

## 1. 数据目录结构

[1-92]	# 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=92, datatype='Multi',
                 usedChannels=[i+1 for i in range(25)], splitratio=[0.6, 0.2, 0.2],
                 splitcount=1, modelbase='recognize_vgg11_bn',
                 datapath = "/datasets/ECUSTDETECT",
                 savepath = 'checkpoints',
                 hist=True,
                 training_no_glass=True):
```

### 3.1 划分比例的确定y

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: 3796, n_train: 365, n_valid: 2633, n_test: 798, ratio: 0.096: 0.694: 0.210
...

[split_112x96_[0.20:0.60:0.20]_[1]] n_items: 3796, n_train: 735,
...

[split_112x96_[0.30:0.50:0.20]_[1]] n_items: 3796, n_train: 1104, n_valid: 1895, n_test: 797, ratio: 0.291: 0.499: 0.210
...

[split_112x96_[0.40:0.40:0.20]_[1]] n_items: 3796, n_train: 1474, n_valid: 1474, n_test: 848, ratio: 0.388: 0.388: 0.223
...

[split_112x96_[0.50:0.30:0.20]_[1]] n_items: 3796, n_train: 1895, n_valid: 1104, n_test: 797, ratio: 0.499: 0.291: 0.210
...

[split_112x96_[0.60:0.20:0.20]_[1]] n_items: 3796, n_train: 2263, n_valid: 704, n_test: 829, ratio: 0.596: 0.185: 0.218
...

[split_112x96_[0.70:0.10:0.20]_[1]] n_items: 3796, n_train: 2633, n_valid: 334, n_test: 829, ratio: 0.694: 0.088: 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1~5。

- 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`
```

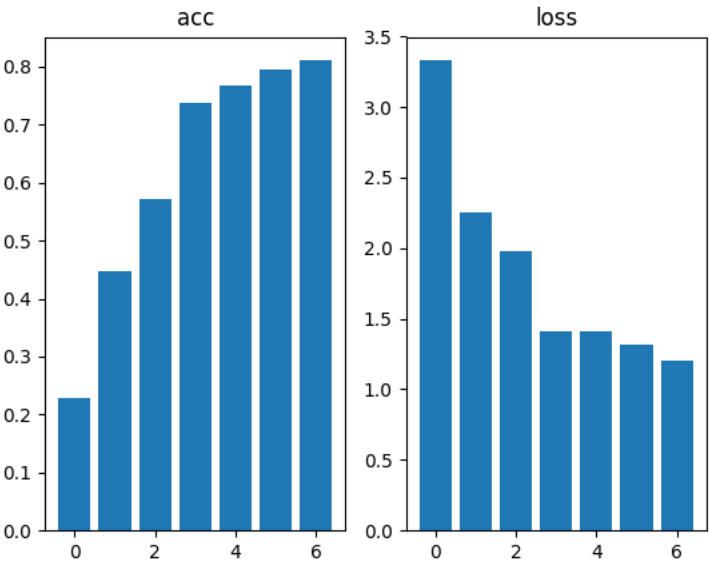
Multi

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	0.2709999978542328	0.559749960899353	0.5568534731864929	0.7384259104728699	0.7769827246665955	0.7653763294219971	0.8
2	0.10999999940395355	0.4934999942779541	0.6752155423164368	0.7291666865348816	0.797974169254303	0.8496352434158325	0.8
3	0.20424999296665192	0.37049999833106995	0.6150861978530884	0.6932870149612427	0.7307327389717102	0.7605686187744141	0.8
4	0.3634999990463257	0.6378333568572998	0.5015517473220825	0.7546296119689941	0.7756034731864929	0.8086455464363098	0.8
5	0.1666666567325592	0.41208332777023315	0.6857327222824097	0.7754629850387573	0.7629741430282593	0.7854360342025757	0.7
6	0.15008333325386047	0.3375000059604645	0.6106034517288208	0.7048611044883728	0.7706034779548645	0.8082726001739502	0.8
7	0.4284999966621399	0.4092499911785126	0.3978017568588257	0.7037037014961243	0.7894827127456665	0.7686091065406799	0.8
8	0.18200001120567322	0.5616666674613953	0.5388362407684326	0.7627314925193787	0.771853506565094	0.8205404281616211	0.8
9	0.2759999930858612	0.30008333921432495	0.6041810512542725	0.7881944179534912	0.7271982431411743	0.7698110342025757	0.8
10	0.12833333015441895	0.39500001072883606	0.5359482765197754	0.7222222089767456	0.779224157333374	0.8197115659713745	0.7
average	0.2280333310365677	0.44771666526794435	0.5721810460090637	0.7372685134410858	0.7682629346847534	0.795660650730133	0.8

loss

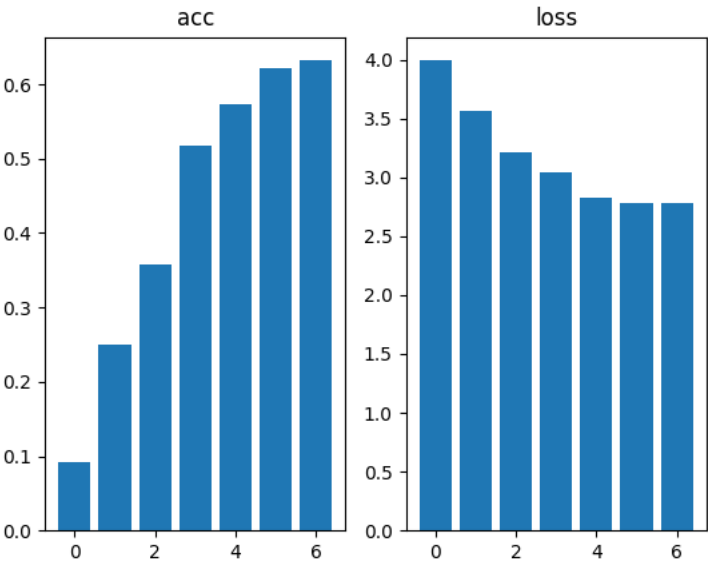
count/ 比例	0.10: 0.70: 0.2	0.20: 0.60: 0.2	0.30: 0.50: 0.2	0.40: 0.40: 0.2	0.50: 0.30: 0.2	0.60: 0.20: 0.2	
1	3.2289278507232666	2.0544815063476562	1.963160753250122	1.487836241722107	1.497024655342102	1.7599220275878906	1.181
2	3.6455414295196533	2.1130411624908447	1.4585685729980469	1.6390678882598877	1.0795620679855347	0.9385173320770264	1.096
3	3.671499252319336	2.506455183029175	2.3841123580932617	1.6479219198226929	1.6757620573043823	1.6705248355865479	1.059
4	2.732400417327881	1.7931513786315918	1.8717366456985474	1.0893120765686035	1.5090388059616089	1.4218674898147583	1.478
5	3.262174129486084	2.337635040283203	1.8584901094436646	1.1539219617843628	1.2876020669937134	1.4476985931396484	1.124
6	3.7884442806243896	2.4000627994537354	1.6614071130752563	1.5046242475509644	1.4528886079788208	1.2691727876663208	1.19
7	2.765063524246216	2.2953836917877197	2.127274990081787	1.5792418718338013	1.2278428077697754	1.2399609088897705	0.975
8	3.513725519180298	1.9367892742156982	2.259281873703003	1.3358622789382935	1.4865803718566895	1.1406867504119873	0.85
9	3.3976376056671143	2.6378209590911865	1.559416651725769	1.1576420068740845	1.6651852130889893	1.323104977607727	1.355
10	3.2904739379882812	2.4179110527038574	2.6605658531188965	1.5366156101226807	1.1955764293670654	0.9999915361404419	1.74
average	3.329588794708252	2.2492732048034667	1.9804014921188355	1.4132046103477478	1.4077063083648682	1.3211447238922118	1.20



