

# Train Short Time Fourier Transform

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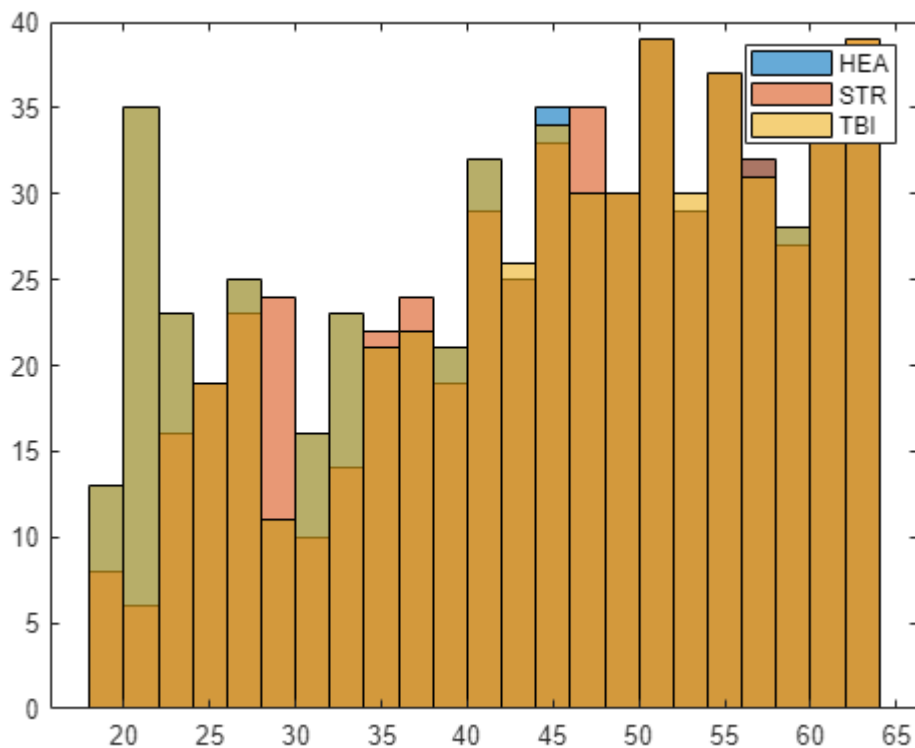
Live script used to train the Short time fourier transform network

```
tic
fs = 100;
fol = "D:\3minSept22";
ds_all=ResampleDatastore(fol,fs,'DataAugmentation',false);
ds_test = ResampleDatastore(fol,fs,'TestSet',false);
ds90_all=ResampleDatastore(fol,fs,'DataAugmentation',true);
ds90_test = ResampleDatastore(fol,fs,'TestSet',true);
toc
```

Used Matched Age and Gender subjects/sessions of HEA and STR

```
[HEA,STR,TBI] = MatchSubjects();
```

```
# HEA subjects/sessions: 595/629
# STR subjects/sessions: 527/585
# TBI subjects/sessions: 552/629
```



```
s = split(HEA.Location,'\');
s = string(s(:,9));
s = split(s, '.');
HEA = s(:,1);
s = split(STR.Location,'\');
```

```

s = string(s(:,9));
s = split(s, '.');
STR = s(:,1);
s = split(TBI.Location, '\');
s = string(s(:,9));
s = split(s, '.');
TBI = s(:,1);

```

Check for overlaps

```

f = string(ds_all.Datastore.Files);
in_HEA = [];
in_STR = [];
in_TBI = [];
for i = 1:length(f)
    for j = 1:length(HEA)
        if contains(f(i),HEA(j))
            in_HEA = [in_HEA i];
            break
        end
    end
    for j = 1:length(STR)
        if contains(f(i),STR(j))
            in_STR = [in_STR i];
            break
        end
    end
    for j = 1:length(TBI)
        if contains(f(i),TBI(j))
            in_TBI = [in_TBI i];
            break
        end
    end
end
%in_TBI = find(ds_all.Labels == "TBI");
in = [in_HEA, in_STR, in_TBI];
ds_match = subset(ds_all,in);
ds_match_test = subset(ds_test,in);
ds90_match = subset(ds90_all,in);
ds90_match_test = subset(ds90_test,in);

```

Set aside >=50 patients for IV

```

c = string(categories(ds_match.Labels));
numsub = max(50,floor(min(countcats(ds_match.Labels)).2));
disp("Using " + numsub + " for IV.")

```

Using 582 for IV.

```

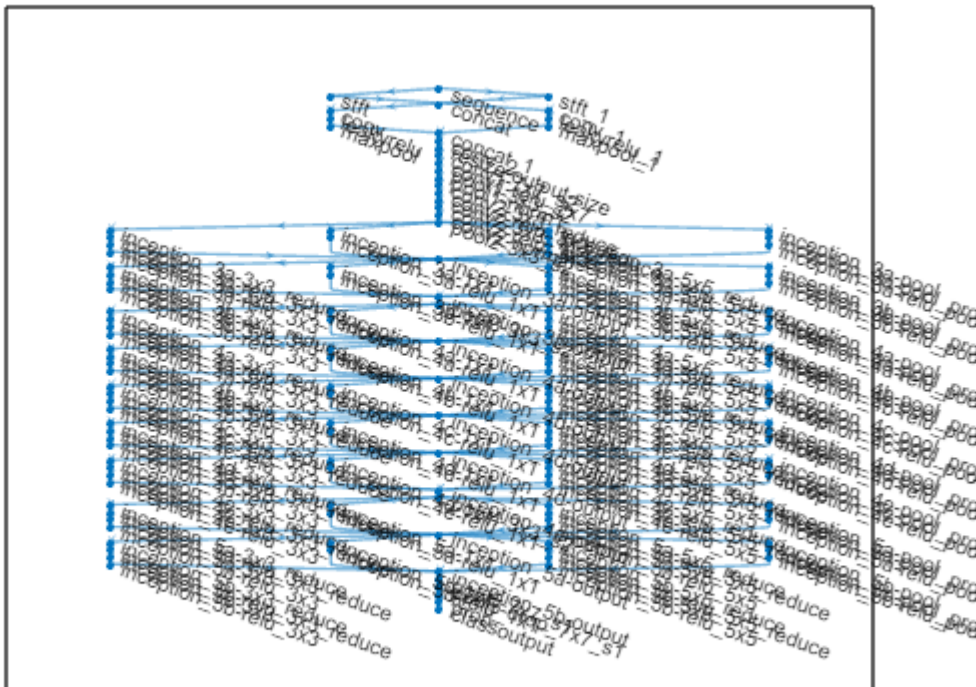
in_iv = [];

```

```

in_cv = [];
for i = 1:length(c)
    in = find(ds_match.Labels == c(i));
    r = randperm(length(in));
    in_iv = [in_iv; in(r(1:numsub))];
    in_cv = [in_cv; in(r(numsub+1:end))];
end
X_Train=subset(ds_match,in_cv);
X_Test=subset(ds_match_test,in_iv);
Y_Train=subset(ds90_match,in_cv);
Y_Test=subset(ds90_match_test,in_iv);
save("STFTData.mat","X_Train","X_Test","Y_Train","Y_Test")

```



## Run Network

```

% gpuDevice(1);
% %load("STFTLayers.mat")
% reset(X_Train);
% reset(X_Test);
% miniBatchSize=24;
% X_Train.MiniBatchSize=miniBatchSize;
% X_Test.MiniBatchSize=miniBatchSize;
% opts=trainingOptions("adam","Plots","training-
progress","ExecutionEnvironment","gpu", ...
%     "Shuffle","every-epoch","MiniBatchSize",miniBatchSize,"MaxEpochs",30*3,...

