

## Final development iteration:

During this period we mainly gathered statistics about game and the database used.

- Our main balanced dataset is the one with 30 actions  
**(dataset\_30\_actions\_fcb\_rma\_full\_int.csv)**
- shape of the dataset: (24016, 51) with 24016 frames/samples/states of the game, and 51 features (frame number, action label, .....). Match is: 45 min long between FCB and RMA
- team holding the ball distribution is: 11092 frames with team1 holding, 12924 frames with team2 holding the ball;
- new ball detection solved the problem of multiple ball detection since the new dataset does not have multiple ball coordinates in one frame;
- action frequency:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
164	387	863	451	646	1178	548	1015	920	116	777	1090	547	1438	2140	262	619	335	434	901	926	521	932	1346	172	441	967	773	1789	1318

### frequency of team1 and team2 players in each frame

#players of team 1 in frame : #frames with such amount of players in team1

0 : 147  
1 : 540  
2 : 1325  
3 : 2449  
4 : 3647  
5 : 4610  
6 : 4492  
7 : 3484  
8 : 2080  
9 : 900  
10 : 257  
11 : 72  
12 : 11  
13 : 2

average players from team1: 5.320411392405063

for example: there are 1325 frames where 2 players from team1 were detected

#players of team 2 in frame : #frames with such amount of players in team2

0 : 138  
1 : 291  
2 : 659  
3 : 1385  
4 : 2370  
5 : 3730  
6 : 4017  
7 : 3621  
8 : 3169  
9 : 2486  
10 : 1444  
11 : 536  
12 : 127  
13 : 39  
14 : 4

average players from team2: 6.3912391738840775

### **Custom object detection to solely detect the ball:**

New ball detector is based on using transfer learning from a pre-trained YOLOv3 model in the training. We gathered a collection of 336 (266 train + 70 validation) match image samples and marked the positions of the ball in them. Then, we used this data to train our custom ball detector:

Training parameters:

ImageAI library

Batch\_size = 8,

Number\_of\_Epochs = 150

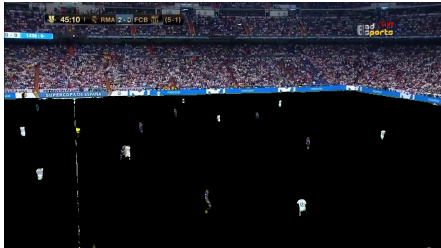
To measure the accuracy 100 frames were sampled from the match. And correct detections were counted;

Ball Detecting Approach	Accuracy (correct/total)	Time Performance (sec)
OpenCV	50% (50/100)	0.0235
Transfer Learning (YOLOv3)	70% (70/100)	0.0605

note: testing batch also had frames with no ball. In such case if ball was not detected and indeed there was no ball, it was considered as a correct detection;

### **How K-means works:**

- 1) Wait until at least 16 contours( players) is detected
- 2) Remove green color of field:



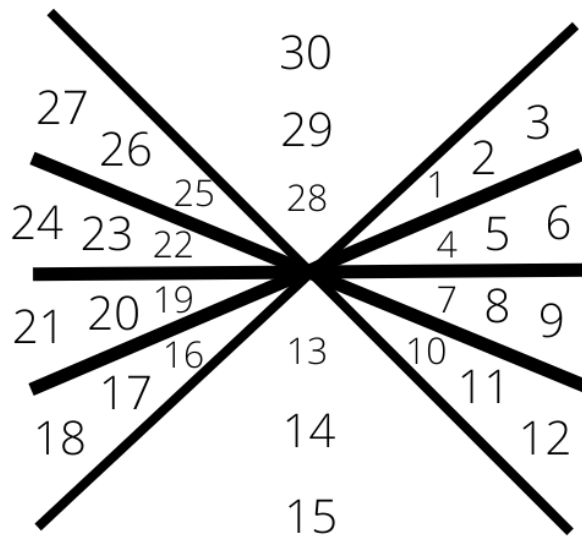
- 3) Remove everything above the field.



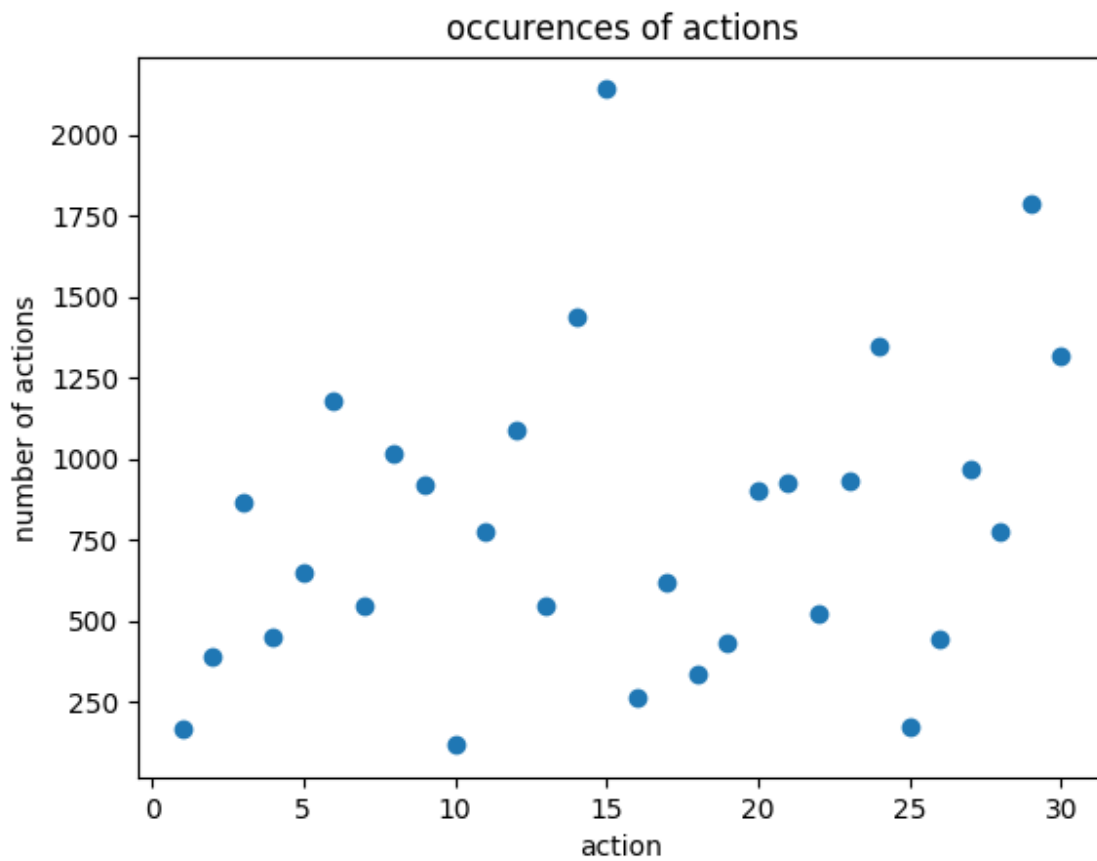
- 4) In the remaining image find 2 dominant colors (except black) using K means clustering from scikits-learn library
- 5) Detect a team of players by finding the closest distance to one of the 2 dominant colors.

### **Making the dataset more balanced:**

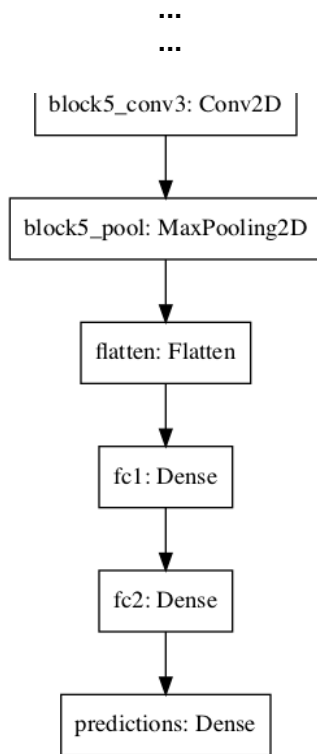
To detect the ball during the match new ball detection above was used (Transfer Learning on YOLOv3); In addition right and left directions were split into 4 subsectors each;



Now actions are labelled as above. 1 - short, 2 - long, 3 - traversal and so on; With such actions the dataset with following frequency for each action was acquired as in the graph. For 45 minute match there are 24016 samples and 51 features (frame, actionLabel, ball\_coordinates and etc);



## VGG usage:



Features outputted from before-classification layer was used in LSTM; In other words outputs from fc2:Dense were used as features. There were 4096 features

For example:  
 (744, 305, 4098) (744, 12) -> x\_train.shape, y\_train.shape  
 (186, 305, 4098) (186, 1) -> x\_test.shape, y\_test.shape

based on 2 previous action sequence  
 744 = number of samples (sequence of frames)  
 305 = max number of frames for 2 consecutive action sequences  
 4098 = 1 (frame) + 1 (action label) + 4096 (features)

## LSTM structure for VGG (\*the same as for OpenCV):

```

def build_model():
    model = Sequential()
    model.add(LSTM(50, return_sequences=True, input_shape=(X_train.shape[1], X_train.shape[2])))
    model.add(SpatialDropout1D(0.2))
    model.add(LSTM(50, return_sequences=True, input_shape=(X_train.shape[1], X_train.shape[2])))
    model.add(Dropout(0.1))
    model.add(LSTM(20, return_sequences=False, activation='relu'))
    model.add(Dropout(0.1))
    model.add(Dense(ACTION_NUM, activation='softmax'))
    model.compile(loss='categorical_crossentropy', optimizer='adam', metrics=['accuracy'])
    return model
  
```

Datasets		
Dataset name	Description	File
d1	dataset with 51 features with Color Hist. detection (RMA-FCB)	dataset_51_features_rma_fcb.csv
d2	dataset with VGG predicted features (4096) (RMA-FCB)	dataset_vgg_rma_fcb.csv

d3	dataset with FrameNumber, Action, 4096 VGG features (total: 4098) (RMA-FCB)	dataset_vgg_rma_fcb_merged.csv
d4	dataset with 51 features with Color Hist. detection (AST-ATY)	dataset_51_features_ast_aty.csv
d5	dataset with VGG predicted features (4096) (AST-ATY)	dataset_vgg_ast_aty.csv
d6	dataset with FrameNumber, Action, 4096 VGG features (total: 4098) (AST-ATY)	dataset_vgg_ast_aty_merged.csv