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	0.2355833500623703	0.23608332872390747	0.45508620142936707	0.4861111044883728	0.6340948343276978	0.5892738699913025	
2	0.029999999329447746	0.2471666783094406	0.5130603313446045	0.5601851940155029	0.5992241501808167	0.6462615728378296	
3	0.056333333253860474	0.2342499941587448	0.34780174493789673	0.5254629850387573	0.5031896829605103	0.6361488699913025	0
4	0.1040833368897438	0.2849166691303253	0.1901293247938156	0.46875	0.6113362312316895	0.5637848377227783	
5	0.11508332937955856	0.24774999916553497	0.4544396698474884	0.5717592835426331	0.5170689821243286	0.6891578435897827	0
6	0.05275000259280205	0.3099166750907898	0.4206896722316742	0.5671296119689941	0.567844808101654	0.6191976070404053	(
7	0.11383333057165146	0.1942499876022339	0.29530173540115356	0.5254629850387573	0.5681034326553345	0.621974527835846	0
8	0.08541666716337204	0.26350000500679016	0.33469825983047485	0.5219907164573669	0.53870689868927	0.5940815210342407	0
9	0.06499999761581421	0.24908332526683807	0.2981896698474884	0.4826388955116272	0.6112068891525269	0.66379314661026	0
10	0.0637499988079071	0.22700001299381256	0.2725431025028229	0.4722222089767456	0.5810775756835938	0.5856680870056152	0
average	0.09218333456665277	0.24939166754484177	0.3581939712166786	0.5181712985038758	0.5731853485107422	0.6209341883659363	0

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	3.9670355319976807	3.0805869102478027	3.4377965927124023	3.3627817630767822	2.162609100341797	3.0050508975982666	2.64:
2	4.210041046142578	3.358847141265869	3.3439040184020996	3.021275758743286	3.1971352100372314	2.5639970302581787	2.50:
3	4.2547807693481445	4.391375541687012	2.7874720096588135	3.8426637649536133	2.9046225547790527	2.8061349391937256	3.466:
4	3.5199835300445557	4.117164134979248	3.0338809490203857	2.787790536880493	2.745626211166382	3.9971559047698975	2.5:
5	3.7266640663146973	3.0574207305908203	3.516650915145874	2.650616407394409	2.9172513484954834	2.147733211517334	3.046:
6	4.172110080718994	3.852867364883423	3.3969826698303223	2.225717782974243	3.391103744506836	2.6829464435577393	3.514:
7	4.264894008636475	3.600917339324951	2.977022171020508	2.9133472442626953	2.628086566925049	2.5199410915374756	2.957:
8	4.083675384521484	3.5949277877807617	3.2587103843688965	2.814436435699463	2.773996353149414	2.948824644088745	2.374:
9	3.7975237369537354	3.2840805053710938	3.319138765335083	3.038895845413208	2.8204119205474854	1.951639175415039	2.001:
10	3.9289700984954834	3.269935369491577	3.0672616958618164	3.774430274963379	2.702028751373291	3.217285394668579	2.666:
average	3.9925678253173826	3.5608122825622557	3.21388201713562	3.0431955814361573	2.824287176132202	2.784070873260498	2.77



