

Testing and Analysis/Evaluation Document

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

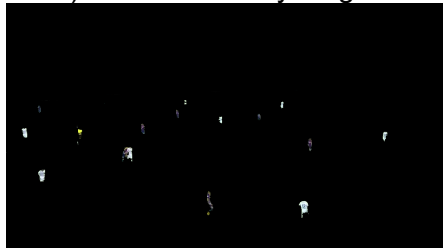
note: testing batch also had frames with no ball. In such case if ball was not detected and indeed there was no ball, it was considered as a correct detection;

How K-means works:

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



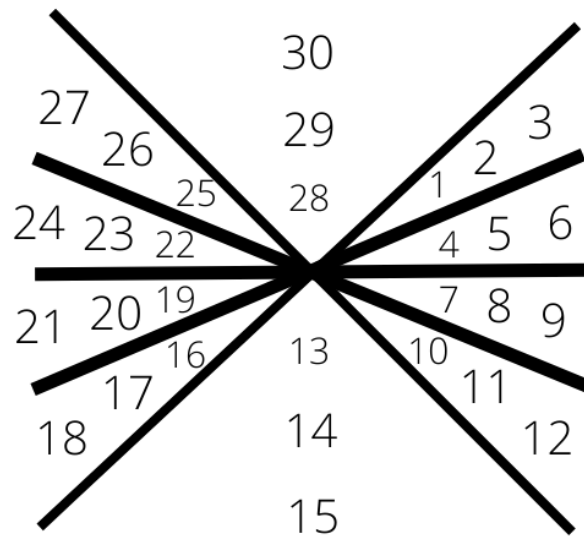
- 3) Remove everything above the field.



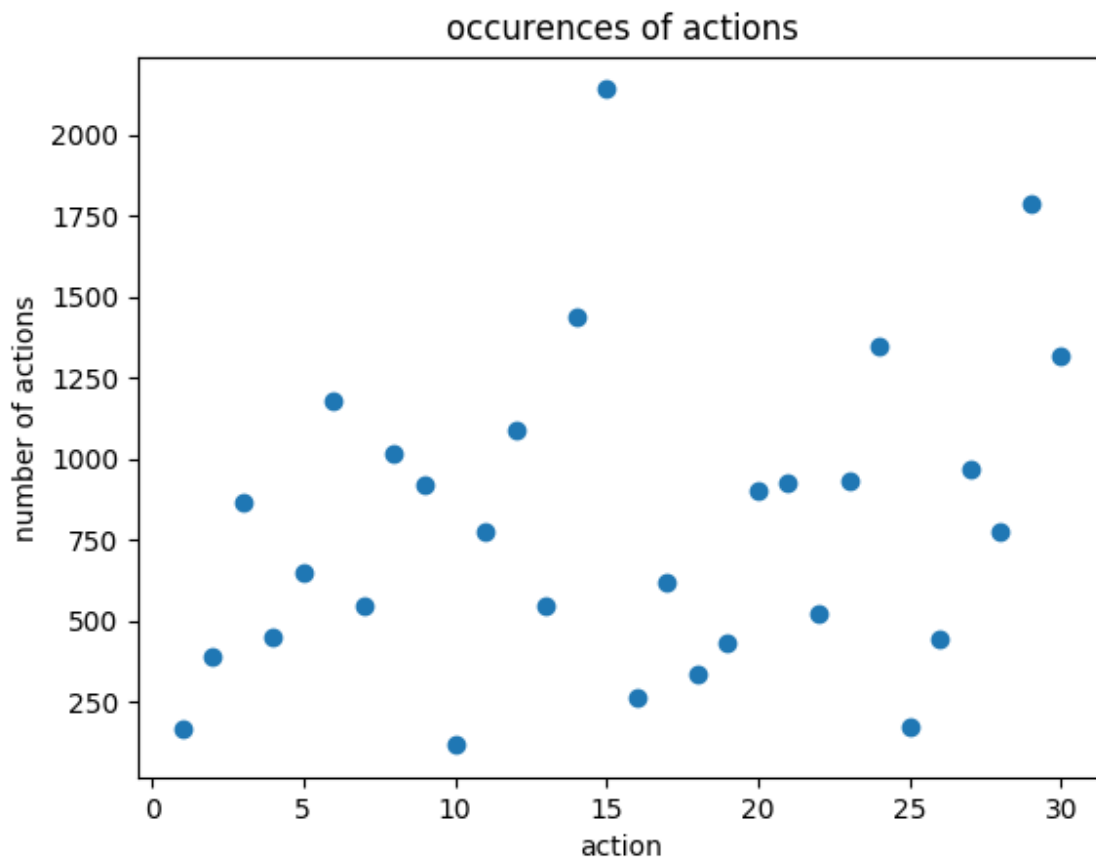
- 4) In the remaining image find 2 dominant colors (except black) using K means clustering from scikits-learn library
- 5) Detect a team of players by finding the closest distance to one of the 2 dominant colors.