```

```
%
"InitialLearnRate",.0001,"LearnRateSchedule","piecewise","LearnRateDropPeriod",30,"GradientThreshold",10,...
%      "OutputNetwork","best-validation-
loss","ValidationData",X_Test,"ValidationFrequency",100);
% net=trainNetwork(X_Train,lgraph_2,opts);
```

Epoch	Iteration	Time Elapsed (hh:mm:ss)	Mini-batch Accuracy	Validation Accuracy	Mini-batch Loss	Validation Loss	Base Learning Rate
1	1	00:01:09	29.17%	33.31%	16.1284	15.9765	1.0000e-05
1	50	00:02:20	54.17%		2.7504		1.0000e-05
1	100	00:04:21	50.00%	45.67%	1.1569	1.6274	1.0000e-05
1	150	00:05:35	41.67%		1.7076		1.0000e-05
1	200	00:07:35	58.33%	47.43%	1.4657	1.5157	1.0000e-05
1	250	00:08:48	54.17%		1.3602		1.0000e-05
1	300	00:10:46	41.67%	47.18%	1.2255	1.3749	1.0000e-05
2	350	00:11:51	45.83%		2.0789		1.0000e-05
2	400	00:13:41	54.17%	41.07%	1.0854	1.3959	1.0000e-05
2	450	00:14:43	45.83%		1.0951		1.0000e-05
2	500	00:16:32	50.00%	49.00%	1.0936	1.2012	1.0000e-05
2	550	00:17:34	45.83%		1.6796		1.0000e-05
2	600	00:19:23	54.17%	49.91%	1.3635	1.3281	1.0000e-05
3	650	00:20:27	41.67%		1.0563		1.0000e-05
3	700	00:22:14	54.17%	47.97%	1.0669	1.3817	1.0000e-05
3	750	00:23:14	50.00%		1.0342		1.0000e-05
3	800	00:24:58	45.83%	47.55%	1.8821	1.3582	1.0000e-05
3	850	00:25:58	45.83%		1.2841		1.0000e-05
3	900	00:27:42	33.33%	46.52%	7.4974	1.4161	1.0000e-05
3	950	00:28:41	45.83%		0.9348		1.0000e-05
4	1000	00:30:27	70.83%	48.82%	1.0795	1.3497	1.0000e-05
4	1050	00:31:26	45.83%		0.9447		1.0000e-05
4	1100	00:33:10	50.00%	48.82%	1.1176	1.1739	1.0000e-05
4	1150	00:34:09	62.50%		0.8702		1.0000e-05
4	1200	00:35:53	45.83%	47.61%	0.9996	1.1982	1.0000e-05
4	1250	00:36:53	58.33%		0.7899		1.0000e-05
5	1300	00:38:38	66.67%	52.15%	0.8445	1.1500	1.0000e-05
5	1350	00:39:37	33.33%		1.1077		1.0000e-05
5	1400	00:41:21	50.00%	52.88%	1.0359	1.0937	1.0000e-05
5	1450	00:42:20	62.50%		0.7166		1.0000e-05
5	1500	00:44:04	33.33%	53.06%	1.2858	1.1699	1.0000e-05
5	1550	00:45:04	50.00%		0.9921		1.0000e-05
6	1600	00:46:48	41.67%	44.40%	1.3784	1.3833	1.0000e-05
6	1650	00:47:48	62.50%		0.7676		1.0000e-05
6	1700	00:49:32	66.67%	45.73%	0.8130	1.2909	1.0000e-05
6	1750	00:50:31	70.83%		0.8187		1.0000e-05
6	1800	00:52:15	66.67%	49.67%	0.6627	1.1576	1.0000e-05
6	1850	00:53:15	54.17%		1.0987		1.0000e-05
6	1900	00:54:58	45.83%	50.33%	1.4795	1.1016	1.0000e-05
7	1950	00:55:59	50.00%		1.3506		1.0000e-05
7	2000	00:57:43	54.17%	54.88%	0.9147	1.0814	1.0000e-05
7	2050	00:58:43	66.67%		0.8464		1.0000e-05
7	2100	01:00:28	37.50%	44.76%	1.3255	1.3221	1.0000e-05
7	2150	01:01:27	66.67%		0.7278		1.0000e-05
7	2200	01:03:11	45.83%	46.82%	1.3151	1.2712	1.0000e-05
8	2250	01:04:12	70.83%		0.7843		1.0000e-05
8	2300	01:05:56	45.83%	44.70%	1.9359	1.6054	1.0000e-05
8	2350	01:06:55	54.17%		0.9256		1.0000e-05
8	2400	01:08:39	50.00%	51.36%	1.2602	1.1636	1.0000e-05
8	2450	01:09:39	58.33%		0.9669		1.0000e-05
8	2500	01:11:22	50.00%	54.88%	1.0068	1.1435	1.0000e-05
9	2550	01:12:23	41.67%		1.1388		1.0000e-05

9	2600	01:14:08	62.50%	57.06%	0.8596	1.0347	1.0000e-
9	2650	01:15:07	62.50%		0.8636		1.0000e-
9	2700	01:16:51	50.00%	56.57%	0.8072	1.0390	1.0000e-
9	2750	01:17:50	62.50%		0.6095		1.0000e-
9	2800	01:19:35	62.50%	56.45%	0.8427	1.0533	1.0000e-
9	2850	01:20:34	54.17%		0.8546		1.0000e-
10	2900	01:22:19	45.83%	55.84%	1.0464	1.0513	1.0000e-
10	2950	01:23:19	50.00%		0.9341		1.0000e-
10	3000	01:25:03	54.17%	56.33%	1.0324	1.0390	1.0000e-
10	3050	01:26:02	75.00%		0.9030		1.0000e-
10	3100	01:27:46	66.67%	55.36%	0.7657	1.1174	1.0000e-
10	3150	01:28:46	58.33%		0.8816		1.0000e-
11	3200	01:30:31	66.67%	56.87%	0.8461	1.0525	1.0000e-
11	3250	01:31:30	75.00%		0.6225		1.0000e-
11	3300	01:33:15	54.17%	55.18%	0.9953	0.9914	1.0000e-
11	3350	01:34:14	58.33%		0.9236		1.0000e-
11	3400	01:35:58	45.83%	55.06%	0.8991	1.0752	1.0000e-
11	3450	01:36:57	62.50%		0.8406		1.0000e-
12	3500	01:38:42	50.00%	55.30%	0.8530	1.0653	1.0000e-
12	3550	01:39:42	75.00%		0.5815		1.0000e-
12	3600	01:41:26	45.83%	53.42%	1.1246	1.0734	1.0000e-
12	3650	01:42:25	45.83%		0.9441		1.0000e-
12	3700	01:44:09	62.50%	57.06%	0.6810	0.9165	1.0000e-
12	3750	01:45:08	50.00%		1.0947		1.0000e-
12	3800	01:46:53	58.33%	56.09%	0.7325	1.0122	1.0000e-
13	3850	01:47:53	66.67%		0.6331		1.0000e-
13	3900	01:49:37	62.50%	58.27%	0.7133	1.0008	1.0000e-
13	3950	01:50:37	62.50%		0.9211		1.0000e-
13	4000	01:52:21	62.50%	57.36%	0.7756	0.9993	1.0000e-
13	4050	01:53:20	50.00%		1.0404		1.0000e-
13	4100	01:55:05	75.00%	53.12%	0.6077	1.0377	1.0000e-
14	4150	01:56:05	62.50%		0.8761		1.0000e-
14	4200	01:57:49	66.67%	52.57%	0.7298	1.0660	1.0000e-
14	4250	01:58:49	75.00%		0.6412		1.0000e-
14	4300	02:00:33	54.17%	57.60%	0.9519	1.0172	1.0000e-
14	4350	02:01:32	70.83%		0.6447		1.0000e-
14	4400	02:03:16	50.00%	57.00%	0.7767	1.0881	1.0000e-
14	4450	02:04:15	70.83%		0.7373		1.0000e-
15	4500	02:06:00	54.17%	52.94%	0.9661	1.1810	1.0000e-
15	4550	02:07:00	62.50%		0.8507		1.0000e-
15	4600	02:08:43	62.50%	54.94%	0.7696	1.0232	1.0000e-
15	4650	02:09:43	75.00%		0.7135		1.0000e-
15	4700	02:11:26	41.67%	57.24%	1.1059	0.9973	1.0000e-
15	4750	02:12:26	66.67%		0.7047		1.0000e-
16	4800	02:14:10	54.17%	54.63%	0.9117	1.1163	1.0000e-
16	4850	02:15:10	66.67%		0.9580		1.0000e-
16	4900	02:16:55	58.33%	50.58%	1.1004	1.1896	1.0000e-
16	4950	02:17:54	66.67%		0.8628		1.0000e-
16	5000	02:19:38	58.33%	52.45%	0.7687	1.0982	1.0000e-
16	5050	02:20:38	70.83%		0.6594		1.0000e-
17	5100	02:22:27	54.17%	53.36%	0.8319	1.1126	1.0000e-
17	5150	02:23:28	54.17%		0.9887		1.0000e-
17	5200	02:25:12	37.50%	50.45%	0.9761	1.2029	1.0000e-
17	5250	02:26:11	45.83%		0.9877		1.0000e-
17	5300	02:27:55	66.67%	50.64%	0.7023	1.1859	1.0000e-
17	5350	02:28:55	54.17%		0.8458		1.0000e-
17	5400	02:30:39	66.67%	55.06%	0.8829	1.0776	1.0000e-
18	5450	02:31:39	79.17%		0.4688		1.0000e-
18	5500	02:33:23	66.67%	57.30%	0.7882	1.0172	1.0000e-
18	5550	02:34:23	66.67%		0.7054		1.0000e-
18	5600	02:36:07	70.83%	57.18%	0.6313	1.0644	1.0000e-
18	5650	02:37:06	62.50%		0.7705		1.0000e-
18	5700	02:38:50	58.33%	58.45%	0.7767	1.0145	1.0000e-
19	5750	02:39:50	79.17%		0.5689		1.0000e-