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

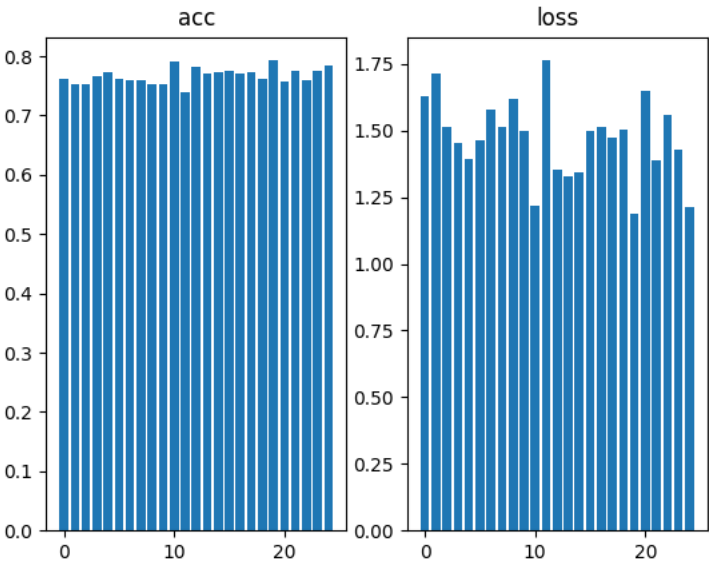
acc

count/ 波段索引	1	2	3	4	5	6	
1	0.7354525923728943	0.7640500664710999	0.7328000664710999	0.7868865728378296	0.7618948817253113	0.7735410928726196	0.7271
2	0.7990301847457886	0.7458968758583069	0.7663295269012451	0.7906166911125183	0.7797994017601013	0.7855603098869324	0.8221
3	0.8146551847457886	0.7186256647109985	0.7231846451759338	0.7378564476966858	0.7341263294219971	0.7147712111473083	0.7501
4	0.7724635004997253	0.7974552512168884	0.7277437448501587	0.7651275992393494	0.7699353098869324	0.7674071788787842	0.7561
5	0.7651275992393494	0.7410891652107239	0.7652519941329956	0.7059847712516785	0.7484250664710999	0.7205321788787842	0.7191
6	0.7603199481964111	0.7461455464363098	0.746974527835846	0.7737897634506226	0.8011853098869324	0.7675314545631409	0.8021
7	0.7594910264015198	0.658985435962677	0.7674071788787842	0.7879641652107239	0.7990301847457886	0.8181365728378296	0.7631
8	0.7197032570838928	0.7928962111473083	0.7781001329421997	0.7652519941329956	0.7461455464363098	0.7302718758583069	0.7431
9	0.7315981388092041	0.7856846451759338	0.7676557898521423	0.7545589804649353	0.8132045269012451	0.7628481388092041	0.7111
10	0.7567141652107239	0.7879641652107239	0.7605686187744141	0.8063660264015198	0.7686091065406799	0.7859333753585815	0.7911
average	0.7614555597305298	0.7538793027400971	0.7536016225814819	0.7674403011798858	0.7722355663776398	0.7626533389091492	0.7591

loss

count/ 波段索引	1	2	3	4	5	6	
1	2.5702121257781982	1.4034186601638794	1.5697879791259766	1.3761613368988037	1.4109280109405518	1.3014321327209473	2.035

count/ 波段索引	1	2	3	4	5	6	
2	1.2678650617599487	1.7083081007003784	1.4741041660308838	1.3528618812561035	1.3281410932540894	1.290221095085144	0.94
3	1.137821078300476	2.4804904460906982	2.0070273876190186	1.478249430656433	1.757352590560913	2.1610472202301025	1.491
4	1.2505755424499512	0.9784629344940186	1.7996872663497925	1.3261255025863647	1.2797505855560303	1.4141892194747925	1.57
5	1.434895634651184	1.5462061166763306	1.2224177122116089	2.3620855808258057	1.727048397064209	1.6896222829818726	1.818
6	1.3134255409240723	2.595977306365967	1.5010154247283936	1.3480745553970337	1.237338900566101	1.403372883796692	0.938
7	1.462486743927002	2.5542960166931152	1.4503026008605957	1.2715264558792114	1.133512020111084	1.1705901622772217	1.287
8	2.1269285678863525	1.5340516567230225	1.315232515335083	1.433039903640747	1.5784891843795776	1.6436983346939087	1.785
9	2.2374370098114014	1.3314045667648315	1.2636278867721558	1.4500274658203125	1.0833271741867065	1.199508547782898	2.712
10	1.473559856414795	0.9826148152351379	1.532702922821045	1.1500636339187622	1.3828837871551514	1.367043137550354	1.19
average	1.6275207161903382	1.711523061990738	1.5135905861854553	1.4548215746879578	1.3918771743774414	1.4640725016593934	1.578



作图如下

RGB

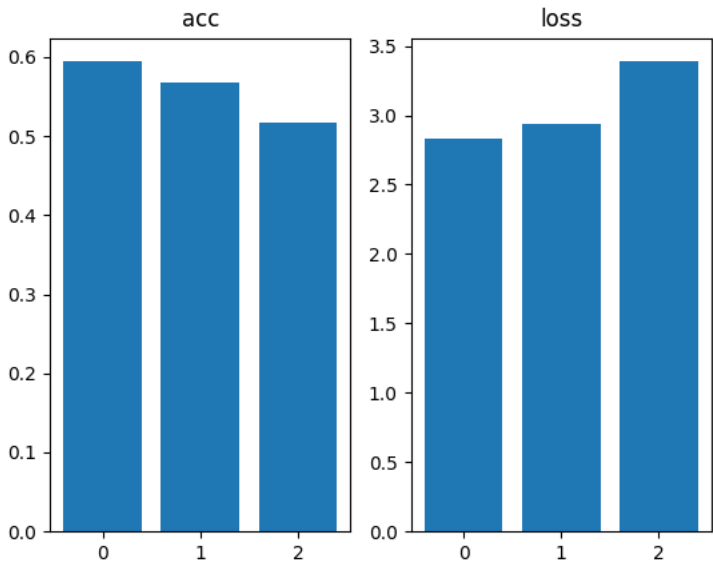
acc

count/波段索引	R	G	B
1	0.589398205280304	0.6003398299217224	0.5530918836593628
2	0.6290616989135742	0.4761273264884949	0.5906001329421997
3	0.6036969423294067	0.555620014667511	0.5468335747718811
4	0.5421501994132996	0.5734001994132996	0.5580238699913025
5	0.5554956793785095	0.5954078435897827	0.4860328137874603
6	0.5527188181877136	0.602495014667511	0.5118534564971924
7	0.5736488699913025	0.6016660928726196	0.5325348377227783
8	0.658985435962677	0.5176558494567871	0.33803051710128784
9	0.6191976070404053	0.5575265288352966	0.5480355024337769
10	0.6199436187744141	0.5895225405693054	0.511480450630188
average	0.5944297075271606	0.566976124048233	0.5176517039537429

loss

count/波段索引	R	G	B
1	2.740489959716797	3.095294952392578	3.4931371212005615
2	2.7393898963928223	3.2378108501434326	2.6522862911224365

count/波段索引	R	G	B
3	3.4625935554504395	2.518115758895874	3.2359941005706787
4	2.548192262649536	2.907376289367676	3.2492563724517822
5	3.377916097640991	2.943293333053589	3.559067726135254
6	2.8337314128875732	2.972339153289795	4.030982971191406
7	2.3537681102752686	3.3101871013641357	3.9205102920532227
8	2.2653255462646484	2.8833887577056885	2.8467090129852295
9	2.604823589324951	2.5767767429351807	2.9761648178100586
10	3.416520595550537	2.951685905456543	3.918877601623535
average	2.8342751026153565	2.9396268844604494	3.3882986307144165



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:  [20 11 25 13 16 22 24 18 15  5 14 17  4  6 19  1 23  7  8 21  2  9  3 10
12]
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；