\*sbd = separate ball detection

Models		
Model name	Description	File
m1	opencv model trained on 200 epochs (RMA-FCB)	lstm2_model_opencv_200e_rma_fcb.h5
m2	vgg model trained on 20 epochs (RMA-FCB)	lstm2_model_vgg_20e_rma_fcb.h5
m3	vgg model trained on 200 epochs (RMA-FCB)	lstm2_model_vgg_200e_rma_fcb.h5
m4	opencv model trained on 100 epochs (AST-ATY)	lstm2_model_opencv_100e_ast_aty.h5
m5	vgg+sbd model trained on 200 epochs	lstm2_model_vgg_balanced_200e_rma_fcb_full.h5

Time performance of OpenCV approach			
FileName	Action	Average time per frame (s)	
		FCB-RMA (match_for_L STM.mp4)	AST-ATY
lfc_not_main.py	K-means fitting 2 dominant colors	5.804	5.210
lfc_not_main.py	Scene recognition time(once in 15 frames)	0.047	0.047
lfc_not_main.py	Detection of players and ball using color histogram and K-means	0.038	0.051
lfc_not_main.py	Ball data noise removal (DB-clustering)	0.00165	0.0038
lfc_not_main.py	Dataset appending (each frame)	0.00015	0.00126
lstm2.py	Measure each epoch while training	m1: 21.870	m4: 74.80
lstm2.py	Predicting action	m1: 0.0149	m4: 0.035

Time performance of VGG approach			
FileName	Action	Average time per frame (s)	
		FCB-RMA (match_for_L STM.mp4)	AST-ATY
vgg_test.py	Measure VGG feature prediction	0.0168	0.0184
vgg_test.py	Dataset appending (each frame)	0.00231	0.00461
dataset_merger.py	Dataset merging	d3: 130.983	d6: 311.446
lstm2.py	Measure each epoch while training model [2]	m2: 30.64	m5: 478 (FCB-RMA)
		m3: 29.61	
		m2: 0.0289	m5: 0.09978

lstm2.py	Prediction action using model [2]	m3: 0.027	(FCB-RMA)
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Accuracy performance	
model	accuracy (top2 match)
m1	26.3%
m2	23.11%
m3	25.8%
m5	2.98% (probably because network is not complex enough for such dataset)

## Appendix:

### **section A (corrupted dataset):**

#### Logs from prediction on VGG(200Epochs+LSTM[1])

true: 11.0 pred 2 fail. confidence: 0.1455081	true: 1.0 pred 8 fail. confidence: 0.1538044
true: 8.0 pred: 8 match2. confidence: 0.14072534	true: 8.0 pred: 8 match1. confidence: 0.153813
true: 7.0 pred 8 fail. confidence: 0.1538237	true: 1.0 pred 2 fail. confidence: 0.14555931
true: 11.0 pred 8 fail. confidence: 0.153807	true: 3.0 pred 2 fail. confidence: 0.14538726
true: 2.0 pred: 2 match1. confidence: 0.13777275	true: 7.0 pred 8 fail. confidence: 0.15363872
true: 12.0 pred 2 fail. confidence: 0.14220731	true: 8.0 pred: 8 match1. confidence: 0.15344219
true: 6.0 pred 2 fail. confidence: 0.13975245	true: 12.0 pred 2 fail. confidence: 0.14285396
true: 1.0 pred 2 fail. confidence: 0.19801652	true: 2.0 pred: 2 match1. confidence: 0.1429624
true: 4.0 pred 2 fail. confidence: 0.14448452	true: 1.0 pred 2 fail. confidence: 0.14383836
true: 11.0 pred 2 fail. confidence: 0.14503302	true: 5.0 pred 2 fail. confidence: 0.14522879
true: 1.0 pred 8 fail. confidence: 0.15034805	true: 7.0 pred 2 fail. confidence: 0.13975245
true: 2.0 pred: 2 match2. confidence: 0.1494695	true: 2.0 pred: 2 match1. confidence: 0.14339466
true: 11.0 pred 2 fail. confidence: 0.14514309	true: 3.0 pred 2 fail. confidence: 0.14448452
true: 8.0 pred: 8 match2. confidence: 0.13780963	true: 7.0 pred 2 fail. confidence: 0.13810316
true: 2.0 pred: 2 match1. confidence: 0.13810316	true: 8.0 pred: 8 match2. confidence: 0.13532282
true: 5.0 pred 2 fail. confidence: 0.14145343	true: 1.0 pred 2 fail. confidence: 0.17836821
true: 6.0 pred 2 fail. confidence: 0.14145343	true: 5.0 pred 2 fail. confidence: 0.19801652
true: 10.0 pred 2 fail. confidence: 0.147646	true: 6.0 pred 2 fail. confidence: 0.14544658
true: 4.0 pred 8 fail. confidence: 0.21011049	true: 7.0 pred 8 fail. confidence: 0.15368444
true: 1.0 pred 2 fail. confidence: 0.17276765	true: 2.0 pred: 2 match2. confidence: 0.14851609
true: 2.0 pred: 2 match1. confidence: 0.14419729	true: 10.0 pred 2 fail. confidence: 0.14448452
true: 8.0 pred: 8 match2. confidence: 0.13833591	true: 9.0 pred 2 fail. confidence: 0.14220731
true: 3.0 pred 2 fail. confidence: 0.14489211	true: 12.0 pred 2 fail. confidence: 0.17836821

true: 8.0 pred: 8 match2. confidence: 0.19711524  
true: 9.0 pred 2 fail. confidence: 0.14576453  
true: 2.0 pred: 2 match1. confidence: 0.14576453  
true: 7.0 pred 2 fail. confidence: 0.1429624  
true: 12.0 pred 2 fail. confidence: 0.14555931  
true: 2.0 pred: 2 match1. confidence: 0.14503302  
true: 8.0 pred: 8 match1. confidence: 0.15287453  
true: 10.0 pred 8 fail. confidence: 0.15377843  
true: 3.0 pred 2 fail. confidence: 0.14285396  
true: 11.0 pred 8 fail. confidence: 0.21011049  
true: 2.0 pred: 2 match1. confidence: 0.13810316  
true: 7.0 pred 8 fail. confidence: 0.15375474  
true: 2.0 pred: 2 match2. confidence: 0.15051362  
true: 7.0 pred 2 fail. confidence: 0.13975245  
true: 8.0 pred 2 fail. confidence: 0.13975245  
true: 12.0 pred 2 fail. confidence: 0.14419729  
true: 11.0 pred 2 fail. confidence: 0.14383836  
true: 8.0 pred: 8 match2. confidence: 0.13811584  
true: 3.0 pred 8 fail. confidence: 0.15330993  
true: 5.0 pred 8 fail. confidence: 0.15371864  
true: 1.0 pred 8 fail. confidence: 0.15170257  
true: 8.0 pred: 8 match2. confidence: 0.13680159  
true: 6.0 pred 2 fail. confidence: 0.14534701  
true: 8.0 pred: 8 match1. confidence: 0.15382487  
true: 5.0 pred 8 fail. confidence: 0.15382487  
true: 11.0 pred 8 fail. confidence: 0.15338127  
true: 3.0 pred 2 fail. confidence: 0.14419729  
true: 7.0 pred 2 fail. confidence: 0.18345699  
true: 8.0 pred: 8 match2. confidence: 0.16708997  
true: 7.0 pred 2 fail. confidence: 0.14534701  
true: 1.0 pred 2 fail. confidence: 0.14529534  
true: 2.0 pred: 2 match1. confidence: 0.147646  
true: 12.0 pred 2 fail. confidence: 0.1455081  
true: 8.0 pred: 8 match1. confidence: 0.15381964  
true: 9.0 pred 8 fail. confidence: 0.1538145  
true: 4.0 pred 2 fail. confidence: 0.14489211  
true: 1.0 pred: 1 match2. confidence: 0.13209087  
true: 2.0 pred: 2 match1. confidence: 0.14489211  
true: 12.0 pred 2 fail. confidence: 0.14617848  
true: 2.0 pred: 2 match1. confidence: 0.14514309  
true: 3.0 pred 2 fail. confidence: 0.14448452  
true: 7.0 pred 2 fail. confidence: 0.14471245  
true: 1.0 pred: 1 match2. confidence: 0.13052367  
true: 2.0 pred: 2 match1. confidence: 0.14471245  
true: 11.0 pred 8 fail. confidence: 0.15132338  
true: 1.0 pred 8 fail. confidence: 0.15338127  
true: 8.0 pred: 8 match2. confidence: 0.13886821  
true: 2.0 pred: 2 match1. confidence: 0.1455081  
true: 4.0 pred 8 fail. confidence: 0.15301158  
true: 10.0 pred 2 fail. confidence: 0.14715087  
true: 9.0 pred 2 fail. confidence: 0.13975245  
true: 7.0 pred 2 fail. confidence: 0.20350899  
true: 5.0 pred 2 fail. confidence: 0.15965338  
true: 12.0 pred 2 fail. confidence: 0.14285396  
true: 1.0 pred 8 fail. confidence: 0.15132338  
true: 12.0 pred 8 fail. confidence: 0.15034805  
true: 4.0 pred 2 fail. confidence: 0.15965338  
true: 2.0 pred: 2 match2. confidence: 0.22289445  
true: 9.0 pred 2 fail. confidence: 0.18825886  
true: 10.0 pred 2 fail. confidence: 0.19302374  
true: 2.0 pred: 2 match1. confidence: 0.18825886