19	5800	02:41:34	62.50%	51.42%	0.7667	1.2213	1.0000e-
19	5850	02:42:34	70.83%		0.7156		1.0000e-
19	5900	02:44:18	79.17%	59.36%	0.5499	1.0319	1.0000e-
19	5950	02:45:18	66.67%		0.7507		1.0000e-
19	6000	02:47:02	66.67%	53.97%	0.8108	1.0693	1.0000e-
20	6050	02:48:02	87.50%		0.4077		1.0000e-
20	6100	02:49:47	62.50%	58.87%	0.8317	1.0375	1.0000e-
20	6150	02:50:46	87.50%		0.5210		1.0000e-
20	6200	02:52:30	62.50%	57.30%	0.8091	1.1064	1.0000e-
20	6250	02:53:30	50.00%		0.8471		1.0000e-
20	6300	02:55:14	70.83%	58.39%	0.5938	0.9956	1.0000e-
20	6350	02:56:14	54.17%		0.7983		1.0000e-
21	6400	02:57:58	66.67%	58.57%	0.7000	1.0216	1.0000e-
21	6450	02:58:58	66.67%		0.6536		1.0000e-
21	6500	03:00:42	66.67%	51.48%	0.7502	1.1936	1.0000e-
21	6550	03:01:41	70.83%		0.7223		1.0000e-
21	6600	03:03:25	66.67%	59.42%	0.6808	1.0520	1.0000e-
21	6650	03:04:25	50.00%		0.9117		1.0000e-
22	6700	03:06:10	58.33%	58.63%	0.7607	1.0412	1.0000e-
22	6750	03:07:09	54.17%		0.8362		1.0000e-
22	6800	03:08:53	75.00%	55.42%	0.6244	1.0921	1.0000e-
22	6850	03:09:53	70.83%		0.5542		1.0000e-
22	6900	03:11:37	62.50%	58.99%	0.7461	1.0210	1.0000e-
22	6950	03:12:37	66.67%		0.7936		1.0000e-
23	7000	03:14:22	75.00%	57.48%	0.5846	1.0624	1.0000e-
23	7050	03:15:22	66.67%		0.7344		1.0000e-
23	7100	03:17:05	62.50%	54.27%	0.8335	1.0992	1.0000e-
23	7150	03:18:05	54.17%		1.0127		1.0000e-
23	7200	03:19:49	62.50%	57.78%	0.9310	1.0351	1.0000e-
23	7250	03:20:48	75.00%		0.6960		1.0000e-
23	7300	03:22:33	66.67%	59.42%	0.6452	1.0198	1.0000e-
24	7350	03:23:33	50.00%		0.9634		1.0000e-
24	7400	03:25:17	62.50%	57.66%	0.7127	1.0188	1.0000e-
24	7450	03:26:16	66.67%		0.6007		1.0000e-
24	7500	03:28:01	70.83%	55.30%	0.6201	1.0862	1.0000e-
24	7550	03:29:00	58.33%		0.7731		1.0000e-
24	7600	03:30:44	87.50%	58.33%	0.6053	1.0310	1.0000e-
25	7650	03:31:44	70.83%		0.6722		1.0000e-
25	7700	03:33:28	54.17%	58.69%	0.8738	1.1082	1.0000e-
25	7750	03:34:28	79.17%		0.5106		1.0000e-
25	7800	03:36:12	70.83%	57.00%	0.7821	1.0879	1.0000e-
25	7850	03:37:12	58.33%		0.7146		1.0000e-
25	7900	03:38:57	79.17%	56.33%	0.5474	1.1032	1.0000e-
25	7950	03:39:56	66.67%		0.6427		1.0000e-
26	8000	03:41:43	62.50%	57.72%	0.6571	1.0523	1.0000e-
26	8050	03:42:44	75.00%		0.5639		1.0000e-
26	8100	03:44:30	66.67%	59.96%	0.7753	1.0866	1.0000e-
26	8150	03:45:31	70.83%		0.6012		1.0000e-
26	8200	03:47:15	83.33%	59.54%	0.4973	1.0486	1.0000e-
26	8250	03:48:15	79.17%		0.5907		1.0000e-
27	8300	03:50:00	75.00%	58.57%	0.6533	0.9903	1.0000e-
27	8350	03:51:00	41.67%		1.0641		1.0000e-
27	8400	03:52:44	41.67%	56.63%	1.1470	1.0139	1.0000e-
27	8450	03:53:43	66.67%		0.7434		1.0000e-
27	8500	03:55:27	50.00%	60.81%	0.7430	1.0205	1.0000e-
27	8550	03:56:27	75.00%		0.5981		1.0000e-
28	8600	03:58:12	75.00%	59.60%	0.7590	1.0025	1.0000e-
28	8650	03:59:12	70.83%		0.5998		1.0000e-
28	8700	04:00:56	70.83%	56.87%	0.7342	1.0357	1.0000e-
28	8750	04:01:56	70.83%		0.6317		1.0000e-
28	8800	04:03:40	75.00%	59.42%	0.5056	1.0587	1.0000e-
28	8850	04:04:39	50.00%		0.9747		1.0000e-
28	8900	04:06:23	75.00%	56.75%	0.4950	1.1117	1.0000e-
29	8950	04:07:24	66.67%		0.7514		1.0000e-