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;

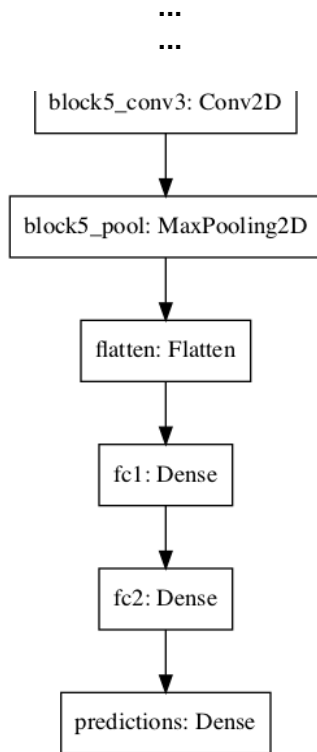


Now actions are labelled as above. 1 - short, 2 - long, 3 - traversal and so on; With such actions the dataset with following frequency for each action was acquired as in the graph. For 45 minute match there are 24016 samples and 51 features (frame, actionLabel, ball_coordinates and etc);



Next step: train different models and check if diversity of actions positively affect the result or not

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	
lstm2.py	Prediction action using model [2]	m2: 0.0289	m5: 0.09978 (FCB-RMA)
		m3: 0.027	

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

true: 11.0 pred 2 fail. confidence: 0.1455081	true: 12.0 pred 2 fail. confidence: 0.14285396
true: 8.0 pred: 8 match2. confidence: 0.14072534	true: 2.0 pred: 2 match1. confidence: 0.1429624
true: 7.0 pred 8 fail. confidence: 0.1538237	true: 1.0 pred 2 fail. confidence: 0.14383836
true: 11.0 pred 8 fail. confidence: 0.153807	true: 5.0 pred 2 fail. confidence: 0.14522879
true: 2.0 pred: 2 match1. confidence: 0.13777275	true: 7.0 pred 2 fail. confidence: 0.13975245
true: 12.0 pred 2 fail. confidence: 0.14220731	true: 2.0 pred: 2 match1. confidence: 0.14339466
true: 6.0 pred 2 fail. confidence: 0.13975245	true: 3.0 pred 2 fail. confidence: 0.14448452
true: 1.0 pred 2 fail. confidence: 0.19801652	true: 7.0 pred 2 fail. confidence: 0.13810316
true: 4.0 pred 2 fail. confidence: 0.14448452	true: 8.0 pred: 8 match2. confidence: 0.13532282
true: 11.0 pred 2 fail. confidence: 0.14503302	true: 1.0 pred 2 fail. confidence: 0.17836821
true: 1.0 pred 8 fail. confidence: 0.15034805	true: 5.0 pred 2 fail. confidence: 0.19801652
true: 2.0 pred: 2 match2. confidence: 0.1494695	true: 6.0 pred 2 fail. confidence: 0.14544658
true: 11.0 pred 2 fail. confidence: 0.14514309	true: 7.0 pred 8 fail. confidence: 0.15368444
true: 8.0 pred: 8 match2. confidence: 0.13780963	true: 2.0 pred: 2 match2. confidence: 0.14851609
true: 2.0 pred: 2 match1. confidence: 0.13810316	true: 10.0 pred 2 fail. confidence: 0.14448452
true: 5.0 pred 2 fail. confidence: 0.14145343	true: 9.0 pred 2 fail. confidence: 0.14220731
true: 6.0 pred 2 fail. confidence: 0.14145343	true: 12.0 pred 2 fail. confidence: 0.17836821
true: 10.0 pred 2 fail. confidence: 0.147646	true: 8.0 pred: 8 match2. confidence: 0.19711524
true: 4.0 pred 8 fail. confidence: 0.21011049	true: 9.0 pred 2 fail. confidence: 0.14576453
true: 1.0 pred 2 fail. confidence: 0.17276765	true: 2.0 pred: 2 match1. confidence: 0.14576453
true: 2.0 pred: 2 match1. confidence: 0.14419729	true: 7.0 pred 2 fail. confidence: 0.1429624
true: 8.0 pred: 8 match2. confidence: 0.13833591	true: 12.0 pred 2 fail. confidence: 0.14555931
true: 3.0 pred 2 fail. confidence: 0.14489211	true: 2.0 pred: 2 match1. confidence: 0.14503302
true: 1.0 pred 8 fail. confidence: 0.1538044	true: 8.0 pred: 8 match1. confidence: 0.15287453
true: 8.0 pred: 8 match1. confidence: 0.153813	true: 10.0 pred 8 fail. confidence: 0.15377843
true: 1.0 pred 2 fail. confidence: 0.14555931	true: 3.0 pred 2 fail. confidence: 0.14285396
true: 3.0 pred 2 fail. confidence: 0.14538726	true: 11.0 pred 8 fail. confidence: 0.21011049
true: 7.0 pred 8 fail. confidence: 0.15363872	true: 2.0 pred: 2 match1. confidence: 0.13810316
true: 8.0 pred: 8 match1. confidence: 0.15344219	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
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true: 7.0 pred 2 fail. confidence: 0.14430156
true: 8.0 pred: 8 match2. confidence: 0.12639984
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true: 6.0 pred 1 fail. confidence: 0.13652793
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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
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true: 9.0 pred 3 fail. confidence: 0.14326316
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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

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