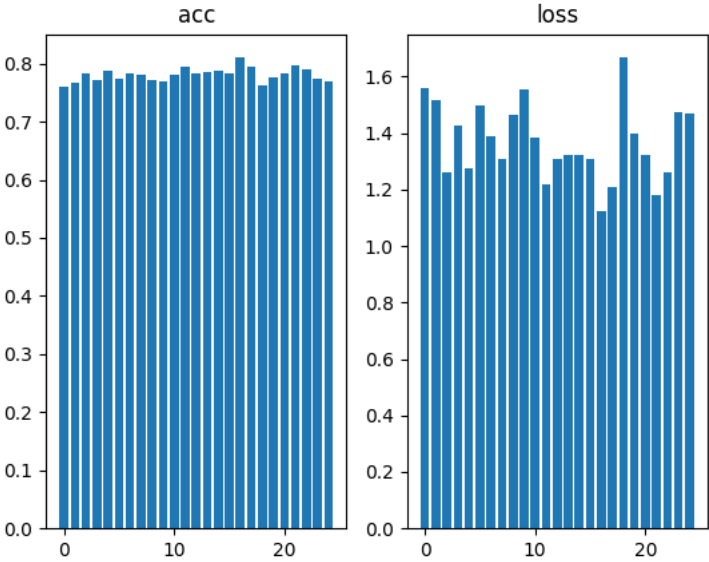
```
cd Ecust/louishsu/recognize_stage_2
python
>>> from main_update_config import main_3_3
>>> main_3_3()      # 训练、测试
>>> main_3_3(True)  # 输出文件到`images`
```

acc							
count/ 组合数	1	2	3	4	5	6	
1	0.7796	0.7781001329421997	0.8266744017601013	0.7689820528030396	0.8015583753585815	0.75227952003479	0.7601
2	0.7846	0.7329244017601013	0.7811256647109985	0.7689820528030396	0.7989057898521423	0.7928962111473083	0.7741

count/ 组合数	1	2	3	4	5	6	
3	0.7136	0.7135692834854126	0.7592423558235168	0.7449436187744141	0.7386853098869324	0.7472231388092041	0.7193
4	0.7592	0.7628481388092041	0.7990301847457886	0.83040452003479	0.8241462111473083	0.7185013294219971	0.8003
5	0.8157	0.8712698817253113	0.7298988699913025	0.7505802512168884	0.7906166911125183	0.7567141652107239	0.7593
6	0.7603	0.7807525992393494	0.8002320528030396	0.7603199481964111	0.8132045269012451	0.8121269941329956	0.7993
7	0.7243999999999999	0.7470988035202026	0.8194628357887268	0.8169346451759338	0.75526362657547	0.8118783235549927	0.7993
8	0.752	0.7771468758583069	0.7846070528030396	0.7133206725120544	0.8085212111473083	0.7914456725120544	0.8073
9	0.7281	0.7698110342025757	0.7688577175140381	0.8265500664710999	0.7889174818992615	0.8372430205345154	0.7753
10	0.7846	0.7373591065406799	0.7539373636245728	0.7439903616905212	0.7667025923728943	0.7185013294219971	0.8253
average	0.7602099999999999	0.7670880258083344	0.7823068499565125	0.7725008189678192	0.7886521816253662	0.7738809704780578	0.7823

loss

count/ 组合数	1	2	3	4	5	6	
1	1.0849	1.20951247215271	0.9960632920265198	1.5322537422180176	1.258631944656372	1.9376261234283447	1.5811
2	1.4321	1.9979057312011719	1.496315598487854	1.6169692277908325	1.2652122974395752	1.1393916606903076	1.7963
3	1.8938	2.2208733558654785	1.402435302734375	1.441996693611145	1.393936038017273	1.4148207902908325	1.9041
4	1.2202	1.3079190254211426	0.9556387662887573	0.8178081512451172	0.9970594644546509	2.173203468322754	1.1483
5	1.0811	0.7321515679359436	1.5946104526519775	1.430275559425354	1.1846683025360107	1.2979881763458252	1.3431
6	1.597	1.337653636932373	1.0360878705978394	1.7308735847473145	1.0976319313049316	1.1569151878356934	1.0341
7	1.6822	1.8375422954559326	0.9364846348762512	1.0179251432418823	1.635854959487915	1.260295033454895	1.4711
8	1.9361	1.4223142862319946	1.284011960029602	1.8943277597427368	1.2642065286636353	1.2285685539245605	1.3941
9	2.3679	1.4297394752502441	1.3347383737564087	1.134124994277954	1.1964234113693237	0.8202165961265564	1.1501
10	1.3147	1.6924331188201904	1.5829548835754395	1.673750638961792	1.4822170734405518	2.550248384475708	1.0711
average	1.5610000000000002	1.5188044965267182	1.2619341135025024	1.4290305495262146	1.277584195137024	1.4979273974895477	1.3901



