356
average	0.15032839588820934	0.11332024019211531	0.014824458328075708	0.025573517358861864	0.025802490371279418 0.020758784096



作图如下

RGB

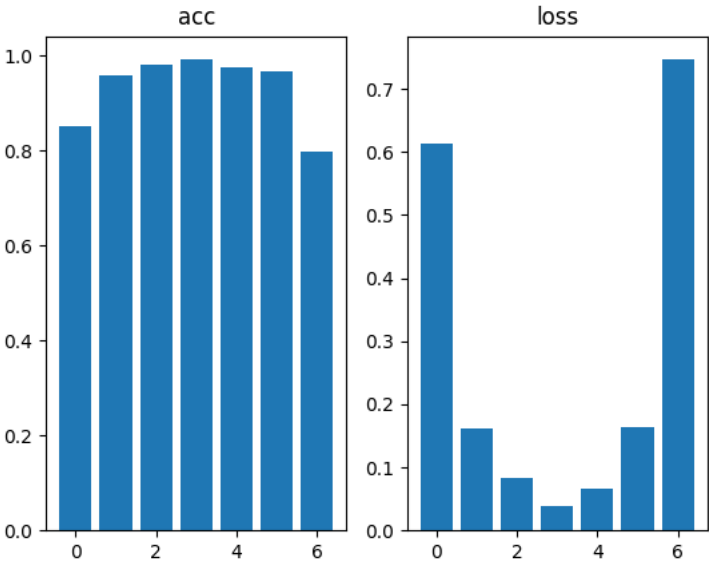
acc

count/ 位置	1	2	3	4	5	6
1	0.8472222089767456	0.9726027250289917	1.0 0.9846153855323792	0.9615384340286255	0.9545454382896423	0.784
2	0.739130437374115	0.8857142925262451	0.9333333373069763 0.9714285731315613	0.9594594836235046	0.9740259647369385	0.633
3	0.8684210777282715	0.9375 0.9764705896377563	1.0 0.9722222089767456	0.9411764740943909		
4	0.9154929518699646	0.9655172228813171	0.984375	1.0 0.9714285731315613	0.9878048896789551	0.833

count/ 位置	1	2	3	4	5	6	
5	0.8181818127632141	0.9878048896789551	1.0	0.9848484992980957	0.9868420958518982	0.9358974099159241	0.80
6	0.868852436542511	0.9733333587646484	1.0	1.0	0.9615384340286255	0.9871794581413269	0.822
7	0.8939393758773804	0.95652174949646	0.9824561476707458	0.9864864945411682	0.9864864945411682	0.9710144996643066	0.913
8	0.868852436542511	0.9552238583564758	0.9452054500579834	0.9882352948188782	1.0	0.9850746393203735	0.780
9	0.813333325386047	0.9736841917037964	1.0	1.0	0.9857142567634583	0.9722222089767456	0.732
10	0.8769230842590332	0.9624999761581421	1.0	1.0	0.9718309640884399	0.9636363387107849	0.835
average	0.8510349154472351	0.9570402264595032	0.9821840524673462	0.9915614247322082	0.9757060945034027	0.9672577321529389	0.796

loss

count/ 位置	1	2	3	4	5	
1	0.5605213642120361	0.09017366915941238	0.030459070578217506	0.050492286682128906	0.0951564759016037	0.230433791875839
2	1.098435640335083	0.4137367904186249	0.28298962116241455	0.110237717628479	0.10201257467269897	0.110782250761985
3	0.6197947263717651	0.2264767587184906	0.12225735932588577	0.019736409187316895	0.059452276676893234	0.151246219873428
4	0.3454452157020569	0.069605752825737	0.08884090930223465	0.004698760341852903	0.08824741095304489	0.127567037940025
5	0.6332056522369385	0.06519671529531479	0.008833960629999638	0.042494166642427444	0.06653585284948349	0.31044611334800
6	0.5859944820404053	0.15122823417186737	0.0076506370678544044	0.015368732623755932	0.055032722651958466	0.08029803633689
7	0.536247730255127	0.18346647918224335	0.07599414139986038	0.055614251643419266	0.028423065319657326	0.208761826157569
8	0.6603409647941589	0.14270997047424316	0.13089868426322937	0.058495111763477325	0.027238700538873672	0.105893373489379
9	0.5716894268989563	0.11508681625127792	0.05228963494300842	0.0052521792240440845	0.0473315566778183	0.11264869570732
10	0.5190131068229675	0.165860116481781	0.021911462768912315	0.019618868827819824	0.08350910991430283	0.193858966231346
average	0.6130688309669494	0.16235413029789925	0.0822125481441617	0.03820084845647216	0.0652939746156335	0.163193631172180