29	9000	04:09:08	66.67%	57.60%	0.7533	0.9481	1.0000e-
29	9050	04:10:07	83.33%		0.4282		1.0000e-
29	9100	04:11:51	62.50%	56.75%	0.7777	1.0747	1.0000e-
29	9150	04:12:50	83.33%		0.5679		1.0000e-
29	9200	04:14:35	58.33%	57.48%	0.7394	1.2354	1.0000e-
30	9250	04:15:35	62.50%		0.8753		1.0000e-
30	9300	04:17:19	70.83%	59.48%	0.5709	1.1086	1.0000e-
30	9350	04:18:19	70.83%		0.5662		1.0000e-
30	9400	04:20:03	54.17%	60.39%	0.7693	1.0723	1.0000e-
30	9450	04:21:03	70.83%		0.6838		1.0000e-
30	9500	04:22:47	62.50%	59.42%	0.8448	1.1699	1.0000e-
31	9550	04:23:48	75.00%		0.5469		1.0000e-
31	9600	04:25:32	79.17%	60.63%	0.5504	1.0599	1.0000e-
31	9650	04:26:32	75.00%		0.6966		1.0000e-
31	9700	04:28:16	91.67%	60.99%	0.4970	1.0576	1.0000e-
31	9750	04:29:15	87.50%		0.3809		1.0000e-
31	9800	04:30:59	75.00%	59.24%	0.7005	1.0633	1.0000e-
31	9850	04:31:59	75.00%		0.5591		1.0000e-
32	9900	04:33:44	75.00%	60.93%	0.5051	1.0530	1.0000e-
32	9950	04:34:43	79.17%		0.6723		1.0000e-
32	10000	04:36:27	70.83%	61.24%	0.7060	1.0595	1.0000e-
32	10050	04:37:27	79.17%		0.5208		1.0000e-
32	10100	04:39:11	75.00%	60.81%	0.4748	1.0433	1.0000e-
32	10150	04:40:10	83.33%		0.4633		1.0000e-
33	10200	04:41:55	79.17%	61.30%	0.5309	1.0433	1.0000e-
33	10250	04:42:54	79.17%		0.4746		1.0000e-
33	10300	04:44:38	70.83%	60.99%	0.5770	1.0454	1.0000e-
33	10350	04:45:38	79.17%		0.5219		1.0000e-
33	10400	04:47:22	70.83%	59.66%	0.4818	1.0599	1.0000e-
33	10450	04:48:21	58.33%		0.6951		1.0000e-
34	10500	04:50:06	66.67%	61.05%	0.5651	1.0611	1.0000e-
34	10550	04:51:06	87.50%		0.5496		1.0000e-
34	10600	04:52:50	83.33%	59.48%	0.5497	1.0855	1.0000e-
34	10650	04:53:49	87.50%		0.5161		1.0000e-
34	10700	04:55:33	70.83%	60.81%	0.6812	1.0721	1.0000e-
34	10750	04:56:33	50.00%		0.7004		1.0000e-
34	10800	04:58:16	83.33%	60.75%	0.4476	1.0689	1.0000e-
35	10850	04:59:16	70.83%		0.5687		1.0000e-
35	10900	05:01:01	83.33%	61.05%	0.4569	1.0630	1.0000e-
35	10950	05:02:03	79.17%		0.5270		1.0000e-
35	11000	05:03:49	66.67%	60.15%	0.6971	1.0749	1.0000e-
35	11050	05:04:48	66.67%		0.6319		1.0000e-
35	11100	05:06:33	87.50%	61.30%	0.4442	1.0635	1.0000e-
36	11150	05:07:33	79.17%		0.6065		1.0000e-
36	11200	05:09:17	91.67%	59.42%	0.4088	1.0704	1.0000e-
36	11250	05:10:16	62.50%		0.6376		1.0000e-
36	11300	05:12:01	75.00%	61.36%	0.6148	1.0567	1.0000e-
36	11350	05:13:01	83.33%		0.3898		1.0000e-
36	11400	05:14:45	79.17%	60.93%	0.5799	1.0606	1.0000e-
37	11450	05:15:46	79.17%		0.6154		1.0000e-
37	11500	05:17:30	70.83%	60.51%	0.5487	1.0593	1.0000e-
37	11550	05:18:30	62.50%		0.7316		1.0000e-
37	11600	05:20:14	79.17%	60.75%	0.5374	1.0591	1.0000e-
37	11650	05:21:14	87.50%		0.4032		1.0000e-
37	11700	05:22:58	62.50%	60.99%	0.5918	1.0494	1.0000e-
37	11750	05:23:57	75.00%		0.8326		1.0000e-
38	11800	05:25:42	79.17%	60.81%	0.4972	1.0477	1.0000e-
38	11850	05:26:42	70.83%		0.5470		1.0000e-
38	11900	05:28:26	87.50%	61.11%	0.5198	1.0381	1.0000e-
38	11950	05:29:25	91.67%		0.4000		1.0000e-
38	12000	05:31:10	75.00%	60.99%	0.6266	1.0459	1.0000e-
38	12050	05:32:09	66.67%		0.6172		1.0000e-
39	12100	05:33:54	79.17%	60.99%	0.5983	1.0548	1.0000e-
39	12150	05:34:54	87.50%		0.5025		1.0000e-

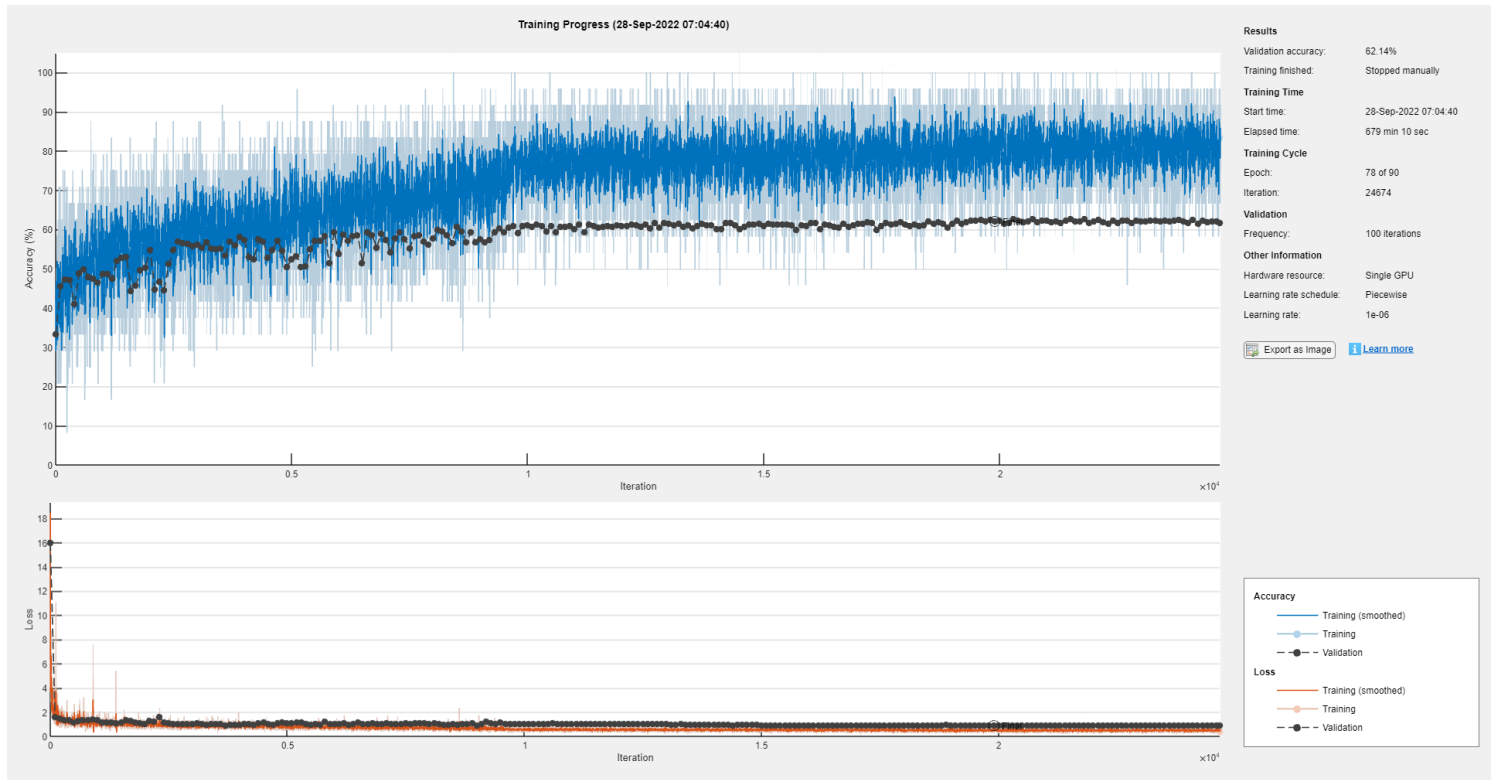
39	12200	05:36:39	83.33%	61.30%	0.4321	1.0362	1.0000e-
39	12250	05:37:38	70.83%		0.5782		1.0000e-
39	12300	05:39:23	66.67%	61.11%	0.7616	1.0287	1.0000e-
39	12350	05:40:22	62.50%		0.8135		1.0000e-
39	12400	05:42:06	50.00%	60.75%	0.9789	1.0422	1.0000e-
40	12450	05:43:07	66.67%		0.5587		1.0000e-
40	12500	05:44:50	75.00%	61.42%	0.6832	1.0386	1.0000e-
40	12550	05:45:50	83.33%		0.4622		1.0000e-
40	12600	05:47:34	79.17%	60.45%	0.6001	1.0296	1.0000e-
40	12650	05:48:33	79.17%		0.5928		1.0000e-
40	12700	05:50:18	91.67%	61.72%	0.4470	1.0286	1.0000e-
41	12750	05:51:18	83.33%		0.4554		1.0000e-
41	12800	05:53:02	83.33%	60.63%	0.5139	1.0188	1.0000e-
41	12850	05:54:02	75.00%		0.4968		1.0000e-
41	12900	05:55:45	70.83%	61.78%	0.5737	1.0229	1.0000e-
41	12950	05:56:45	79.17%		0.4662		1.0000e-
41	13000	05:58:29	75.00%	61.60%	0.6364	1.0265	1.0000e-
42	13050	05:59:29	66.67%		0.6917		1.0000e-
42	13100	06:01:13	66.67%	61.24%	0.6543	1.0171	1.0000e-
42	13150	06:02:13	66.67%		0.6045		1.0000e-
42	13200	06:03:57	66.67%	61.54%	0.6580	1.0141	1.0000e-
42	13250	06:04:56	66.67%		0.6022		1.0000e-
42	13300	06:06:41	58.33%	60.75%	0.6087	1.0205	1.0000e-
42	13350	06:07:40	75.00%		0.5436		1.0000e-
43	13400	06:09:26	87.50%	61.24%	0.3984	1.0006	1.0000e-
43	13450	06:10:25	66.67%		0.6372		1.0000e-
43	13500	06:12:10	83.33%	60.39%	0.4509	1.0121	1.0000e-
43	13550	06:13:09	83.33%		0.3885		1.0000e-
43	13600	06:14:53	70.83%	61.05%	0.5958	1.0058	1.0000e-
43	13650	06:15:53	75.00%		0.6090		1.0000e-
44	13700	06:17:38	75.00%	61.48%	0.7320	1.0114	1.0000e-
44	13750	06:18:37	66.67%		0.5939		1.0000e-
44	13800	06:20:21	95.83%	61.18%	0.4445	0.9896	1.0000e-
44	13850	06:21:21	79.17%		0.4639		1.0000e-
44	13900	06:23:05	75.00%	61.18%	0.5709	0.9950	1.0000e-
44	13950	06:24:05	79.17%		0.3895		1.0000e-
45	14000	06:25:50	75.00%	60.15%	0.5454	1.0017	1.0000e-
45	14050	06:26:50	66.67%		0.5322		1.0000e-
45	14100	06:28:35	70.83%	60.21%	0.6551	0.9847	1.0000e-
45	14150	06:29:35	70.83%		0.6071		1.0000e-
45	14200	06:31:19	79.17%	61.84%	0.3902	0.9668	1.0000e-
45	14250	06:32:18	83.33%		0.5233		1.0000e-
45	14300	06:34:02	66.67%	61.78%	0.7013	0.9683	1.0000e-
46	14350	06:35:02	70.83%		0.5941		1.0000e-
46	14400	06:36:47	75.00%	61.18%	0.5374	0.9412	1.0000e-
46	14450	06:37:46	83.33%		0.6835		1.0000e-
46	14500	06:39:30	75.00%	60.08%	0.5426	0.9797	1.0000e-
46	14550	06:40:30	75.00%		0.6327		1.0000e-
46	14600	06:42:14	83.33%	60.81%	0.4450	0.9712	1.0000e-
47	14650	06:43:14	79.17%		0.5130		1.0000e-
47	14700	06:44:58	79.17%	61.36%	0.4098	0.9694	1.0000e-
47	14750	06:45:58	87.50%		0.3829		1.0000e-
47	14800	06:47:42	83.33%	61.30%	0.5791	0.9607	1.0000e-
47	14850	06:48:41	91.67%		0.3966		1.0000e-
47	14900	06:50:25	87.50%	61.54%	0.3929	0.9550	1.0000e-
48	14950	06:51:26	83.33%		0.5604		1.0000e-
48	15000	06:53:10	83.33%	60.93%	0.5446	0.9359	1.0000e-
48	15050	06:54:10	75.00%		0.5748		1.0000e-
48	15100	06:55:54	70.83%	61.66%	0.5257	0.9393	1.0000e-
48	15150	06:56:54	70.83%		0.5096		1.0000e-
48	15200	06:58:38	79.17%	61.36%	0.6102	0.9197	1.0000e-
48	15250	06:59:37	83.33%		0.4963		1.0000e-
49	15300	07:01:23	70.83%	61.30%	0.6737	0.9130	1.0000e-
49	15350	07:02:22	83.33%		0.5255		1.0000e-