true: 8.0 pred: 8 match2. confidence: 0.13929789  
true: 4.0 pred 2 fail. confidence: 0.14576453  
true: 2.0 pred: 2 match1. confidence: 0.15330157  
true: 5.0 pred 2 fail. confidence: 0.14679687  
true: 3.0 pred 2 fail. confidence: 0.14715087  
true: 2.0 pred: 2 match1. confidence: 0.17836821  
true: 12.0 pred 2 fail. confidence: 0.19801652  
true: 7.0 pred 2 fail. confidence: 0.13810316  
true: 8.0 pred: 8 match2. confidence: 0.13817677  
true: 1.0 pred 2 fail. confidence: 0.14534701  
true: 9.0 pred 2 fail. confidence: 0.13882154  
true: 10.0 pred 2 fail. confidence: 0.17836821  
true: 3.0 pred 2 fail. confidence: 0.16648571  
true: 1.0 pred 2 fail. confidence: 0.19302374  
true: 7.0 pred 2 fail. confidence: 0.19302374  
true: 1.0 pred: 1 match2. confidence: 0.13403375  
true: 4.0 pred 2 fail. confidence: 0.13777275  
true: 1.0 pred: 1 match2. confidence: 0.12835707  
true: 7.0 pred 2 fail. confidence: 0.147646  
true: 10.0 pred 2 fail. confidence: 0.17836821  
true: 1.0 pred: 1 match2. confidence: 0.13613777  
true: 8.0 pred: 8 match2. confidence: 0.13780963  
true: 6.0 pred 8 fail. confidence: 0.15087536  
true: 1.0 pred 2 fail. confidence: 0.14564028  
true: 7.0 pred 2 fail. confidence: 0.14534701  
true: 9.0 pred 8 fail. confidence: 0.14901488  
true: 7.0 pred 2 fail. confidence: 0.14383836  
true: 1.0 pred: 1 match2. confidence: 0.1346374  
true: 7.0 pred 2 fail. confidence: 0.13882154  
true: 12.0 pred 2 fail. confidence: 0.13810316  
true: 1.0 pred 2 fail. confidence: 0.147646  
true: 7.0 pred 2 fail. confidence: 0.13970213  
true: 8.0 pred 2 fail. confidence: 0.14145343  
true: 9.0 pred 2 fail. confidence: 0.17836821  
true: 12.0 pred 2 fail. confidence: 0.17836821  
true: 3.0 pred 2 fail. confidence: 0.14617848  
true: 8.0 pred: 8 match1. confidence: 0.15375474  
true: 10.0 pred 2 fail. confidence: 0.14617848  
true: 7.0 pred 2 fail. confidence: 0.15330157  
true: 9.0 pred 2 fail. confidence: 0.16648571  
true: 2.0 pred: 2 match1. confidence: 0.19801652  
true: 7.0 pred 2 fail. confidence: 0.14544658  
true: 4.0 pred 2 fail. confidence: 0.14715087  
true: 1.0 pred: 1 match2. confidence: 0.1346374  
true: 3.0 pred 2 fail. confidence: 0.17276765  
true: 10.0 pred 8 fail. confidence: 0.22175652  
true: 7.0 pred 2 fail. confidence: 0.18345699  
true: 11.0 pred 2 fail. confidence: 0.19302374  
true: 3.0 pred 2 fail. confidence: 0.19302374  
true: 2.0 pred: 2 match1. confidence: 0.19801652  
true: 1.0 pred 8 fail. confidence: 0.15202273  
true: 4.0 pred 8 fail. confidence: 0.15373243  
true: 8.0 pred: 8 match2. confidence: 0.13803834  
true: 7.0 pred 2 fail. confidence: 0.1406056  
true: 5.0 pred 2 fail. confidence: 0.18825886  
true: 7.0 pred 2 fail. confidence: 0.14489211  
true: 1.0 pred 2 fail. confidence: 0.14555931  
true: 2.0 pred: 2 match1. confidence: 0.13810316  
true: 9.0 pred 2 fail. confidence: 0.14617848  
true: 8.0 pred: 8 match2. confidence: 0.13827565  
acc: 29.94011976047904 %



## section B:

### Logs from prediction on OpenCV (200Epochs+LSTM[2])

Training time: 4374.966883659363  
Prediction time: 2.7865853309631348  
true: 8.0 pred: 8 match2. confidence: 0.13605268  
true: 6.0 pred 1 fail. confidence: 0.13651389  
true: 2.0 pred: 2 match1. confidence: 0.1342633  
true: 12.0 pred 2 fail. confidence: 0.14025342  
true: 9.0 pred 2 fail. confidence: 0.14983082  
true: 5.0 pred 2 fail. confidence: 0.14987423  
true: 7.0 pred 2 fail. confidence: 0.1498163  
true: 9.0 pred: 9 match2. confidence: 0.13234317  
true: 7.0 pred 1 fail. confidence: 0.1401684  
true: 8.0 pred 1 fail. confidence: 0.14189507  
true: 1.0 pred: 1 match1. confidence: 0.14201006  
true: 8.0 pred: 8 match2. confidence: 0.12761171  
true: 9.0 pred 2 fail. confidence: 0.14899059  
true: 3.0 pred 2 fail. confidence: 0.15003341  
true: 6.0 pred 1 fail. confidence: 0.13539313  
true: 2.0 pred: 2 match1. confidence: 0.14998312  
true: 7.0 pred 2 fail. confidence: 0.14998311  
true: 1.0 pred 2 fail. confidence: 0.14803268  
true: 11.0 pred 1 fail. confidence: 0.14001763  
true: 7.0 pred 1 fail. confidence: 0.1372925  
true: 8.0 pred 1 fail. confidence: 0.13973595  
true: 3.0 pred 2 fail. confidence: 0.14983054  
true: 7.0 pred 2 fail. confidence: 0.14983058  
true: 11.0 pred 2 fail. confidence: 0.14218044  
true: 2.0 pred: 2 match2. confidence: 0.1304221  
true: 12.0 pred 1 fail. confidence: 0.13609718  
true: 6.0 pred 2 fail. confidence: 0.13279614  
true: 1.0 pred 2 fail. confidence: 0.14512263  
true: 4.0 pred 1 fail. confidence: 0.13639542  
true: 11.0 pred 1 fail. confidence: 0.13645457  
true: 1.0 pred 2 fail. confidence: 0.14716414  
true: 2.0 pred: 2 match1. confidence: 0.14848347  
true: 11.0 pred 1 fail. confidence: 0.1364754  
true: 8.0 pred 1 fail. confidence: 0.13724494  
true: 2.0 pred 1 fail. confidence: 0.1362294  
true: 5.0 pred 1 fail. confidence: 0.1374262  
true: 11.0 pred 1 fail. confidence: 0.13903503  
true: 1.0 pred: 1 match1. confidence: 0.14170493  
true: 2.0 pred 1 fail. confidence: 0.14038609  
true: 8.0 pred: 8 match2. confidence: 0.13736884  
true: 3.0 pred 1 fail. confidence: 0.13653012  
true: 1.0 pred 2 fail. confidence: 0.14998312  
true: 8.0 pred: 8 match2. confidence: 0.13505493

true: 1.0 pred: 1 match1. confidence: 0.14118709  
true: 3.0 pred 1 fail. confidence: 0.13696672  
true: 1.0 pred 2 fail. confidence: 0.14982896  
true: 8.0 pred: 8 match2. confidence: 0.13770118  
true: 10.0 pred 2 fail. confidence: 0.1389784  
true: 8.0 pred: 8 match2. confidence: 0.12672018  
true: 2.0 pred 1 fail. confidence: 0.13595228  
true: 1.0 pred 2 fail. confidence: 0.14643456  
true: 5.0 pred 1 fail. confidence: 0.13899706  
true: 7.0 pred 2 fail. confidence: 0.13419405  
true: 2.0 pred 1 fail. confidence: 0.1362281  
true: 3.0 pred 1 fail. confidence: 0.1412248  
true: 7.0 pred 1 fail. confidence: 0.1351112  
true: 8.0 pred: 8 match2. confidence: 0.12679437  
true: 1.0 pred 2 fail. confidence: 0.138183  
true: 5.0 pred 2 fail. confidence: 0.14819166  
true: 6.0 pred 1 fail. confidence: 0.13652517  
true: 7.0 pred 2 fail. confidence: 0.14982894  
true: 2.0 pred: 2 match1. confidence: 0.13420294  
true: 10.0 pred 1 fail. confidence: 0.13634723  
true: 9.0 pred: 9 match2. confidence: 0.13069747  
true: 12.0 pred 2 fail. confidence: 0.13924746  
true: 8.0 pred: 8 match2. confidence: 0.12931478  
true: 7.0 pred 1 fail. confidence: 0.13652517  
true: 2.0 pred 1 fail. confidence: 0.13652517  
true: 12.0 pred 2 fail. confidence: 0.1364299  
true: 10.0 pred 2 fail. confidence: 0.1396395  
true: 12.0 pred 2 fail. confidence: 0.1739836  
true: 2.0 pred: 2 match1. confidence: 0.14958768  
true: 8.0 pred: 8 match2. confidence: 0.13476737  
true: 10.0 pred 2 fail. confidence: 0.14981288  
true: 8.0 pred 1 fail. confidence: 0.13974823  
true: 11.0 pred 1 fail. confidence: 0.136351  
true: 2.0 pred 1 fail. confidence: 0.1364975  
true: 7.0 pred 2 fail. confidence: 0.1498302  
true: 12.0 pred 2 fail. confidence: 0.14981933  
true: 1.0 pred 2 fail. confidence: 0.14363672  
true: 7.0 pred 2 fail. confidence: 0.14430156  
true: 8.0 pred: 8 match2. confidence: 0.12639984  
true: 12.0 pred 1 fail. confidence: 0.14201269  
true: 11.0 pred 1 fail. confidence: 0.14201269  
true: 8.0 pred 1 fail. confidence: 0.14187627  
true: 3.0 pred 2 fail. confidence: 0.149926  
true: 5.0 pred 2 fail. confidence: 0.14935216  
true: 1.0 pred 2 fail. confidence: 0.14827664  
true: 8.0 pred 1 fail. confidence: 0.13712887  
true: 6.0 pred 1 fail. confidence: 0.13652793  
true: 8.0 pred: 8 match2. confidence: 0.13790433  
true: 5.0 pred 2 fail. confidence: 0.14971836  
true: 10.0 pred 2 fail. confidence: 0.15009572  
true: 7.0 pred 1 fail. confidence: 0.14158225  
true: 9.0 pred: 9 match2. confidence: 0.13043909  
true: 7.0 pred 2 fail. confidence: 0.14732645  
true: 1.0 pred: 1 match1. confidence: 0.14181274  
true: 2.0 pred: 2 match1. confidence: 0.13909836  
true: 12.0 pred 1 fail. confidence: 0.14180438  
true: 10.0 pred 2 fail. confidence: 0.15026101  
true: 8.0 pred: 8 match2. confidence: 0.13588934  
true: 5.0 pred 1 fail. confidence: 0.14143121  
true: 3.0 pred 2 fail. confidence: 0.14798473  
true: 1.0 pred: 1 match1. confidence: 0.1364754