作图如下

3.5.3 遮挡实验

统计无眼镜、近视眼镜、太阳镜下，每次实验的准确率、损失

Multi

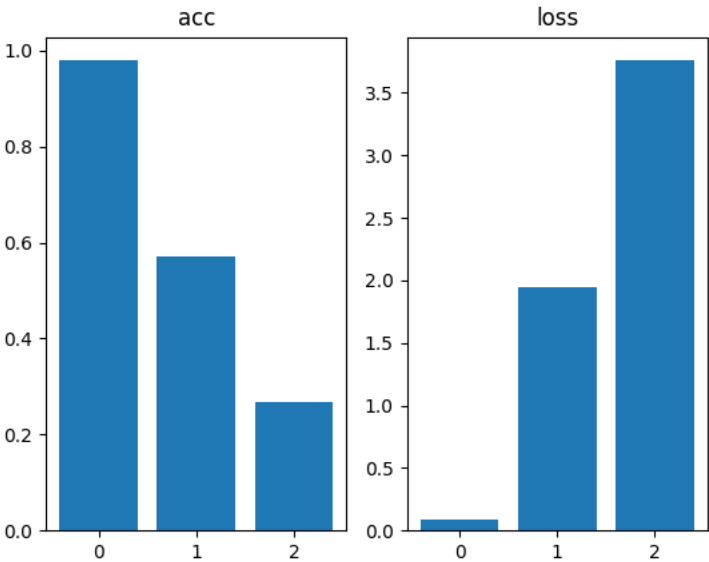
acc

count/眼镜	1	5	6
1	0.9896265268325806	0.607594907283783	0.2763157784938812
2	0.9474747180938721	0.5677419304847717	0.19696970283985138

count/眼镜	1	5	6
3	0.98591548204422	0.5194805264472961	0.2769230902194977
4	0.9896694421768188	0.6265822649002075	0.29729729890823364
5	0.9780439138412476	0.66666666865348816	0.38461539149284363
6	0.981632649898529	0.6333333253860474	0.31578946113586426
7	0.9892933368682861	0.5909090638160706	0.2631579041481018
8	0.9756097793579102	0.5617284178733826	0.22580644488334656
9	0.977911651134491	0.44594594836235046	0.18571428954601288
10	0.9771783947944641	0.49696969985961914	0.260869562625885
average	0.9792355895042419	0.571695277094841	0.2683458924293518

loss

count/眼镜	1	5	6
1	0.05397241190075874	1.9961684942245483	3.7226450443267822
2	0.20440146327018738	2.3618297576904297	5.602774620056152
3	0.06309375911951065	1.9489222764968872	3.012773036956787
4	0.05225598067045212	1.4604887962341309	3.0895049571990967
5	0.08055444806814194	1.360411524772644	2.6827425956726074
6	0.06062646582722664	1.6112438440322876	3.4648091793060303
7	0.05131542682647705	1.7186081409454346	3.53769850730896
8	0.12217029929161072	2.163999080657959	4.669853687286377
9	0.06988543272018433	2.5268394947052	3.887953042984009
10	0.08333006501197815	2.334954023361206	3.9169209003448486
average	0.08416057527065277	1.9483465433120728	3.758767557144165



作图如下

RGB

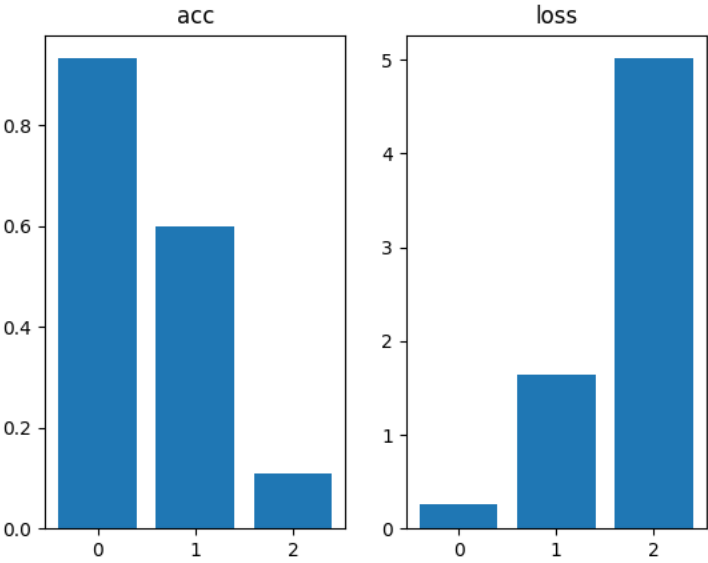
acc

count/眼镜	1	5	6
1	0.9294605851173401	0.5443037748336792	0.09210526198148727
2	0.8787878751754761	0.6129032373428345	0.19696970283985138
3	0.9336016178131104	0.6233766078948975	0.07692307978868484
4	0.9504132270812988	0.594936728477478	0.13513512909412384

count/眼镜	1	5	6
5	0.9321357011795044	0.5799999833106995	0.1230769231915474
6	0.9489796161651611	0.6399999856948853	0.10526315867900848
7	0.9571734666824341	0.6038960814476013	0.09473684430122375
8	0.9329268336296082	0.654321014881134	0.06451612710952759
9	0.9236947894096375	0.5945945978164673	0.1428571492433548
10	0.9460580945014954	0.5454545617103577	0.07246376574039459
average	0.9333231806755066	0.5993786573410034	0.1104047141969204

loss

count/眼镜	1	5	6
1	0.24256792664527893	1.9629151821136475	6.8578643798828125
2	0.4638546109199524	1.6823010444641113	5.069395065307617
3	0.2600482404232025	1.43081533908844	6.063082695007324
4	0.21816162765026093	1.616342544555664	4.1845784187316895
5	0.27224448323249817	1.694547176361084	5.8314409255981445
6	0.19619087874889374	1.381851315498352	3.8841307163238525
7	0.20132587850093842	1.6494500637054443	4.561709880828857
8	0.28268152475357056	1.4729324579238892	4.799480438232422
9	0.26377567648887634	1.7303192615509033	4.339154243469238
10	0.2077593356370926	1.758067011833191	4.5530900955200195
average	0.2608610183000565	1.6379541397094726	5.014392685890198



作图如下