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`
```

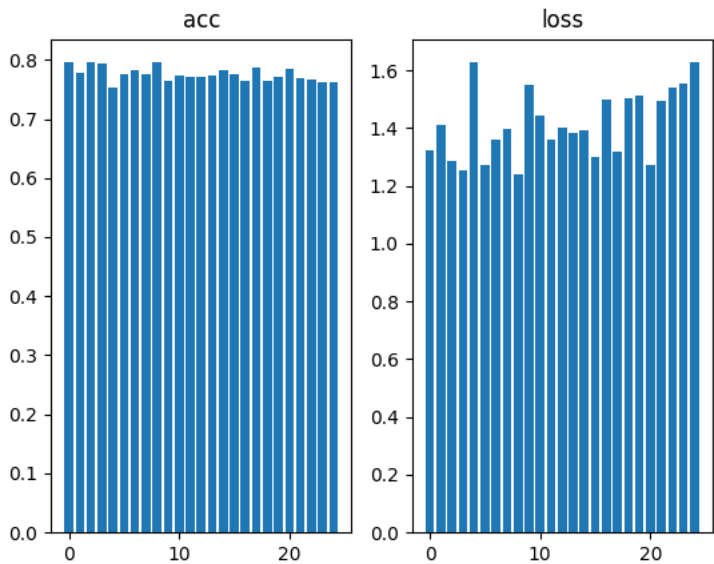
acc

count/ 波段步 长	1	2	3	4	5	6	
1	0.7654000000000001	0.7882128357887268	0.7927718758583069	0.8288295269012451	0.7689820528030396	0.7999833822250366	0.7654000000000001
2	0.8495999999999999	0.8145307898521423	0.8410974740982056	0.8025115728378296	0.7763179540634155	0.7641744017601013	0.7763179540634155
3	0.7606	0.715724527835846	0.7520307898521423	0.7206564545631409	0.7761936187744141	0.7655006647109985	0.7430769232952803
4	0.8086	0.7879641652107239	0.7362814545631409	0.7773955464363098	0.7770226001739502	0.8204160928726196	0.8495999999999999
5	0.7854000000000001	0.77088862657547	0.7544346451759338	0.7689820528030396	0.7497513294219971	0.7667025923728943	0.7544346451759338
6	0.8083	0.7759449481964111	0.8396468758583069	0.8181365728378296	0.7723391652107239	0.6991462111473083	0.7843076923295280
7	0.7686	0.8190898895263672	0.7894147634506226	0.8146551847457886	0.6998507976531982	0.7651275992393494	0.8086
8	0.8205	0.7641744017601013	0.7940981388092041	0.7882128357887268	0.7229360342025757	0.7722148895263672	0.7758507976531982
9	0.7698	0.7638014554977417	0.8347148895263672	0.8436256647109985	0.7291942834854126	0.7854360342025757	0.7879641652107239
10	0.8197	0.773914098739624	0.8219910264015198	0.7808769941329956	0.7543103098869324	0.8156083822250366	0.7821942834854126
average	0.79565	0.7774245738983154	0.795648193359375	0.7943882405757904	0.7526898145675659	0.7754310250282288	0.7821942834854126

loss

count/ 波段步 长	1	2	3	4	5	6	
1	1.7599	1.2868307828903198	1.0641248226165771	1.0114271640777588	1.528338074684143	1.2064138650894165	1.762231945991516
2	0.9385	1.1474463939666748	0.9652187824249268	1.240093469619751	1.6246412992477417	1.391249179840088	1.226407647132873
3	1.6705	2.5013842582702637	1.9802199602127075	1.7260664701461792	1.3630198240280151	1.4539873600006104	1.753726363182067
4	1.4219	1.1701982021331787	1.8089231252670288	1.251643419265747	1.1440190076828003	0.935849130153656	0.713849782943725
5	1.4477	1.3400121927261353	1.7310805320739746	1.340477466583252	1.758177399635315	1.2935371398925781	1.389972805976867
6	1.2692	1.1802505254745483	0.9139976501464844	1.1442748308181763	1.540682077407837	1.889602541923523	1.201695799827575
7	1.24	1.106026291847229	1.1167628765106201	1.1172213554382324	1.6520781517028809	1.3885794878005981	1.13937401771545
8	1.1407	1.222273349761963	1.333425760269165	1.6387486457824707	2.196079969406128	1.2181408405303955	1.576855897903442
9	1.3231	1.7588791847229004	0.7835788130760193	0.9506422877311707	1.961113452911377	1.0914945602416992	1.518744587898254
10	1.0	1.4130648374557495	1.167898416519165	1.1154868602752686	1.5061657428741455	0.8373400568962097	1.2988573312759
average	1.32115	1.4126366019248962	1.2865230739116669	1.2536081969738007	1.6274314999580384	1.2706194162368774	1.358171617984777





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

Multi

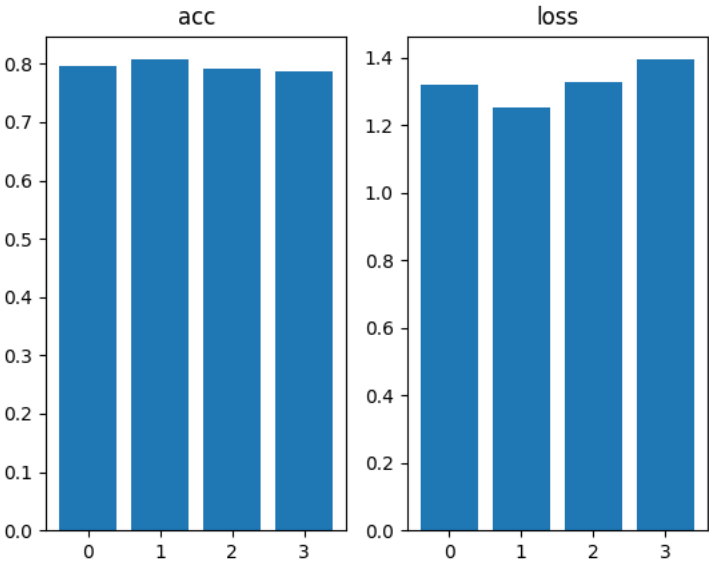
acc

count/光照	illum1	illum2	illum3	normal
1	0.7713004350662231	0.7843137383460999	0.7638190984725952	0.738916277885437
2	0.9158878326416016	0.8536585569381714	0.8445596098899841	0.7834101319313049
3	0.7581395506858826	0.7926267385482788	0.7487437129020691	0.7373737096786499
4	0.7836538553237915	0.8333333134651184	0.8288770318031311	0.7901785969734192
5	0.782608687877655	0.7979274392127991	0.7536945939064026	0.807881772518158
6	0.8227272629737854	0.7941176295280457	0.790243923664093	0.824999988079071
7	0.7990654110908508	0.772946834564209	0.7465437650680542	0.753926694393158
8	0.77625572681427	0.8350515365600586	0.8284313678741455	0.8443396091461182
9	0.7722222208976746	0.8017621040344238	0.7809523940086365	0.7216981053352356
10	0.7771739363670349	0.8059701323509216	0.8238095045089722	0.8589743375778198