true: 3.0 pred 1 fail. confidence: 0.13182454  
true: 10.0 pred 1 fail. confidence: 0.13182454  
true: 2.0 pred: 2 match1. confidence: 0.1342236  
true: 3.0 pred 1 fail. confidence: 0.13658929  
true: 8.0 pred 1 fail. confidence: 0.13747405  
true: 1.0 pred 2 fail. confidence: 0.14382683  
true: 2.0 pred 1 fail. confidence: 0.13982344  
true: 11.0 pred 2 fail. confidence: 0.14994088  
true: 1.0 pred 2 fail. confidence: 0.14742771  
true: 12.0 pred 1 fail. confidence: 0.14165054  
true: 4.0 pred 2 fail. confidence: 0.14983073  
true: 10.0 pred 2 fail. confidence: 0.15008122  
true: 9.0 pred 1 fail. confidence: 0.14101923  
true: 7.0 pred 2 fail. confidence: 0.15857227  
true: 5.0 pred 2 fail. confidence: 0.13893981  
true: 12.0 pred 1 fail. confidence: 0.13612369  
true: 7.0 pred 2 fail. confidence: 0.14797935  
true: 1.0 pred: 1 match1. confidence: 0.13652082  
true: 2.0 pred: 2 match1. confidence: 0.13774328  
true: 9.0 pred 1 fail. confidence: 0.13974836  
true: 10.0 pred 2 fail. confidence: 0.14180906  
true: 2.0 pred: 2 match1. confidence: 0.1380579  
true: 8.0 pred 2 fail. confidence: 0.13420916  
true: 4.0 pred 1 fail. confidence: 0.13700546  
true: 2.0 pred: 2 match1. confidence: 0.13722566  
true: 5.0 pred 1 fail. confidence: 0.13654894  
true: 1.0 pred: 1 match1. confidence: 0.14115873  
true: 11.0 pred 2 fail. confidence: 0.1388118  
true: 3.0 pred 2 fail. confidence: 0.14658204  
true: 7.0 pred 1 fail. confidence: 0.14099708  
true: 8.0 pred 1 fail. confidence: 0.1411523  
true: 1.0 pred: 1 match1. confidence: 0.13885725  
true: 9.0 pred 1 fail. confidence: 0.13929667  
true: 10.0 pred 2 fail. confidence: 0.14226948  
true: 3.0 pred 2 fail. confidence: 0.1388118  
true: 1.0 pred 2 fail. confidence: 0.14245927  
true: 7.0 pred 2 fail. confidence: 0.14658204  
true: 1.0 pred: 1 match1. confidence: 0.13902664  
true: 4.0 pred 1 fail. confidence: 0.13944899  
true: 1.0 pred: 1 match1. confidence: 0.13291436  
true: 7.0 pred 2 fail. confidence: 0.135837  
true: 10.0 pred 2 fail. confidence: 0.14065675  
true: 1.0 pred: 1 match1. confidence: 0.14198916  
true: 8.0 pred 1 fail. confidence: 0.14194936  
true: 6.0 pred 2 fail. confidence: 0.14893429  
true: 1.0 pred: 1 match1. confidence: 0.14151372  
true: 7.0 pred 1 fail. confidence: 0.13985327  
true: 9.0 pred 2 fail. confidence: 0.14638834  
true: 7.0 pred 1 fail. confidence: 0.14181454  
true: 1.0 pred: 1 match1. confidence: 0.1414537  
true: 12.0 pred 1 fail. confidence: 0.1385878  
true: 1.0 pred: 1 match1. confidence: 0.1410837  
true: 8.0 pred 1 fail. confidence: 0.14191012  
true: 9.0 pred 1 fail. confidence: 0.14169596  
true: 1.0 pred 2 fail. confidence: 0.14071958  
true: 9.0 pred 2 fail. confidence: 0.14430156  
true: 12.0 pred 2 fail. confidence: 0.14942291  
true: 8.0 pred: 8 match2. confidence: 0.13790429  
true: 3.0 pred 2 fail. confidence: 0.14021105  
true: 8.0 pred 1 fail. confidence: 0.14128025  
true: 10.0 pred 2 fail. confidence: 0.15003538

true: 9.0 pred: 9 match2. confidence: 0.1300158  
true: 8.0 pred: 8 match2. confidence: 0.1281896  
true: 9.0 pred 1 fail. confidence: 0.14169596  
true: 2.0 pred: 2 match2. confidence: 0.13326655  
true: 7.0 pred 1 fail. confidence: 0.14182842  
true: 4.0 pred 2 fail. confidence: 0.13968371  
true: 3.0 pred 1 fail. confidence: 0.14078099  
true: 11.0 pred 1 fail. confidence: 0.1337116  
true: 8.0 pred 2 fail. confidence: 0.13474542  
true: 9.0 pred 1 fail. confidence: 0.14061879  
true: 2.0 pred: 2 match2. confidence: 0.13336459  
true: 4.0 pred 2 fail. confidence: 0.14983073  
true: 8.0 pred: 8 match2. confidence: 0.13790433  
true: 3.0 pred 1 fail. confidence: 0.13643883  
true: 6.0 pred 1 fail. confidence: 0.13997076  
true: 5.0 pred 2 fail. confidence: 0.14418668  
true: 7.0 pred 1 fail. confidence: 0.13694067  
true: 1.0 pred: 1 match1. confidence: 0.14083578  
true: 2.0 pred: 2 match2. confidence: 0.12995382  
true: 8.0 pred 1 fail. confidence: 0.13698082  
true: 9.0 pred: 9 match2. confidence: 0.12967317  
acc: 26.344086021505376 %

## section C: (20 epochs+vgg)

(744, 305, 4098) (744, 12)

(186, 305, 4098) (186, 1)

Training time: 612.8224229812622

Prediction time: 5.387319326400757

true: 8.0 pred 2 fail. confidence: 0.15354702  
true: 6.0 pred 2 fail. confidence: 0.15353145  
true: 2.0 pred: 2 match1. confidence: 0.15328124  
true: 12.0 pred 2 fail. confidence: 0.15231399  
true: 9.0 pred 2 fail. confidence: 0.15354702  
true: 5.0 pred 2 fail. confidence: 0.15354703  
true: 7.0 pred: 7 match2. confidence: 0.12850805  
true: 9.0 pred 2 fail. confidence: 0.15354176  
true: 7.0 pred: 7 match2. confidence: 0.12850519  
true: 8.0 pred 2 fail. confidence: 0.15354176  
true: 1.0 pred 2 fail. confidence: 0.15352765  
true: 8.0 pred 2 fail. confidence: 0.15275249  
true: 9.0 pred 2 fail. confidence: 0.15354702  
true: 3.0 pred 2 fail. confidence: 0.15354702  
true: 6.0 pred 2 fail. confidence: 0.1535467  
true: 2.0 pred: 2 match1. confidence: 0.15354702  
true: 7.0 pred: 7 match2. confidence: 0.12850808  
true: 1.0 pred 2 fail. confidence: 0.15354699  
true: 11.0 pred 2 fail. confidence: 0.15348944  
true: 7.0 pred: 7 match2. confidence: 0.12850125  
true: 8.0 pred 2 fail. confidence: 0.1535098  
true: 3.0 pred 2 fail. confidence: 0.15354702  
true: 7.0 pred: 7 match2. confidence: 0.12850806  
true: 11.0 pred 2 fail. confidence: 0.15231399  
true: 2.0 pred: 2 match1. confidence: 0.15343617  
true: 12.0 pred 2 fail. confidence: 0.15351708  
true: 6.0 pred 2 fail. confidence: 0.15333346  
true: 1.0 pred 2 fail. confidence: 0.15163034  
true: 4.0 pred 2 fail. confidence: 0.15353447  
true: 11.0 pred 2 fail. confidence: 0.1535389

true: 1.0 pred 2 fail. confidence: 0.15354699  
true: 2.0 pred: 2 match1. confidence: 0.153547  
true: 11.0 pred 2 fail. confidence: 0.15354049  
true: 8.0 pred 2 fail. confidence: 0.1535428  
true: 2.0 pred: 2 match1. confidence: 0.15351708  
true: 5.0 pred 2 fail. confidence: 0.15352765  
true: 11.0 pred 2 fail. confidence: 0.15351708  
true: 1.0 pred 2 fail. confidence: 0.1535098  
true: 2.0 pred: 2 match1. confidence: 0.15354665  
true: 8.0 pred 2 fail. confidence: 0.15354702  
true: 3.0 pred 2 fail. confidence: 0.15354481  
true: 1.0 pred 2 fail. confidence: 0.15354702  
true: 8.0 pred 2 fail. confidence: 0.15354702  
true: 1.0 pred 2 fail. confidence: 0.15354426  
true: 3.0 pred 2 fail. confidence: 0.15354523  
true: 1.0 pred 2 fail. confidence: 0.15354702  
true: 8.0 pred 2 fail. confidence: 0.15354702  
true: 10.0 pred 2 fail. confidence: 0.15290897  
true: 8.0 pred 2 fail. confidence: 0.15290897  
true: 2.0 pred: 2 match1. confidence: 0.1535098  
true: 1.0 pred 2 fail. confidence: 0.15354699  
true: 5.0 pred 2 fail. confidence: 0.15354559  
true: 7.0 pred: 7 match2. confidence: 0.12846749  
true: 2.0 pred: 2 match1. confidence: 0.15352294  
true: 3.0 pred 2 fail. confidence: 0.15353447  
true: 7.0 pred: 7 match2. confidence: 0.12849164  
true: 8.0 pred 2 fail. confidence: 0.15321624  
true: 1.0 pred 2 fail. confidence: 0.15275249  
true: 5.0 pred 2 fail. confidence: 0.15056051  
true: 6.0 pred 2 fail. confidence: 0.15354653  
true: 7.0 pred: 7 match2. confidence: 0.12850806  
true: 2.0 pred: 2 match1. confidence: 0.15354685  
true: 10.0 pred 2 fail. confidence: 0.15353145  
true: 9.0 pred 2 fail. confidence: 0.15350074  
true: 12.0 pred 2 fail. confidence: 0.15255739  
true: 8.0 pred 2 fail. confidence: 0.1511553  
true: 7.0 pred: 7 match2. confidence: 0.12850794  
true: 2.0 pred: 2 match1. confidence: 0.15354653  
true: 12.0 pred 2 fail. confidence: 0.15328124  
true: 10.0 pred 2 fail. confidence: 0.15275249  
true: 12.0 pred 2 fail. confidence: 0.1421322  
true: 2.0 pred: 2 match1. confidence: 0.1511553  
true: 8.0 pred 2 fail. confidence: 0.15354702  
true: 10.0 pred 2 fail. confidence: 0.15354702  
true: 8.0 pred 2 fail. confidence: 0.15352765  
true: 11.0 pred 2 fail. confidence: 0.1533754  
true: 2.0 pred: 2 match1. confidence: 0.15354176  
true: 7.0 pred: 7 match2. confidence: 0.12850808  
true: 12.0 pred 2 fail. confidence: 0.153547  
true: 1.0 pred 2 fail. confidence: 0.15201008  
true: 7.0 pred: 7 match2. confidence: 0.12813418  
true: 8.0 pred 2 fail. confidence: 0.15313533  
true: 12.0 pred 2 fail. confidence: 0.15353145  
true: 11.0 pred 2 fail. confidence: 0.15353145  
true: 8.0 pred 2 fail. confidence: 0.15354426  
true: 3.0 pred 2 fail. confidence: 0.15354702  
true: 5.0 pred 2 fail. confidence: 0.15354702  
true: 1.0 pred 2 fail. confidence: 0.153547  
true: 8.0 pred 2 fail. confidence: 0.15353145  
true: 6.0 pred 2 fail. confidence: 0.15354481  
true: 8.0 pred 2 fail. confidence: 0.15354703