49	15400	07:04:06	91.67%	61.36%	0.3354	0.9092	1.0000e-
49	15450	07:05:06	66.67%		0.5986		1.0000e-
49	15500	07:06:50	83.33%	61.42%	0.4736	0.9050	1.0000e-
49	15550	07:07:50	70.83%		0.5007		1.0000e-
50	15600	07:09:35	83.33%	61.24%	0.4600	0.9144	1.0000e-
50	15650	07:10:34	75.00%		0.6146		1.0000e-
50	15700	07:12:19	75.00%	59.96%	0.5638	0.9119	1.0000e-
50	15750	07:13:18	66.67%		0.7324		1.0000e-
50	15800	07:15:02	75.00%	61.18%	0.6384	0.9098	1.0000e-
50	15850	07:16:02	70.83%		0.5152		1.0000e-
50	15900	07:17:44	87.50%	60.93%	0.4528	0.9049	1.0000e-
51	15950	07:18:46	79.17%		0.5161		1.0000e-
51	16000	07:20:30	70.83%	61.78%	0.6553	0.9046	1.0000e-
51	16050	07:21:30	75.00%		0.5208		1.0000e-
51	16100	07:23:14	70.83%	61.78%	0.7149	0.9046	1.0000e-
51	16150	07:24:13	70.83%		0.6200		1.0000e-
51	16200	07:25:57	62.50%	60.15%	0.7121	0.9356	1.0000e-
52	16250	07:26:58	70.83%		0.5677		1.0000e-
52	16300	07:28:42	83.33%	61.42%	0.5905	0.9036	1.0000e-
52	16350	07:29:41	66.67%		0.6072		1.0000e-
52	16400	07:31:26	87.50%	61.18%	0.4935	0.9146	1.0000e-
52	16450	07:32:25	79.17%		0.4939		1.0000e-
52	16500	07:34:09	79.17%	60.75%	0.5539	0.9104	1.0000e-
53	16550	07:35:09	83.33%		0.3528		1.0000e-
53	16600	07:36:54	75.00%	60.63%	0.5306	0.9316	1.0000e-
53	16650	07:37:54	79.17%		0.5209		1.0000e-
53	16700	07:39:38	83.33%	61.66%	0.5170	0.9151	1.0000e-
53	16750	07:40:37	79.17%		0.5038		1.0000e-
53	16800	07:42:22	79.17%	60.87%	0.5404	0.9174	1.0000e-
53	16850	07:43:21	75.00%		0.6437		1.0000e-
54	16900	07:45:06	87.50%	61.11%	0.3517	0.9231	1.0000e-
54	16950	07:46:05	79.17%		0.5560		1.0000e-
54	17000	07:47:49	79.17%	61.66%	0.4368	0.9115	1.0000e-
54	17050	07:48:49	91.67%		0.4761		1.0000e-
54	17100	07:50:33	66.67%	61.66%	0.5945	0.9111	1.0000e-
54	17150	07:51:33	75.00%		0.5646		1.0000e-
55	17200	07:53:18	66.67%	62.02%	0.5559	0.9005	1.0000e-
55	17250	07:54:18	66.67%		0.7031		1.0000e-
55	17300	07:56:02	87.50%	61.72%	0.3907	0.9100	1.0000e-
55	17350	07:57:01	66.67%		0.6434		1.0000e-
55	17400	07:58:45	58.33%	60.02%	0.7551	0.9202	1.0000e-
55	17450	07:59:44	75.00%		0.4985		1.0000e-
56	17500	08:01:29	83.33%	61.05%	0.4667	0.9044	1.0000e-
56	17550	08:02:29	79.17%		0.6270		1.0000e-
56	17600	08:04:13	75.00%	61.78%	0.4626	0.9048	1.0000e-
56	17650	08:05:12	83.33%		0.5215		1.0000e-
56	17700	08:06:57	70.83%	61.36%	0.5414	0.9163	1.0000e-
56	17750	08:07:56	75.00%		0.6407		1.0000e-
56	17800	08:09:41	91.67%	61.48%	0.3640	0.9149	1.0000e-
57	17850	08:10:41	83.33%		0.4599		1.0000e-
57	17900	08:12:25	62.50%	61.90%	0.6222	0.9026	1.0000e-
57	17950	08:13:25	91.67%		0.4985		1.0000e-
57	18000	08:15:10	79.17%	61.42%	0.5023	0.9141	1.0000e-
57	18050	08:16:09	95.83%		0.3866		1.0000e-
57	18100	08:17:53	75.00%	60.99%	0.5290	0.9064	1.0000e-
58	18150	08:18:53	79.17%		0.5438		1.0000e-
58	18200	08:20:38	70.83%	61.36%	0.6473	0.9086	1.0000e-
58	18250	08:21:37	58.33%		0.7497		1.0000e-
58	18300	08:23:21	95.83%	60.99%	0.3270	0.9097	1.0000e-
58	18350	08:24:21	79.17%		0.4796		1.0000e-
58	18400	08:26:06	87.50%	61.11%	0.5682	0.9070	1.0000e-
59	18450	08:27:06	79.17%		0.5163		1.0000e-
59	18500	08:28:50	87.50%	62.08%	0.4795	0.9145	1.0000e-
59	18550	08:29:50	91.67%		0.3699		1.0000e-