average	0.795903491973877	0.8071708023548126	0.7909675002098083	0.7861699223518371

loss

count/光照	illum1	illum2	illum3	normal
1	1.9118068218231201	1.699059009552002	1.554986834526062	1.8774585723876953
2	0.6065924167633057	0.9490084052085876	0.8108446002006531	1.3798937797546387
3	1.6098906993865967	1.5571985244750977	1.7089624404907227	1.8422045707702637

count/光照	illum1	illum2	illum3	normal
4	1.9842249155044556	1.0618343353271484	1.3655422925949097	1.2866477966308594
5	1.2747846841812134	1.3903290033340454	1.7146602869033813	1.4446815252304077
6	1.156367540359497	1.545818567276001	1.3807940483093262	1.0055325031280518
7	1.0562026500701904	1.1387536525726318	1.3035560846328735	1.49080491065979
8	1.2567758560180664	1.0771069526672363	1.1608532667160034	1.062200903892517
9	1.160076379776001	1.25908625125885	1.1781690120697021	1.665277123451233
10	1.1786777973175049	0.8577198386192322	1.1102075576782227	0.8953640460968018
average	1.319539976119995	1.2535914540290833	1.3288576424121856	1.395006573200226



作图如下

RGB

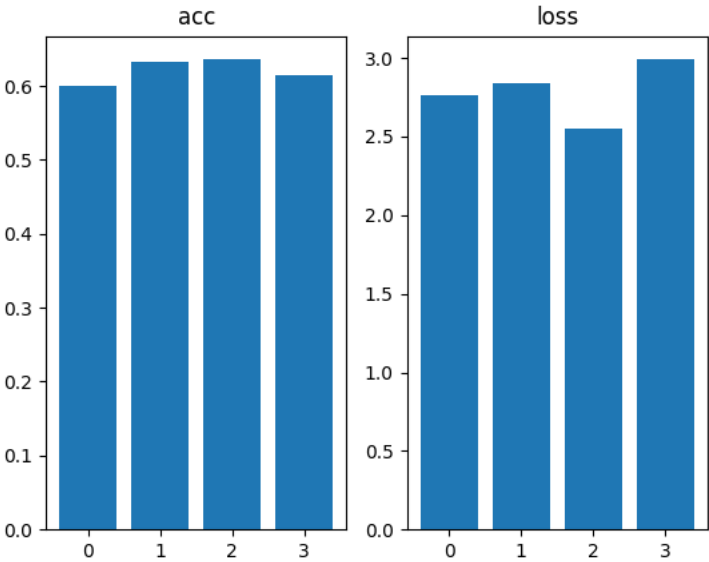
acc

count/光照	illum1	illum2	illum3	normal
1	0.5246636867523193	0.656862735748291	0.6331658363342285	0.546798050403595
2	0.6168224215507507	0.6682927012443542	0.6424870491027832	0.6543778777122498
3	0.6186046600341797	0.6267281174659729	0.6633166074752808	0.6363636255264282
4	0.4951923191547394	0.5666666626930237	0.5882353186607361	0.6026785969734192
5	0.6826087236404419	0.6891191601753235	0.6699507236480713	0.7142857313156128
6	0.6363636255264282	0.5784313678741455	0.6634146571159363	0.5950000286102295
7	0.6495327353477478	0.6038647294044495	0.617511510848999	0.6125654578208923
8	0.5890411138534546	0.6030927896499634	0.6225489974021912	0.5613207817077637
9	0.6499999761581421	0.6828193664550781	0.6904761791229248	0.6273584961891174
10	0.532608687877655	0.6517412662506104	0.5666666626930237	0.5854700803756714
average	0.5995437949895859	0.6327618896961212	0.6357773542404175	0.6136218726634979

loss

count/光照	illum1	illum2	illum3	normal
1	3.2701876163482666	2.434255361557007	2.800248146057129	3.497804641723633
2	2.486541748046875	2.397963762283325	2.5875864028930664	2.8014755249023438
3	2.516329288482666	2.6953604221343994	2.640336275100708	3.4280123710632324
4	4.320362567901611	4.636221885681152	3.313593626022339	3.6898186206817627
5	2.1427979469299316	2.4807891845703125	2.0634632110595703	1.9231728315353394

count/光照	illum1	illum2	illum3	normal
6	2.2589523792266846	2.834406852722168	2.221442461013794	3.4742658138275146
7	2.640953302383423	2.558797836303711	2.5836374759674072	2.2949419021606445
8	2.920504570007324	2.9745986461639404	2.4328105449676514	3.4632396697998047
9	2.0120863914489746	1.9804511070251465	1.6457183361053467	2.1853973865509033
10	3.0496740341186523	3.442809820175171	3.2342188358306885	3.150097131729126
average	2.761838984489441	2.843565487861633	2.55230553150177	2.9908225893974305



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

Multi

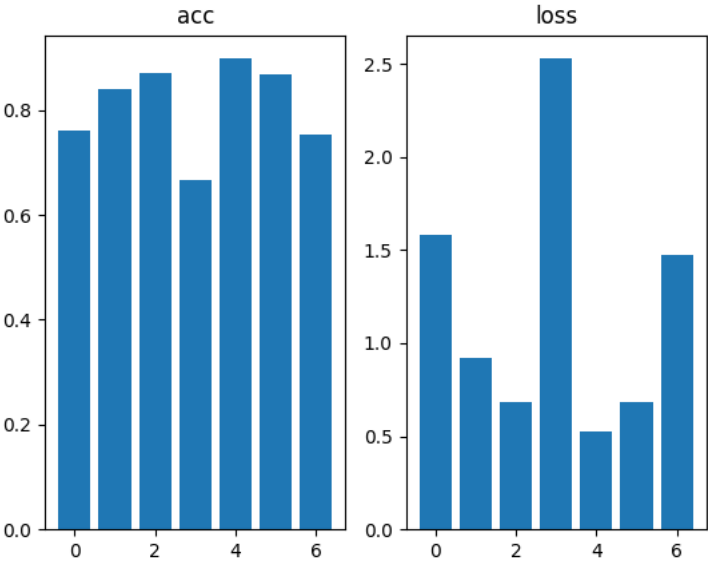
acc

count/ 位置	1	2	3	4	5	6	
1	0.7350427508354187	0.8494623899459839	0.84375	0.6476190686225891	0.9081632494926453	0.8363636136054993	0.676
2	0.8482142686843872	0.8636363744735718	0.8839285969734192	0.7591623067855835	0.9115044474601746	0.9298245906829834	0.80
3	0.7008547186851501	0.78378379344494019	0.7946428656578064	0.6384180784225464	0.8857142925262451	0.8529411554336548	0.752
4	0.7647058963775635	0.8899082541465759	0.8534482717514038	0.6460674405097961	0.9117646813392639	0.8653846383094788	0.830
5	0.7722772359848022	0.8241758346557617	0.8409090638160706	0.7098445892333984	0.9122806787490845	0.8571428656578064	0.669
6	0.75789475440979	0.8407079577445984	0.9100000262260437	0.6685393452644348	0.8425925970077515	0.920634925365448	0.7