true: 5.0 pred 2 fail. confidence: 0.15354703  
true: 10.0 pred 2 fail. confidence: 0.15354702  
true: 7.0 pred: 7 match2. confidence: 0.12850764  
true: 9.0 pred 2 fail. confidence: 0.15352765  
true: 7.0 pred: 7 match2. confidence: 0.12850808  
true: 1.0 pred 2 fail. confidence: 0.15354629  
true: 2.0 pred: 2 match1. confidence: 0.15313533  
true: 12.0 pred 2 fail. confidence: 0.15354642  
true: 10.0 pred 2 fail. confidence: 0.15354702  
true: 8.0 pred 2 fail. confidence: 0.15354702  
true: 5.0 pred 2 fail. confidence: 0.15353447  
true: 3.0 pred 2 fail. confidence: 0.15354699  
true: 1.0 pred 2 fail. confidence: 0.15354049  
true: 3.0 pred 2 fail. confidence: 0.1533754  
true: 10.0 pred 2 fail. confidence: 0.1533754  
true: 2.0 pred: 2 match1. confidence: 0.15328124  
true: 3.0 pred 2 fail. confidence: 0.15354426  
true: 8.0 pred 2 fail. confidence: 0.1535389  
true: 1.0 pred 2 fail. confidence: 0.15201008  
true: 2.0 pred: 2 match1. confidence: 0.15354642  
true: 11.0 pred 2 fail. confidence: 0.15354702  
true: 1.0 pred 2 fail. confidence: 0.15354699  
true: 12.0 pred 2 fail. confidence: 0.15353693  
true: 4.0 pred 2 fail. confidence: 0.15354702  
true: 10.0 pred 2 fail. confidence: 0.15354703  
true: 9.0 pred 2 fail. confidence: 0.15352294  
true: 7.0 pred: 7 match2. confidence: 0.12700756  
true: 5.0 pred 2 fail. confidence: 0.15303452  
true: 12.0 pred 2 fail. confidence: 0.15351708  
true: 7.0 pred: 7 match2. confidence: 0.12850805  
true: 1.0 pred 2 fail. confidence: 0.15354653  
true: 2.0 pred: 2 match1. confidence: 0.15313533  
true: 9.0 pred 2 fail. confidence: 0.15343617  
true: 10.0 pred 2 fail. confidence: 0.15201008  
true: 2.0 pred: 2 match1. confidence: 0.15303452  
true: 8.0 pred 2 fail. confidence: 0.15354685  
true: 4.0 pred 2 fail. confidence: 0.1535467  
true: 2.0 pred: 2 match1. confidence: 0.15313533  
true: 5.0 pred 2 fail. confidence: 0.15354629  
true: 1.0 pred 2 fail. confidence: 0.15354665  
true: 11.0 pred 2 fail. confidence: 0.15303452  
true: 3.0 pred 2 fail. confidence: 0.15163034  
true: 7.0 pred: 7 match2. confidence: 0.12849492  
true: 8.0 pred 2 fail. confidence: 0.1534754  
true: 1.0 pred 2 fail. confidence: 0.15343617  
true: 9.0 pred 2 fail. confidence: 0.15345791  
true: 10.0 pred 2 fail. confidence: 0.15231399  
true: 3.0 pred 2 fail. confidence: 0.15303452  
true: 1.0 pred 2 fail. confidence: 0.15231399  
true: 7.0 pred: 7 match2. confidence: 0.12801872  
true: 1.0 pred 2 fail. confidence: 0.15345791  
true: 4.0 pred 2 fail. confidence: 0.15343617  
true: 1.0 pred 2 fail. confidence: 0.1534091  
true: 7.0 pred: 7 match2. confidence: 0.1284569  
true: 10.0 pred 2 fail. confidence: 0.15255739  
true: 1.0 pred 2 fail. confidence: 0.15352294  
true: 8.0 pred 2 fail. confidence: 0.15354049  
true: 6.0 pred 2 fail. confidence: 0.153547  
true: 1.0 pred 2 fail. confidence: 0.15354665  
true: 7.0 pred: 7 match2. confidence: 0.1284996  
true: 9.0 pred 2 fail. confidence: 0.15354696

true: 7.0 pred: 7 match2. confidence: 0.12850788  
true: 1.0 pred 2 fail. confidence: 0.15348944  
true: 12.0 pred 2 fail. confidence: 0.1534091  
true: 1.0 pred 2 fail. confidence: 0.1534754  
true: 8.0 pred 2 fail. confidence: 0.1535428  
true: 9.0 pred 2 fail. confidence: 0.15350074  
true: 1.0 pred 2 fail. confidence: 0.15255739  
true: 9.0 pred 2 fail. confidence: 0.15201008  
true: 12.0 pred 2 fail. confidence: 0.15354702  
true: 8.0 pred 2 fail. confidence: 0.15354702  
true: 3.0 pred 2 fail. confidence: 0.15354693  
true: 8.0 pred 2 fail. confidence: 0.15354523  
true: 10.0 pred 2 fail. confidence: 0.15354702  
true: 9.0 pred 2 fail. confidence: 0.15354481  
true: 8.0 pred 2 fail. confidence: 0.15255739  
true: 9.0 pred 2 fail. confidence: 0.15350074  
true: 2.0 pred: 2 match1. confidence: 0.15345791  
true: 7.0 pred: 7 match2. confidence: 0.12850784  
true: 4.0 pred 2 fail. confidence: 0.15354688  
true: 3.0 pred 2 fail. confidence: 0.1534754  
true: 11.0 pred 2 fail. confidence: 0.1533754  
true: 8.0 pred 2 fail. confidence: 0.15333346  
true: 9.0 pred 2 fail. confidence: 0.15353145  
true: 2.0 pred: 2 match1. confidence: 0.15343617  
true: 4.0 pred 2 fail. confidence: 0.15354702  
true: 8.0 pred 2 fail. confidence: 0.15354702  
true: 3.0 pred 2 fail. confidence: 0.15353145  
true: 6.0 pred 2 fail. confidence: 0.15348944  
true: 5.0 pred 2 fail. confidence: 0.15201008  
true: 7.0 pred: 7 match2. confidence: 0.1284996  
true: 1.0 pred 2 fail. confidence: 0.1535461  
true: 2.0 pred: 2 match1. confidence: 0.15353145  
true: 8.0 pred 2 fail. confidence: 0.15354683  
true: 9.0 pred 2 fail. confidence: 0.1535461  
acc: 23.118279569892472 %

## section D:

### vgg+200epochs

(744, 305, 4098) (744, 12)

(186, 305, 4098) (186, 1)

Training time: 5923.256415128708

Prediction time: 5.197706937789917

true: 8.0 pred: 8 match2. confidence: 0.12801228  
true: 6.0 pred 2 fail. confidence: 0.1503177  
true: 2.0 pred: 2 match1. confidence: 0.15037507  
true: 12.0 pred 2 fail. confidence: 0.15695131  
true: 9.0 pred 2 fail. confidence: 0.15047686  
true: 5.0 pred 2 fail. confidence: 0.15047686  
true: 7.0 pred 2 fail. confidence: 0.15047677  
true: 9.0 pred 2 fail. confidence: 0.15036884  
true: 7.0 pred 2 fail. confidence: 0.1503177  
true: 8.0 pred: 8 match2. confidence: 0.12747476  
true: 1.0 pred 2 fail. confidence: 0.15031447  
true: 8.0 pred 2 fail. confidence: 0.15303811  
true: 9.0 pred 2 fail. confidence: 0.15047479  
true: 3.0 pred 2 fail. confidence: 0.15047686  
true: 6.0 pred 2 fail. confidence: 0.15045679  
true: 2.0 pred: 2 match1. confidence: 0.15047686  
true: 7.0 pred 2 fail. confidence: 0.15047686  
true: 1.0 pred 2 fail. confidence: 0.15047318

true: 11.0 pred 2 fail. confidence: 0.15023169  
true: 7.0 pred 2 fail. confidence: 0.1502825  
true: 8.0 pred: 8 match2. confidence: 0.12668116  
true: 3.0 pred 2 fail. confidence: 0.15047686  
true: 7.0 pred 2 fail. confidence: 0.15047686  
true: 11.0 pred 2 fail. confidence: 0.15695131  
true: 2.0 pred: 2 match1. confidence: 0.15012121  
true: 12.0 pred 2 fail. confidence: 0.150298  
true: 6.0 pred 2 fail. confidence: 0.15024917  
true: 1.0 pred 2 fail. confidence: 0.16403115  
true: 4.0 pred 2 fail. confidence: 0.15032475  
true: 11.0 pred 2 fail. confidence: 0.15034603  
true: 1.0 pred 2 fail. confidence: 0.15047318  
true: 2.0 pred: 2 match1. confidence: 0.15047435  
true: 11.0 pred 2 fail. confidence: 0.15035753  
true: 8.0 pred: 8 match2. confidence: 0.12753849  
true: 2.0 pred: 2 match1. confidence: 0.150298  
true: 5.0 pred 2 fail. confidence: 0.15031447  
true: 11.0 pred 2 fail. confidence: 0.150298  
true: 1.0 pred 2 fail. confidence: 0.1502825  
true: 2.0 pred: 2 match1. confidence: 0.1504535  
true: 8.0 pred: 8 match2. confidence: 0.1280087  
true: 3.0 pred 2 fail. confidence: 0.15040794  
true: 1.0 pred 2 fail. confidence: 0.15047686  
true: 8.0 pred: 8 match2. confidence: 0.12801327  
true: 1.0 pred 2 fail. confidence: 0.15039924  
true: 3.0 pred 2 fail. confidence: 0.15041587  
true: 1.0 pred 2 fail. confidence: 0.15047686  
true: 8.0 pred: 8 match2. confidence: 0.12801288  
true: 10.0 pred 2 fail. confidence: 0.1519482  
true: 8.0 pred 2 fail. confidence: 0.1519482  
true: 2.0 pred: 2 match1. confidence: 0.1502825  
true: 1.0 pred 2 fail. confidence: 0.15047243  
true: 5.0 pred 2 fail. confidence: 0.15042311  
true: 7.0 pred: 7 match2. confidence: 0.1273339  
true: 2.0 pred: 2 match1. confidence: 0.15030827  
true: 3.0 pred 2 fail. confidence: 0.15032475  
true: 7.0 pred 2 fail. confidence: 0.15015663  
true: 8.0 pred 2 fail. confidence: 0.15054984  
true: 1.0 pred 2 fail. confidence: 0.15303811  
true: 5.0 pred 2 fail. confidence: 0.17457771  
true: 6.0 pred 2 fail. confidence: 0.15044978  
true: 7.0 pred 2 fail. confidence: 0.15047686  
true: 2.0 pred: 2 match1. confidence: 0.15046437  
true: 10.0 pred 2 fail. confidence: 0.1503177  
true: 9.0 pred 2 fail. confidence: 0.15026063  
true: 12.0 pred 2 fail. confidence: 0.15466028  
true: 8.0 pred 2 fail. confidence: 0.16894175  
true: 7.0 pred 2 fail. confidence: 0.15044978  
true: 2.0 pred: 2 match1. confidence: 0.15044978  
true: 12.0 pred 2 fail. confidence: 0.15037507  
true: 10.0 pred 2 fail. confidence: 0.15303811  
true: 12.0 pred 7 fail. confidence: 0.2262677  
true: 2.0 pred: 2 match1. confidence: 0.16894175  
true: 8.0 pred: 8 match2. confidence: 0.12800957  
true: 10.0 pred 2 fail. confidence: 0.15047686  
true: 8.0 pred: 8 match2. confidence: 0.12698272  
true: 11.0 pred 2 fail. confidence: 0.15014586  
true: 2.0 pred: 2 match1. confidence: 0.15036884  
true: 7.0 pred 2 fail. confidence: 0.15047686  
true: 12.0 pred 2 fail. confidence: 0.15047677