59	18600	08:31:35	79.17%	61.66%	0.4843	0.9111	1.0000e-
59	18650	08:32:34	75.00%		0.5659		1.0000e-
59	18700	08:34:18	95.83%	61.96%	0.4290	0.9149	1.0000e-
59	18750	08:35:18	66.67%		0.6240		1.0000e-
60	18800	08:37:03	83.33%	61.66%	0.5296	0.9105	1.0000e-
60	18850	08:38:02	70.83%		0.4617		1.0000e-
60	18900	08:39:46	70.83%	60.57%	0.7272	0.9584	1.0000e-
60	18950	08:40:46	95.83%		0.3469		1.0000e-
60	19000	08:42:30	83.33%	61.48%	0.5657	0.9145	1.0000e-
60	19050	08:43:29	83.33%		0.5409		1.0000e-
61	19100	08:45:14	79.17%	62.33%	0.4201	0.9095	1.0000e-
61	19150	08:46:14	87.50%		0.3964		1.0000e-
61	19200	08:47:58	87.50%	61.54%	0.4264	0.9072	1.0000e-
61	19250	08:48:57	62.50%		0.6845		1.0000e-
61	19300	08:50:41	70.83%	61.96%	0.6243	0.9102	1.0000e-
61	19350	08:51:41	79.17%		0.4794		1.0000e-
62	19400	08:53:26	83.33%	62.27%	0.5274	0.9090	1.0000e-
62	19450	08:54:26	95.83%		0.3968		1.0000e-
62	19500	08:56:10	62.50%	62.33%	0.7314	0.9105	1.0000e-
62	19550	08:57:09	79.17%		0.5142		1.0000e-
62	19600	08:58:54	66.67%	62.51%	0.6880	0.9073	1.0000e-
62	19650	08:59:53	62.50%		0.6294		1.0000e-
62	19700	09:01:37	79.17%	62.08%	0.5032	0.8979	1.0000e-
63	19750	09:02:38	91.67%		0.3993		1.0000e-
63	19800	09:04:22	79.17%	62.51%	0.4488	0.9064	1.0000e-
63	19850	09:05:22	79.17%		0.4312		1.0000e-
63	19900	09:07:05	87.50%	62.20%	0.5321	0.8965	1.0000e-
63	19950	09:08:05	87.50%		0.5588		1.0000e-
63	20000	09:09:49	75.00%	62.33%	0.4558	0.9112	1.0000e-
64	20050	09:10:50	75.00%		0.5506		1.0000e-
64	20100	09:12:34	70.83%	61.54%	0.4301	0.9076	1.0000e-
64	20150	09:13:34	75.00%		0.5072		1.0000e-
64	20200	09:15:19	70.83%	61.72%	0.5402	0.9071	1.0000e-
64	20250	09:16:18	87.50%		0.4020		1.0000e-
64	20300	09:18:02	75.00%	62.75%	0.5796	0.9030	1.0000e-
64	20350	09:19:02	91.67%		0.3018		1.0000e-
65	20400	09:20:47	75.00%	62.39%	0.5610	0.9041	1.0000e-
65	20450	09:21:47	79.17%		0.4402		1.0000e-
65	20500	09:23:31	79.17%	62.02%	0.5728	0.9067	1.0000e-
65	20550	09:24:31	79.17%		0.5434		1.0000e-
65	20600	09:26:15	79.17%	62.20%	0.3960	0.9090	1.0000e-
65	20650	09:27:15	83.33%		0.4614		1.0000e-
66	20700	09:29:00	91.67%	62.81%	0.4139	0.9058	1.0000e-
66	20750	09:30:00	83.33%		0.3696		1.0000e-
66	20800	09:31:44	83.33%	61.96%	0.3861	0.9033	1.0000e-
66	20850	09:32:44	75.00%		0.5297		1.0000e-
66	20900	09:34:28	79.17%	62.27%	0.5197	0.9086	1.0000e-
66	20950	09:35:28	79.17%		0.5032		1.0000e-
67	21000	09:37:13	70.83%	62.39%	0.6490	0.9010	1.0000e-
67	21050	09:38:12	66.67%		0.6021		1.0000e-
67	21100	09:39:57	83.33%	62.02%	0.5974	0.9083	1.0000e-
67	21150	09:40:57	87.50%		0.5534		1.0000e-
67	21200	09:42:41	83.33%	62.20%	0.3721	0.9091	1.0000e-
67	21250	09:43:41	79.17%		0.6457		1.0000e-
67	21300	09:45:25	79.17%	61.72%	0.4021	0.9070	1.0000e-
68	21350	09:46:26	79.17%		0.5544		1.0000e-
68	21400	09:48:13	79.17%	62.45%	0.4533	0.9064	1.0000e-
68	21450	09:49:14	75.00%		0.4974		1.0000e-
68	21500	09:51:01	62.50%	62.81%	0.7245	0.9011	1.0000e-
68	21550	09:52:02	79.17%		0.5858		1.0000e-
68	21600	09:53:47	95.83%	62.20%	0.3418	0.9054	1.0000e-
69	21650	09:54:48	87.50%		0.4738		1.0000e-
69	21700	09:56:32	83.33%	62.20%	0.5292	0.9076	1.0000e-
69	21750	09:57:32	75.00%		0.5143		1.0000e-

69	21800	09:59:16	87.50%	62.69%	0.4182	0.9003	1.0000e-
69	21850	10:00:16	70.83%		0.5476		1.0000e-
69	21900	10:02:00	79.17%	61.84%	0.4858	0.9082	1.0000e-
70	21950	10:03:01	75.00%		0.5058		1.0000e-
70	22000	10:04:46	70.83%	62.14%	0.5968	0.9094	1.0000e-
70	22050	10:05:46	87.50%		0.3925		1.0000e-
70	22100	10:07:30	62.50%	62.57%	0.7914	0.9059	1.0000e-
70	22150	10:08:30	79.17%		0.5667		1.0000e-
70	22200	10:10:15	66.67%	61.90%	0.6407	0.9112	1.0000e-
70	22250	10:11:15	83.33%		0.4559		1.0000e-
71	22300	10:13:00	79.17%	61.66%	0.4343	0.9066	1.0000e-
71	22350	10:14:00	66.67%		0.6518		1.0000e-
71	22400	10:15:45	83.33%	62.33%	0.4179	0.9061	1.0000e-
71	22450	10:16:45	87.50%		0.5229		1.0000e-
71	22500	10:18:29	75.00%	61.72%	0.5317	0.9052	1.0000e-
71	22550	10:19:29	83.33%		0.4251		1.0000e-
72	22600	10:21:14	70.83%	62.39%	0.5541	0.9064	1.0000e-
72	22650	10:22:14	83.33%		0.4394		1.0000e-
72	22700	10:23:58	45.83%	62.45%	0.8403	0.9078	1.0000e-
72	22750	10:24:58	75.00%		0.5302		1.0000e-
72	22800	10:26:42	79.17%	61.72%	0.4558	0.8991	1.0000e-
72	22850	10:27:42	75.00%		0.5261		1.0000e-
73	22900	10:29:27	87.50%	62.39%	0.4550	0.9033	1.0000e-
73	22950	10:30:27	83.33%		0.4903		1.0000e-
73	23000	10:32:11	83.33%	62.20%	0.4615	0.9047	1.0000e-
73	23050	10:33:11	70.83%		0.7284		1.0000e-
73	23100	10:34:56	75.00%	62.20%	0.8157	0.9092	1.0000e-
73	23150	10:35:56	87.50%		0.4409		1.0000e-
73	23200	10:37:40	91.67%	62.45%	0.4500	0.9050	1.0000e-
74	23250	10:38:41	91.67%		0.3936		1.0000e-
74	23300	10:40:25	62.50%	62.27%	0.6490	0.8967	1.0000e-
74	23350	10:41:25	70.83%		0.6626		1.0000e-
74	23400	10:43:09	83.33%	62.14%	0.4745	0.9084	1.0000e-
74	23450	10:44:09	79.17%		0.5335		1.0000e-
74	23500	10:45:54	75.00%	62.33%	0.5769	0.9044	1.0000e-
75	23550	10:46:55	70.83%		0.5081		1.0000e-
75	23600	10:48:39	83.33%	62.14%	0.3909	0.9091	1.0000e-
75	23650	10:49:39	87.50%		0.4368		1.0000e-
75	23700	10:51:24	91.67%	62.45%	0.4329	0.9002	1.0000e-
75	23750	10:52:23	91.67%		0.2284		1.0000e-
75	23800	10:54:08	87.50%	62.51%	0.4350	0.9056	1.0000e-
75	23850	10:55:06	79.17%		0.5487		1.0000e-
76	23900	10:56:52	75.00%	62.08%	0.6079	0.9011	1.0000e-
76	23950	10:57:52	75.00%		0.5424		1.0000e-
76	24000	10:59:36	83.33%	61.78%	0.4878	0.9073	1.0000e-
76	24050	11:00:36	87.50%		0.3418		1.0000e-
76	24100	11:02:20	79.17%	62.51%	0.4856	0.9046	1.0000e-
76	24150	11:03:20	83.33%		0.4497		1.0000e-
77	24200	11:05:05	83.33%	61.66%	0.4142	0.9025	1.0000e-
77	24250	11:06:05	83.33%		0.3910		1.0000e-
77	24300	11:07:49	75.00%	62.27%	0.5342	0.9077	1.0000e-
77	24350	11:08:49	79.17%		0.5465		1.0000e-
77	24400	11:10:34	91.67%	61.96%	0.3507	0.9054	1.0000e-
77	24450	11:11:33	75.00%		0.5201		1.0000e-
78	24500	11:13:19	79.17%	62.20%	0.6429	0.9044	1.0000e-
78	24550	11:14:19	79.17%		0.4571		...