7	0.7575757503509521	0.844660222530365	0.8834951519966125	0.6091370582580566	0.8442623019218445	0.8440366983413696	
8	0.752212405204773	0.8347107172012329	0.9217391014099121	0.6589595079421997	0.9579831957817078	0.8865979313850403	0.813
9	0.7264150977134705	0.7878788113594055	0.8684210777282715	0.6524063944816589	0.859649121761322	0.8613861203193665	0.712
10	0.8048780560493469	0.875	0.9134615659713745	0.6864864826202393	0.9473684430122375	0.8367347121238708	0.752
average	0.7620070934295654	0.8393924355506897	0.8713795721530915	0.6676640272140503	0.8981283009052277	0.8691047251224517	0.752

loss

count/ 位置	1	2	3	4	5	6	
1	2.1002495288848877	1.438583493232727	1.2262259721755981	2.935471773147583	0.6786747574806213	0.815438985824585	1.8
2	1.0427807569503784	0.9518938660621643	0.6444579362869263	1.7006219625473022	0.5890639424324036	0.2321455031633377	0.9
3	2.659806251525879	0.947240948677063	1.2636910676956177	2.6519103050231934	0.7076479196548462	0.6385489106178284	2.1

count/ 位置	1	2	3	4	5	6	
4	1.8502506017684937	0.629801869392395	0.6736916899681091	3.3532602787017822	0.3929300606250763	0.7328631281852722	1.
5	1.685506820678711	1.1449213027954102	0.8723421692848206	2.489414930343628	0.41885071992874146	0.6446256041526794	1.9
6	1.47279691696167	0.6383172869682312	0.343819260597229	3.069955587387085	0.7522889375686646	0.49659183621406555	1.1
7	1.4322230815887451	0.6172358393669128	0.4645536243915558	2.213364362716675	0.5340311527252197	0.9691110849380493	1.7
8	1.4456440210342407	0.7778286337852478	0.2887769043445587	2.4850032329559326	0.2351364642381668	0.7719354629516602	1.3
9	1.0842303037643433	1.3220677375793457	0.6347894668579102	2.382858991622925	0.7659170031547546	0.6920584440231323	1.6
10	1.0406419038772583	0.7705426216125488	0.4102778732776642	2.0021066665649414	0.1834125816822052	0.8639852404594421	1.0
average	1.5814130187034607	0.9238433599472046	0.6822625964879989	2.5283968091011046	0.52579535394907	0.6857304200530052	1.

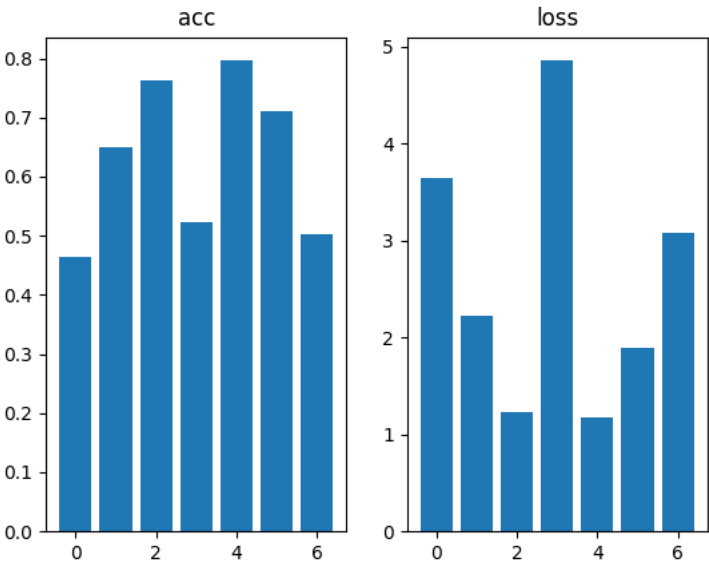


作图如下

count/ 位置	1	2	3	4	5	6	
1	0.4615384638309479	0.602150559425354	0.7395833134651184	0.5190476179122925	0.7653061151504517	0.6818181872367859	0.4
2	0.5089285969734192	0.6931818127632141	0.7767857313156128	0.5654450058937073	0.8053097128868103	0.6754385828971863	0.5
3	0.49572649598121643	0.6936936974525452	0.7589285969734192	0.5141242742538452	0.7809523940086365	0.7156862616539001	0.5
4	0.4117647111415863	0.60550457239151	0.6896551847457886	0.449438214302063	0.7450980544090271	0.6442307829856873	0.47
5	0.594059407711029	0.6813187003135681	0.8295454382896423	0.5958549380302429	0.9122806787490845	0.7767857313156128	0.5
6	0.4842105209827423	0.6814159154891968	0.769999809265137	0.5224719047546387	0.7870370149612427	0.7063491940498352	0.4
7	0.4444444477558136	0.6407766938209534	0.708737850189209	0.5380710363388062	0.7786885499954224	0.7064220309257507	
8	0.44247788190841675	0.6198347210884094	0.7217391133308411	0.4393063485622406	0.7647058963775635	0.7319587469100952	0.5
9	0.4245283007621765	0.6363636255264282	0.8157894611358643	0.6577540040016174	0.8421052694320679	0.7524752616882324	
10	0.38211381435394287	0.6428571343421936	0.817307710647583	0.4378378391265869	0.780701756477356	0.7142857313156128	0.44
average	0.4649792641401291	0.6497097432613372	0.7628072381019593	0.5239351183176041	0.7962185442447662	0.7105450510978699	0.5

count/ 位置	1	2	3	4	5	6	
1	3.7750260829925537	3.3099782466888428	1.408963680267334	3.976470708847046	2.1188347339630127	2.2280445098876953	3.05
2	4.265000343322754	1.753989815711975	1.4046915769577026	3.815946102142334	1.2194796800613403	1.74789297580719	2.785
3	3.2085747718811035	1.8937443494796753	1.0598593950271606	6.231753826141357	1.1170971393585205	1.863623857498169	2.051

count/ 位置	1	2	3	4	5	6	