true: 1.0 pred 2 fail. confidence: 0.16003829  
true: 7.0 pred: 7 match2. confidence: 0.1419642  
true: 8.0 pred 2 fail. confidence: 0.15081821  
true: 12.0 pred 2 fail. confidence: 0.1503177  
true: 11.0 pred 2 fail. confidence: 0.1503177  
true: 8.0 pred: 8 match2. confidence: 0.12764858  
true: 3.0 pred 2 fail. confidence: 0.15047647  
true: 5.0 pred 2 fail. confidence: 0.15047684  
true: 1.0 pred 2 fail. confidence: 0.15047435  
true: 8.0 pred: 8 match2. confidence: 0.12707298  
true: 6.0 pred 2 fail. confidence: 0.15040794  
true: 8.0 pred: 8 match2. confidence: 0.12801325  
true: 5.0 pred 2 fail. confidence: 0.15047686  
true: 10.0 pred 2 fail. confidence: 0.15047678  
true: 7.0 pred 2 fail. confidence: 0.15040794  
true: 9.0 pred 2 fail. confidence: 0.15031447  
true: 7.0 pred 2 fail. confidence: 0.15047243  
true: 1.0 pred 2 fail. confidence: 0.15044086  
true: 2.0 pred: 2 match1. confidence: 0.15081821  
true: 12.0 pred 2 fail. confidence: 0.1504456  
true: 10.0 pred 2 fail. confidence: 0.15047686  
true: 8.0 pred: 8 match2. confidence: 0.12801173  
true: 5.0 pred 2 fail. confidence: 0.15032475  
true: 3.0 pred 2 fail. confidence: 0.15047382  
true: 1.0 pred 2 fail. confidence: 0.15035753  
true: 3.0 pred 2 fail. confidence: 0.15014586  
true: 10.0 pred 2 fail. confidence: 0.15014586  
true: 2.0 pred: 2 match1. confidence: 0.15037507  
true: 3.0 pred 2 fail. confidence: 0.15039924  
true: 8.0 pred: 8 match2. confidence: 0.12732928  
true: 1.0 pred 2 fail. confidence: 0.16003829  
true: 2.0 pred: 2 match1. confidence: 0.1504456  
true: 11.0 pred 2 fail. confidence: 0.15047647  
true: 1.0 pred 2 fail. confidence: 0.15047243  
true: 12.0 pred 2 fail. confidence: 0.15033478  
true: 4.0 pred 2 fail. confidence: 0.15047686  
true: 10.0 pred 2 fail. confidence: 0.15047686  
true: 9.0 pred 2 fail. confidence: 0.15030827  
true: 7.0 pred: 7 match2. confidence: 0.18404451  
true: 5.0 pred 2 fail. confidence: 0.15125073  
true: 12.0 pred 2 fail. confidence: 0.150298  
true: 7.0 pred 2 fail. confidence: 0.15047382  
true: 1.0 pred 2 fail. confidence: 0.15044978  
true: 2.0 pred: 2 match1. confidence: 0.15081821  
true: 9.0 pred 2 fail. confidence: 0.15012121  
true: 10.0 pred 2 fail. confidence: 0.16003829  
true: 2.0 pred: 2 match1. confidence: 0.15125073  
true: 8.0 pred: 8 match2. confidence: 0.1279662  
true: 4.0 pred 2 fail. confidence: 0.15045679  
true: 2.0 pred: 2 match1. confidence: 0.15081821  
true: 5.0 pred 2 fail. confidence: 0.15044086  
true: 1.0 pred 2 fail. confidence: 0.1504535  
true: 11.0 pred 2 fail. confidence: 0.15125073  
true: 3.0 pred 2 fail. confidence: 0.16403115  
true: 7.0 pred 2 fail. confidence: 0.15019605  
true: 8.0 pred: 8 match2. confidence: 0.12635677  
true: 1.0 pred 2 fail. confidence: 0.15012121  
true: 9.0 pred 2 fail. confidence: 0.15015663  
true: 10.0 pred 2 fail. confidence: 0.15695131  
true: 3.0 pred 2 fail. confidence: 0.15125073  
true: 1.0 pred 2 fail. confidence: 0.15695131

true: 7.0 pred: 7 match2. confidence: 0.14759427  
true: 1.0 pred 2 fail. confidence: 0.15015663  
true: 4.0 pred 2 fail. confidence: 0.15012121  
true: 1.0 pred 2 fail. confidence: 0.1501069  
true: 7.0 pred: 7 match2. confidence: 0.12762101  
true: 10.0 pred 2 fail. confidence: 0.15466028  
true: 1.0 pred 2 fail. confidence: 0.15030827  
true: 8.0 pred: 8 match2. confidence: 0.127405  
true: 6.0 pred 2 fail. confidence: 0.15047435  
true: 1.0 pred 2 fail. confidence: 0.1504535  
true: 7.0 pred 2 fail. confidence: 0.15026063  
true: 9.0 pred 2 fail. confidence: 0.15047155  
true: 7.0 pred 2 fail. confidence: 0.15043558  
true: 1.0 pred 2 fail. confidence: 0.15023169  
true: 12.0 pred 2 fail. confidence: 0.1501069  
true: 1.0 pred 2 fail. confidence: 0.15019605  
true: 8.0 pred: 8 match2. confidence: 0.12753849  
true: 9.0 pred 2 fail. confidence: 0.15026063  
true: 1.0 pred 2 fail. confidence: 0.15466028  
true: 9.0 pred 2 fail. confidence: 0.16003829  
true: 12.0 pred 2 fail. confidence: 0.15047516  
true: 8.0 pred: 8 match2. confidence: 0.12801327  
true: 3.0 pred 2 fail. confidence: 0.15046789  
true: 8.0 pred: 8 match2. confidence: 0.12773725  
true: 10.0 pred 2 fail. confidence: 0.15047662  
true: 9.0 pred 2 fail. confidence: 0.15040794  
true: 8.0 pred 2 fail. confidence: 0.15466028  
true: 9.0 pred 2 fail. confidence: 0.15026063  
true: 2.0 pred: 2 match1. confidence: 0.15015663  
true: 7.0 pred 2 fail. confidence: 0.15042967  
true: 4.0 pred 2 fail. confidence: 0.15046628  
true: 3.0 pred 2 fail. confidence: 0.15019605  
true: 11.0 pred 2 fail. confidence: 0.15014586  
true: 8.0 pred 2 fail. confidence: 0.15024917  
true: 9.0 pred 2 fail. confidence: 0.1503177  
true: 2.0 pred: 2 match1. confidence: 0.15012121  
true: 4.0 pred 2 fail. confidence: 0.15047686  
true: 8.0 pred: 8 match2. confidence: 0.12801327  
true: 3.0 pred 2 fail. confidence: 0.1503177  
true: 6.0 pred 2 fail. confidence: 0.15023169  
true: 5.0 pred 2 fail. confidence: 0.16003829  
true: 7.0 pred 2 fail. confidence: 0.15026063  
true: 1.0 pred 2 fail. confidence: 0.15043558  
true: 2.0 pred: 2 match1. confidence: 0.1503177  
true: 8.0 pred: 8 match2. confidence: 0.12795717  
true: 9.0 pred 2 fail. confidence: 0.15043558  
acc: 25.806451612903224 %

## section E: opencv + 100epochs

(1257, 626, 51) (1257, 12)

(315, 626, 51) (315, 1)

Training time: 7480.572418451309

Prediction time: 11.042449712753296

true: 3.0 pred: 3 match1. confidence: 0.14326368

true: 9.0 pred 3 fail. confidence: 0.14326368

true: 6.0 pred 3 fail. confidence: 0.14326368

true: 1.0 pred 3 fail. confidence: 0.14326368

true: 7.0 pred 3 fail. confidence: 0.14326368

true: 12.0 pred 3 fail. confidence: 0.14326327

true: 3.0 pred: 3 match1. confidence: 0.14326365

true: 7.0 pred 3 fail. confidence: 0.14326364  
true: 6.0 pred 3 fail. confidence: 0.14327341  
true: 5.0 pred 3 fail. confidence: 0.14326368  
true: 11.0 pred 3 fail. confidence: 0.14326368  
true: 9.0 pred 3 fail. confidence: 0.14326356  
true: 2.0 pred: 2 match2. confidence: 0.1423481  
true: 8.0 pred 3 fail. confidence: 0.14326341  
true: 7.0 pred 3 fail. confidence: 0.1432634  
true: 8.0 pred 3 fail. confidence: 0.14332595  
true: 2.0 pred: 2 match2. confidence: 0.14234741  
true: 1.0 pred 3 fail. confidence: 0.14326365  
true: 3.0 pred: 3 match1. confidence: 0.14326335  
true: 12.0 pred 3 fail. confidence: 0.1434083  
true: 10.0 pred 3 fail. confidence: 0.14324501  
true: 3.0 pred: 3 match1. confidence: 0.14342923  
true: 8.0 pred 3 fail. confidence: 0.14326373  
true: 3.0 pred: 3 match1. confidence: 0.1432631  
true: 11.0 pred 3 fail. confidence: 0.14326368  
true: 3.0 pred: 3 match1. confidence: 0.14326368  
true: 11.0 pred 3 fail. confidence: 0.14326368  
true: 1.0 pred 3 fail. confidence: 0.14311706  
true: 7.0 pred 3 fail. confidence: 0.14339437  
true: 10.0 pred 3 fail. confidence: 0.14331363  
true: 3.0 pred: 3 match1. confidence: 0.1432945  
true: 12.0 pred 3 fail. confidence: 0.14327061  
true: 2.0 pred: 2 match2. confidence: 0.14235279  
true: 3.0 pred: 3 match1. confidence: 0.14326368  
true: 9.0 pred 3 fail. confidence: 0.14326368  
true: 12.0 pred 3 fail. confidence: 0.14326368  
true: 8.0 pred 3 fail. confidence: 0.14326368  
true: 1.0 pred 3 fail. confidence: 0.14332595  
true: 2.0 pred: 2 match2. confidence: 0.14235562  
true: 8.0 pred 3 fail. confidence: 0.14326847  
true: 9.0 pred 3 fail. confidence: 0.14326347  
true: 1.0 pred 3 fail. confidence: 0.14326684  
true: 9.0 pred 3 fail. confidence: 0.1434221  
true: 7.0 pred 3 fail. confidence: 0.1433913  
true: 8.0 pred 3 fail. confidence: 0.14342923  
true: 3.0 pred: 3 match1. confidence: 0.14326313  
true: 8.0 pred 3 fail. confidence: 0.14326316  
true: 9.0 pred 3 fail. confidence: 0.14328735  
true: 8.0 pred 3 fail. confidence: 0.14326368  
true: 2.0 pred: 2 match2. confidence: 0.1423471  
true: 3.0 pred: 3 match1. confidence: 0.14326312  
true: 9.0 pred 3 fail. confidence: 0.14326316  
true: 8.0 pred 3 fail. confidence: 0.14326368  
true: 1.0 pred 3 fail. confidence: 0.14326368  
true: 11.0 pred 3 fail. confidence: 0.14326684  
true: 7.0 pred 3 fail. confidence: 0.14326373  
true: 1.0 pred 3 fail. confidence: 0.14326479  
true: 7.0 pred 3 fail. confidence: 0.14337346  
true: 8.0 pred 3 fail. confidence: 0.14330317  
true: 3.0 pred: 3 match1. confidence: 0.14326416  
true: 9.0 pred 3 fail. confidence: 0.14326368  
true: 3.0 pred: 3 match1. confidence: 0.14326368  
true: 9.0 pred 3 fail. confidence: 0.14335613  
true: 6.0 pred 3 fail. confidence: 0.14335613  
true: 3.0 pred: 3 match1. confidence: 0.14332595  
true: 2.0 pred: 2 match2. confidence: 0.14231886  
true: 7.0 pred 3 fail. confidence: 0.14334016  
true: 2.0 pred: 2 match2. confidence: 0.14231886  
true: 3.0 pred: 3 match1. confidence: 0.14326566  
true: 9.0 pred 3 fail. confidence: 0.14263558  
true: 6.0 pred 3 fail. confidence: 0.14326368  
true: 7.0 pred 3 fail. confidence: 0.14326368  
true: 10.0 pred 3 fail. confidence: 0.14326352  
true: 1.0 pred 3 fail. confidence: 0.14326347  
true: 8.0 pred 3 fail. confidence: 0.1432635  
true: 7.0 pred 3 fail. confidence: 0.14326368  
true: 8.0 pred 3 fail. confidence: 0.14326316  
true: 1.0 pred 3 fail. confidence: 0.14327341  
true: 2.0 pred: 2 match2. confidence: 0.14235279  
true: 1.0 pred 3 fail. confidence: 0.14326566  
true: 8.0 pred 3 fail. confidence: 0.1432945  
true: 6.0 pred 3 fail. confidence: 0.14326352  
true: 7.0 pred 3 fail. confidence: 0.14326368  
true: 1.0 pred 3 fail. confidence: 0.14326353  
true: 7.0 pred 3 fail. confidence: 0.14332595  
true: 8.0 pred 3 fail. confidence: 0.14330317  
true: 1.0 pred 3 fail. confidence: 0.14326313  
true: 12.0 pred 3 fail. confidence: 0.14326316  
true: 7.0 pred 3 fail. confidence: 0.1434221  
true: 10.0 pred 3 fail. confidence: 0.14337346  
true: 8.0 pred 3 fail. confidence: 0.14335613  
true: 3.0 pred: 3 match1. confidence: 0.14326335  
true: 9.0 pred 3 fail. confidence: 0.1432636  
true: 2.0 pred: 2 match2. confidence: 0.14234741  
true: 3.0 pred: 3 match1. confidence: 0.14326368  
true: 9.0 pred 3 fail. confidence: 0.14326364  
true: 5.0 pred 3 fail. confidence: 0.1434221  
true: 9.0 pred 3 fail. confidence: 0.14326312  
true: 2.0 pred: 2 match2. confidence: 0.1423471  
true: 11.0 pred 3 fail. confidence: 0.14326368  
true: 2.0 pred: 2 match2. confidence: 0.1423471  
true: 3.0 pred: 3 match1. confidence: 0.14326341  
true: 8.0 pred 3 fail. confidence: 0.14326352  
true: 1.0 pred 3 fail. confidence: 0.14326364  
true: 12.0 pred 3 fail. confidence: 0.14326367  
true: 9.0 pred 3 fail. confidence: 0.14326312  
true: 8.0 pred 3 fail. confidence: 0.14332595  
true: 9.0 pred 3 fail. confidence: 0.14326324  
true: 1.0 pred 3 fail. confidence: 0.14326335  
true: 7.0 pred 3 fail. confidence: 0.14331363  
true: 2.0 pred: 2 match2. confidence: 0.1423507  
true: 3.0 pred: 3 match1. confidence: 0.1433913  
true: 7.0 pred 3 fail. confidence: 0.14326312  
true: 11.0 pred 3 fail. confidence: 0.1432633  
true: 8.0 pred 3 fail. confidence: 0.14326316  
true: 9.0 pred 3 fail. confidence: 0.14326368  
true: 6.0 pred 3 fail. confidence: 0.1432789  
true: 3.0 pred: 3 match1. confidence: 0.14326368  
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true: 6.0 pred 3 fail. confidence: 0.14326368  
true: 2.0 pred: 2 match2. confidence: 0.14152622  
true: 7.0 pred 3 fail. confidence: 0.14328161  
true: 12.0 pred 3 fail. confidence: 0.14328161  
true: 8.0 pred 3 fail. confidence: 0.14334549  
true: 7.0 pred 3 fail. confidence: 0.14326416  
true: 9.0 pred 3 fail. confidence: 0.14326341  
true: 3.0 pred: 3 match1. confidence: 0.14326368  
true: 2.0 pred: 2 match2. confidence: 0.14234708  
true: 1.0 pred 3 fail. confidence: 0.14327341

true: 11.0 pred 3 fail. confidence: 0.1432633  
true: 7.0 pred 3 fail. confidence: 0.1432634  
true: 9.0 pred 3 fail. confidence: 0.14326364  
true: 1.0 pred 3 fail. confidence: 0.14326316  
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true: 5.0 pred 2 fail. confidence: 0.142375  
true: 7.0 pred 2 fail. confidence: 0.14278102  
true: 3.0 pred: 3 match1. confidence: 0.14306138  
true: 11.0 pred 3 fail. confidence: 0.14326368  
true: 2.0 pred: 2 match2. confidence: 0.1423471  
true: 5.0 pred 3 fail. confidence: 0.14326364  
true: 1.0 pred 3 fail. confidence: 0.14326416  
true: 7.0 pred 3 fail. confidence: 0.14327061  
true: 1.0 pred 3 fail. confidence: 0.1432945  
true: 3.0 pred: 3 match1. confidence: 0.14327702  
true: 8.0 pred 3 fail. confidence: 0.14335613  
true: 1.0 pred 3 fail. confidence: 0.14326684  
true: 3.0 pred: 3 match1. confidence: 0.14326367  
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true: 7.0 pred 3 fail. confidence: 0.14332049  
true: 2.0 pred: 2 match2. confidence: 0.14234449  
true: 12.0 pred 3 fail. confidence: 0.14326368  
true: 2.0 pred: 2 match2. confidence: 0.1423471  
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true: 12.0 pred 3 fail. confidence: 0.14338553  
true: 9.0 pred 3 fail. confidence: 0.14326368  
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true: 12.0 pred 3 fail. confidence: 0.14326368  
true: 1.0 pred 3 fail. confidence: 0.14326368  
true: 5.0 pred 3 fail. confidence: 0.14326373  
true: 2.0 pred: 2 match2. confidence: 0.14235562  
true: 12.0 pred 3 fail. confidence: 0.14326368  
true: 8.0 pred 3 fail. confidence: 0.14326368  
true: 12.0 pred 3 fail. confidence: 0.1432636  
true: 4.0 pred 3 fail. confidence: 0.14326362  
true: 6.0 pred 3 fail. confidence: 0.14327341  
true: 8.0 pred 3 fail. confidence: 0.14326365  
true: 9.0 pred 3 fail. confidence: 0.14326368  
true: 10.0 pred 3 fail. confidence: 0.14326368  
true: 8.0 pred 3 fail. confidence: 0.14326364  
true: 9.0 pred 3 fail. confidence: 0.14326368  
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true: 9.0 pred 3 fail. confidence: 0.14260238  
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true: 3.0 pred: 3 match1. confidence: 0.14208531  
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true: 10.0 pred 3 fail. confidence: 0.14326368  
true: 3.0 pred: 3 match1. confidence: 0.14326368  
true: 9.0 pred 3 fail. confidence: 0.14326368  
true: 6.0 pred 3 fail. confidence: 0.14326368  
true: 12.0 pred 3 fail. confidence: 0.14326368  
true: 3.0 pred: 3 match1. confidence: 0.14326416  
true: 12.0 pred 3 fail. confidence: 0.1432631  
true: 9.0 pred 3 fail. confidence: 0.14326364  
true: 1.0 pred 3 fail. confidence: 0.14326335  
true: 3.0 pred: 3 match1. confidence: 0.1434221  
true: 1.0 pred 3 fail. confidence: 0.14334016