4	4.862539291381836	2.1147167682647705	1.7244702577590942	8.933626174926758	1.4212474822998047	2.854114532470703	3.0501
5	2.4173824787139893	2.43808650970459	1.0041673183441162	2.760826826095581	0.8115078210830688	1.3418635129928589	3.461
6	3.729260206222534	2.4967100620269775	1.0652590990066528	3.5519332885742188	1.245143175125122	1.5306737422943115	4.791
7	2.997537612915039	2.2303619384765625	1.530517816543579	3.871936082839966	1.3292776346206665	1.6533740758895874	3.171
8	3.6281917095184326	1.866903305053711	1.2190266847610474	6.415624141693115	1.0565248727798462	1.9265682697296143	2.711
9	3.3597195148468018	2.17751145362854	0.6943118572235107	2.209991693496704	0.6237087845802307	1.867114782333374	2.7481
10	4.2403082847595215	1.9503554105758667	1.2204581499099731	6.794689655303955	0.8032512068748474	1.8992024660110474	2.8791
average	3.6483540296554566	2.223235785961151	1.2331725835800171	4.8562798500061035	1.174607253074646	1.891247272491455	3.0731



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

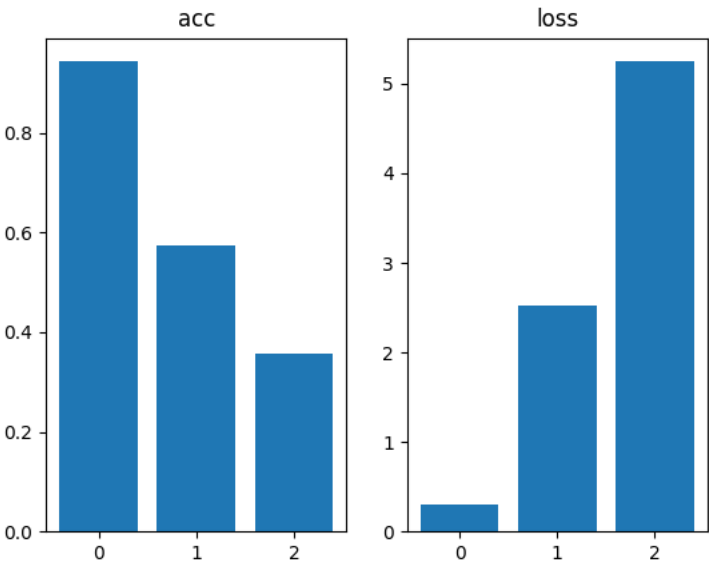
acc

count/眼镜	1	5	6
1	0.9310986995697021	0.5190476179122925	0.3048780560493469
2	0.9659090638160706	0.6605504751205444	0.6024096608161926
3	0.9206641912460327	0.5115207433700562	0.2857142984867096
4	0.9490908980369568	0.594059407711029	0.3636363744735718
5	0.937381386756897	0.5851528644561768	0.31506848335266113
6	0.9591836929321289	0.6081081032752991	0.2647058963775635
7	0.9357798099517822	0.5192307829856873	0.25
8	0.9657142758369446	0.6184210777282715	0.42105263471603394
9	0.9270073175430298	0.5067873597145081	0.30000001192092896
10	0.9433272480964661	0.6288659572601318	0.46590909361839294
average	0.9435156583786011	0.5751744389533997	0.3573374509811401

loss

count/眼镜	1	5	6
1	0.3462700843811035	3.630403995513916	6.2826313972473145
2	0.20754124224185944	1.9422376155853271	2.979490041732788

count/眼镜	1	5	6
3	0.4957267940044403	3.488509178161621	5.188406467437744
4	0.2756806015968323	2.6194188594818115	6.474323749542236
5	0.4004882574081421	2.4297685623168945	5.964469909667969
6	0.1860966831445694	2.0494914054870605	7.332704067230225
7	0.33390259742736816	2.3160669803619385	4.811129570007324
8	0.21254678070545197	2.1269025802612305	4.600955009460449
9	0.32599544525146484	2.7271878719329834	5.228770732879639
10	0.2716965079307556	1.8740746974945068	3.6335084438323975
average	0.30559449940919875	2.520406174659729	5.249638938903809



作图如下

RGB

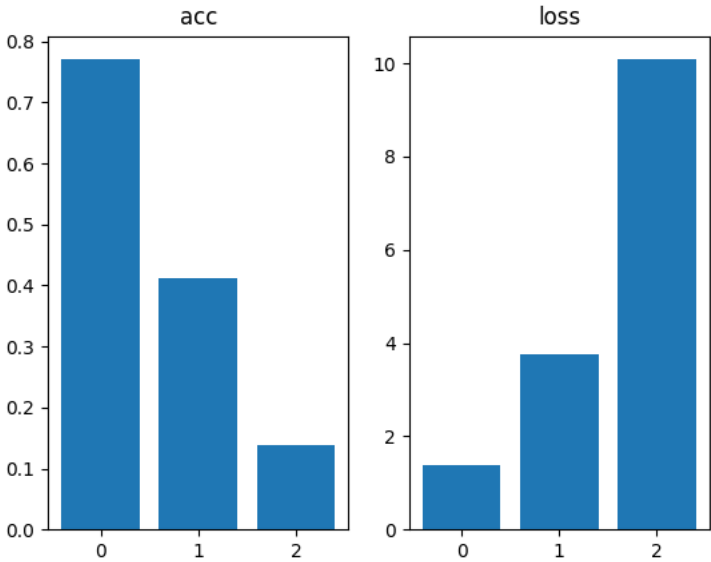
acc

count/眼镜	1	5	6
1	0.7467411756515503	0.3619047701358795	0.13414634764194489
2	0.7708333134651184	0.5045871734619141	0.21686747670173645
3	0.7804428339004517	0.4377880096435547	0.12857143580913544
4	0.7400000095367432	0.2772277295589447	0.051948051899671555
5	0.8159393072128296	0.5589519739151001	0.1780821979045868
6	0.7625231742858887	0.4234234094619751	0.11764705926179886
7	0.7816513776779175	0.36538460850715637	0.17105263471603394
8	0.7714285850524902	0.359649121761322	0.06578947603702545
9	0.7974452376365662	0.4524886906147003	0.21666666865348816
10	0.7367458939552307	0.37628865242004395	0.10227272659540176
average	0.7703750908374787	0.4117694139480591	0.13830440752208234

loss

count/眼镜	1	5	6
1	1.425113558769226	5.241634845733643	7.647731304168701
2	1.4867364168167114	3.212266445159912	7.780185699462891
3	1.2322335243225098	3.0852267742156982	14.181615829467773
4	1.669318675994873	4.670815944671631	18.919132232666016

count/眼镜	1	5	6
5	1.2373433113098145	3.087848663330078	5.777073383331299
6	1.4901782274246216	4.334621429443359	6.76389217376709
7	1.213112235069275	3.787665367126465	8.484713554382324
8	1.1976898908615112	3.630889892578125	13.033319473266602
9	1.2211518287658691	2.864997148513794	5.304786205291748
10	1.4935593605041504	3.6773130893707275	12.944067001342773
average	1.3666437029838563	3.7593279600143434	10.083651685714722



作图如下