true: 5.0 pred 3 fail. confidence: 0.14327341  
true: 9.0 pred 3 fail. confidence: 0.14326324  
true: 1.0 pred 3 fail. confidence: 0.14326479  
true: 3.0 pred: 3 match1. confidence: 0.14337346  
true: 11.0 pred 3 fail. confidence: 0.1434002  
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true: 3.0 pred: 3 match1. confidence: 0.14326316  
true: 7.0 pred 3 fail. confidence: 0.14326368  
true: 5.0 pred 3 fail. confidence: 0.1432636  
true: 1.0 pred 3 fail. confidence: 0.14326324  
true: 9.0 pred 3 fail. confidence: 0.14326344  
true: 2.0 pred: 2 match2. confidence: 0.14229572  
true: 1.0 pred 3 fail. confidence: 0.14326322  
true: 3.0 pred: 3 match1. confidence: 0.14327328  
true: 2.0 pred: 2 match1. confidence: 0.14264621  
true: 8.0 pred 3 fail. confidence: 0.14326367  
true: 4.0 pred 2 fail. confidence: 0.14282814  
true: 7.0 pred 2 fail. confidence: 0.14228448  
true: 9.0 pred 2 fail. confidence: 0.14194359  
true: 8.0 pred 3 fail. confidence: 0.143265  
true: 2.0 pred: 2 match2. confidence: 0.14234708  
true: 8.0 pred 3 fail. confidence: 0.14326313  
true: 1.0 pred 3 fail. confidence: 0.1432635  
true: 2.0 pred: 2 match2. confidence: 0.14234711  
true: 11.0 pred 3 fail. confidence: 0.14326344  
true: 12.0 pred 3 fail. confidence: 0.14326373  
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true: 12.0 pred 3 fail. confidence: 0.14326368  
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true: 5.0 pred 3 fail. confidence: 0.14326322  
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true: 9.0 pred 3 fail. confidence: 0.14326368  
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true: 9.0 pred 3 fail. confidence: 0.1432633  
true: 7.0 pred 3 fail. confidence: 0.14326479  
true: 3.0 pred: 3 match1. confidence: 0.14326847  
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true: 9.0 pred 3 fail. confidence: 0.14326368  
true: 8.0 pred 3 fail. confidence: 0.14326368  
true: 7.0 pred 3 fail. confidence: 0.14326368  
true: 2.0 pred: 2 match2. confidence: 0.14234708  
true: 12.0 pred 3 fail. confidence: 0.14326368  
true: 1.0 pred 3 fail. confidence: 0.14326368  
true: 4.0 pred 3 fail. confidence: 0.14326368  
true: 2.0 pred: 2 match2. confidence: 0.14082031  
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true: 6.0 pred 3 fail. confidence: 0.14326313  
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true: 9.0 pred 3 fail. confidence: 0.1432633  
true: 2.0 pred: 2 match2. confidence: 0.14235425  
true: 1.0 pred 3 fail. confidence: 0.1432633  
true: 12.0 pred 3 fail. confidence: 0.14326364  
true: 2.0 pred: 2 match2. confidence: 0.14234711  
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true: 2.0 pred: 2 match2. confidence: 0.14235188  
true: 3.0 pred: 3 match1. confidence: 0.1432633  
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true: 1.0 pred 3 fail. confidence: 0.14326368  
true: 2.0 pred: 2 match2. confidence: 0.14235035  
true: 8.0 pred 3 fail. confidence: 0.14330317  
true: 1.0 pred 3 fail. confidence: 0.14326368  
true: 3.0 pred: 3 match1. confidence: 0.14326368  
true: 12.0 pred 3 fail. confidence: 0.14326368  
true: 8.0 pred 3 fail. confidence: 0.14326368  
true: 6.0 pred 3 fail. confidence: 0.14326368  
true: 7.0 pred 3 fail. confidence: 0.14326368  
true: 9.0 pred 3 fail. confidence: 0.14326368  
true: 6.0 pred 3 fail. confidence: 0.1432703  
true: 7.0 pred 3 fail. confidence: 0.143264  
true: 12.0 pred 3 fail. confidence: 0.14326365  
true: 8.0 pred 3 fail. confidence: 0.14326362  
true: 9.0 pred 3 fail. confidence: 0.14326313  
true: 3.0 pred: 3 match1. confidence: 0.14326368  
true: 2.0 pred: 2 match2. confidence: 0.14234708  
true: 1.0 pred 3 fail. confidence: 0.14326327  
true: 2.0 pred: 2 match2. confidence: 0.14234711  
true: 7.0 pred 3 fail. confidence: 0.14326365  
true: 9.0 pred 3 fail. confidence: 0.14326365  
true: 2.0 pred: 2 match2. confidence: 0.14235651  
true: 3.0 pred: 3 match1. confidence: 0.14326365  
true: 6.0 pred 3 fail. confidence: 0.14326368  
true: 11.0 pred 3 fail. confidence: 0.14326368  
true: 2.0 pred: 2 match2. confidence: 0.14234708  
true: 9.0 pred 3 fail. confidence: 0.14326368  
true: 8.0 pred 3 fail. confidence: 0.14326368  
true: 9.0 pred 3 fail. confidence: 0.14326364  
true: 1.0 pred 3 fail. confidence: 0.14326368  
true: 3.0 pred: 3 match1. confidence: 0.14326341  
true: 8.0 pred 3 fail. confidence: 0.14326341  
true: 2.0 pred: 2 match2. confidence: 0.14234708  
true: 9.0 pred 3 fail. confidence: 0.14326347  
true: 8.0 pred 3 fail. confidence: 0.14326368  
true: 3.0 pred: 3 match1. confidence: 0.14326368  
true: 5.0 pred 3 fail. confidence: 0.14326368  
true: 12.0 pred 3 fail. confidence: 0.14326368  
true: 8.0 pred 3 fail. confidence: 0.14337346  
true: 12.0 pred 3 fail. confidence: 0.14326322  
true: 11.0 pred 3 fail. confidence: 0.14326313  
true: 7.0 pred 3 fail. confidence: 0.14334016  
true: 1.0 pred 3 fail. confidence: 0.1432945  
true: 8.0 pred 3 fail. confidence: 0.14334016  
true: 5.0 pred 3 fail. confidence: 0.14326566  
true: 9.0 pred 3 fail. confidence: 0.14326316

true: 2.0 pred: 2 match1. confidence: 0.14207868  
true: 7.0 pred 3 fail. confidence: 0.1433791  
true: 9.0 pred 3 fail. confidence: 0.14326327  
acc: 24.126984126984127 %

section F: VGG + SBD 200 epochs (on DGX):  
(937, 257, 4098) (937, 30)  
(235, 257, 4098) (235, 1)

Training time: 120869.2154712677

Prediction time: 23.44919776916504

true: 16.0 pred 1 fail. confidence: nan  
true: 19.0 pred 1 fail. confidence: nan  
true: 29.0 pred 1 fail. confidence: nan  
true: 23.0 pred 1 fail. confidence: nan  
true: 19.0 pred 1 fail. confidence: nan  
true: 23.0 pred 1 fail. confidence: nan  
true: 2.0 pred: 2 match2. confidence: nan  
true: 13.0 pred 1 fail. confidence: nan  
true: 22.0 pred 1 fail. confidence: nan  
true: 3.0 pred 1 fail. confidence: nan  
true: 18.0 pred 1 fail. confidence: nan  
true: 15.0 pred 1 fail. confidence: nan  
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true: 6.0 pred 1 fail. confidence: nan  
true: 16.0 pred 1 fail. confidence: nan  
true: 14.0 pred 1 fail. confidence: nan  
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true: 13.0 pred 1 fail. confidence: nan  
true: 5.0 pred 1 fail. confidence: nan  
true: 25.0 pred 1 fail. confidence: nan  
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true: 23.0 pred 1 fail. confidence: nan  
true: 28.0 pred 1 fail. confidence: nan  
true: 11.0 pred 1 fail. confidence: nan  
true: 22.0 pred 1 fail. confidence: nan  
true: 5.0 pred 1 fail. confidence: nan  
true: 10.0 pred 1 fail. confidence: nan  
true: 7.0 pred 1 fail. confidence: nan  
true: 8.0 pred 1 fail. confidence: nan  
true: 19.0 pred 1 fail. confidence: nan  
true: 18.0 pred 1 fail. confidence: nan





true: 12.0 pred 1 fail. confidence: nan  
true: 22.0 pred 1 fail. confidence: nan  
true: 23.0 pred 1 fail. confidence: nan  
true: 6.0 pred 1 fail. confidence: nan  
true: 18.0 pred 1 fail. confidence: nan  
true: 17.0 pred 1 fail. confidence: nan  
true: 24.0 pred 1 fail. confidence: nan  
true: 20.0 pred 1 fail. confidence: nan  
true: 23.0 pred 1 fail. confidence: nan  
true: 28.0 pred 1 fail. confidence: nan  
true: 14.0 pred 1 fail. confidence: nan  
true: 28.0 pred 1 fail. confidence: nan  
true: 16.0 pred 1 fail. confidence: nan  
true: 13.0 pred 1 fail. confidence: nan  
true: 30.0 pred 1 fail. confidence: nan  
true: 14.0 pred 1 fail. confidence: nan  
true: 19.0 pred 1 fail. confidence: nan  
true: 15.0 pred 1 fail. confidence: nan  
true: 20.0 pred 1 fail. confidence: nan  
true: 23.0 pred 1 fail. confidence: nan  
true: 30.0 pred 1 fail. confidence: nan  
true: 6.0 pred 1 fail. confidence: nan  
true: 22.0 pred 1 fail. confidence: nan  
true: 11.0 pred 1 fail. confidence: nan  
true: 9.0 pred 1 fail. confidence: nan  
true: 14.0 pred 1 fail. confidence: nan  
true: 8.0 pred 1 fail. confidence: nan  
true: 4.0 pred 1 fail. confidence: nan  
true: 15.0 pred 1 fail. confidence: nan  
true: 14.0 pred 1 fail. confidence: nan  
true: 30.0 pred 1 fail. confidence: nan  
true: 4.0 pred 1 fail. confidence: nan  
true: 6.0 pred 1 fail. confidence: nan  
true: 24.0 pred 1 fail. confidence: nan  
true: 5.0 pred 1 fail. confidence: nan  
true: 3.0 pred 1 fail. confidence: nan  
true: 15.0 pred 1 fail. confidence: nan  
true: 7.0 pred 1 fail. confidence: nan  
true: 12.0 pred 1 fail. confidence: nan  
true: 9.0 pred 1 fail. confidence: nan  
true: 29.0 pred 1 fail. confidence: nan  
true: 23.0 pred 1 fail. confidence: nan  
true: 16.0 pred 1 fail. confidence: nan  
true: 12.0 pred 1 fail. confidence: nan  
true: 11.0 pred 1 fail. confidence: nan  
true: 14.0 pred 1 fail. confidence: nan  
true: 4.0 pred 1 fail. confidence: nan  
true: 1.0 pred: 1 match1. confidence: nan  
true: 29.0 pred 1 fail. confidence: nan  
true: 13.0 pred 1 fail. confidence: nan  
true: 29.0 pred 1 fail. confidence: nan  
true: 15.0 pred 1 fail. confidence: nan  
true: 17.0 pred 1 fail. confidence: nan  
true: 24.0 pred 1 fail. confidence: nan  
true: 8.0 pred 1 fail. confidence: nan  
true: 12.0 pred 1 fail. confidence: nan  
true: 13.0 pred 1 fail. confidence: nan  
true: 30.0 pred 1 fail. confidence: nan  
true: 28.0 pred 1 fail. confidence: nan  
true: 25.0 pred 1 fail. confidence: nan  
true: 10.0 pred 1 fail. confidence: nan

true: 28.0 pred 1 fail. confidence: nan  
acc: 2.9787234042553195 %