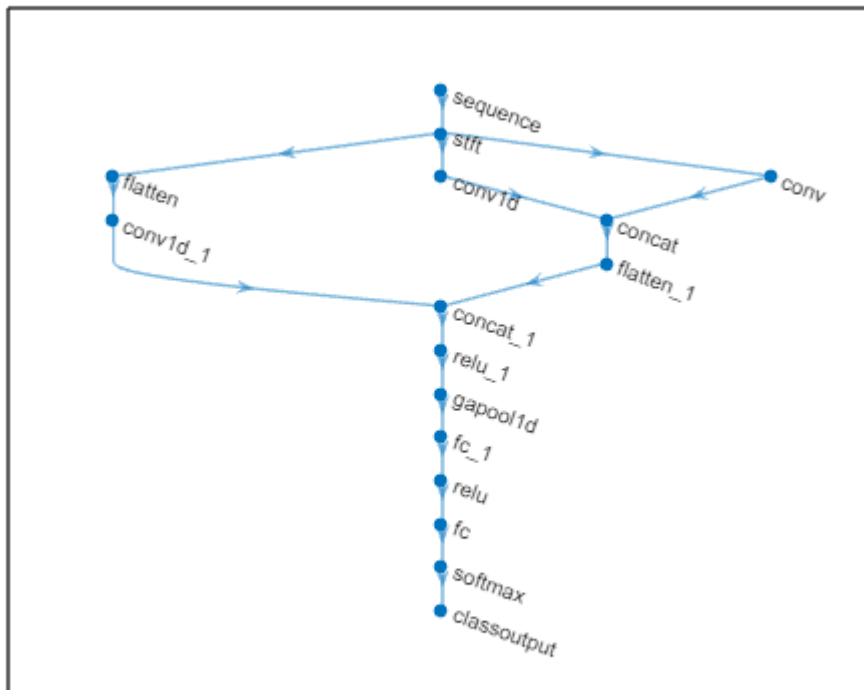


## CNN Models

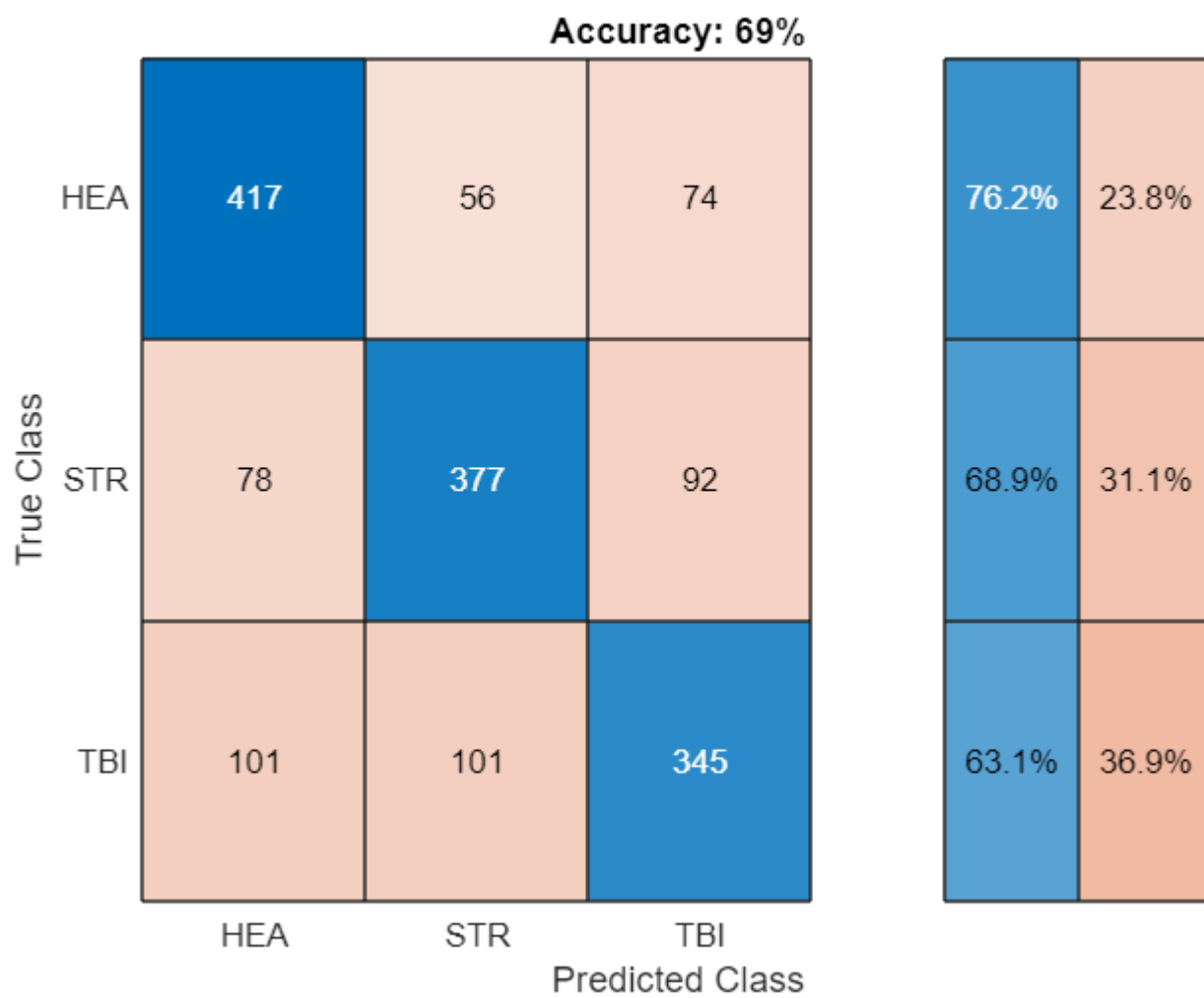
### Layers:

3 types of convolution

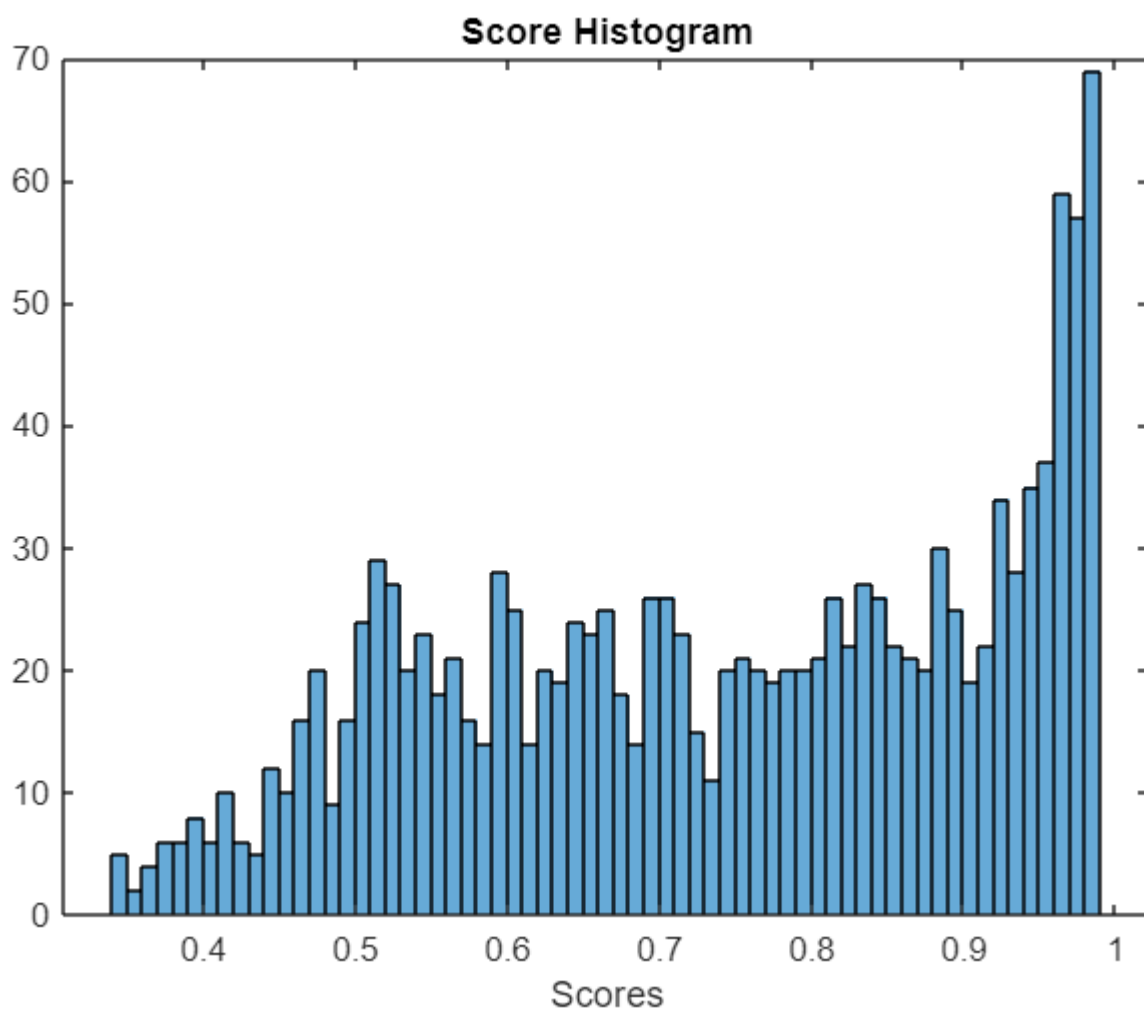
```
load("STFTNet.mat","lgraph_2");  
plot(lgraph_2)
```

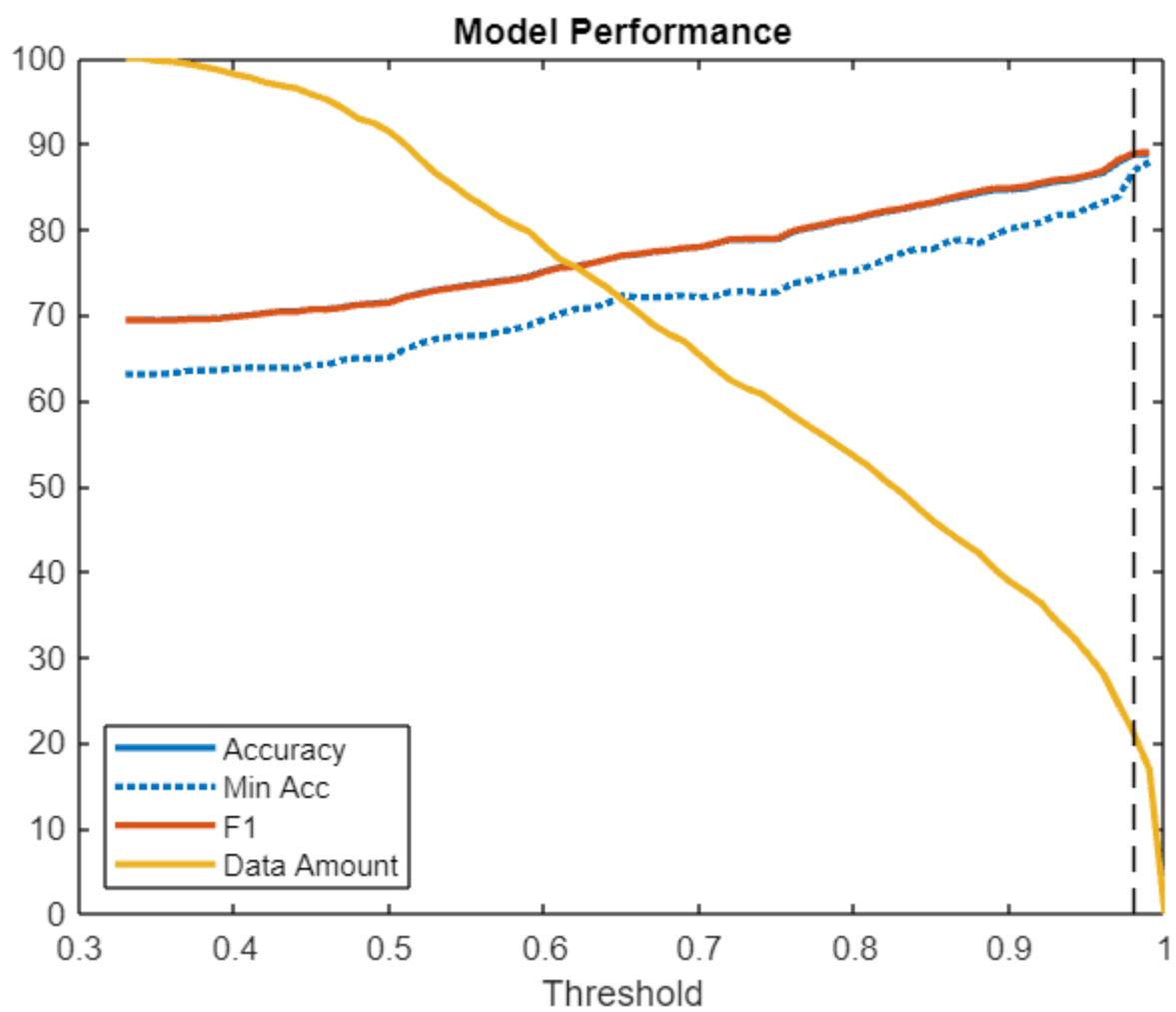


```
load("STFTNet.mat")
Snet4 = MdlResults(net4a,Y_Test,Y_Test.Labels);
classify(Snet4);
```



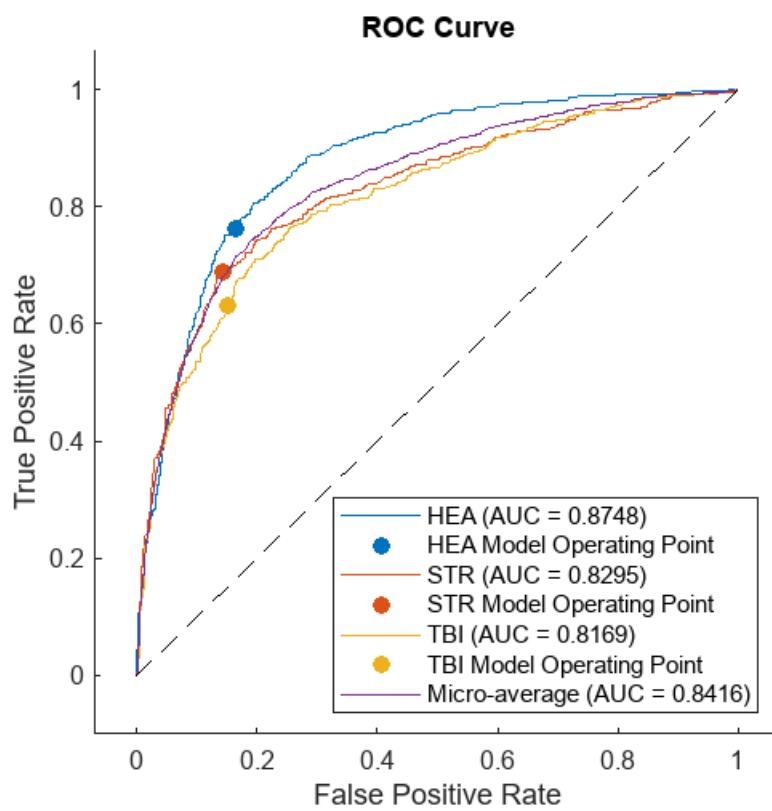
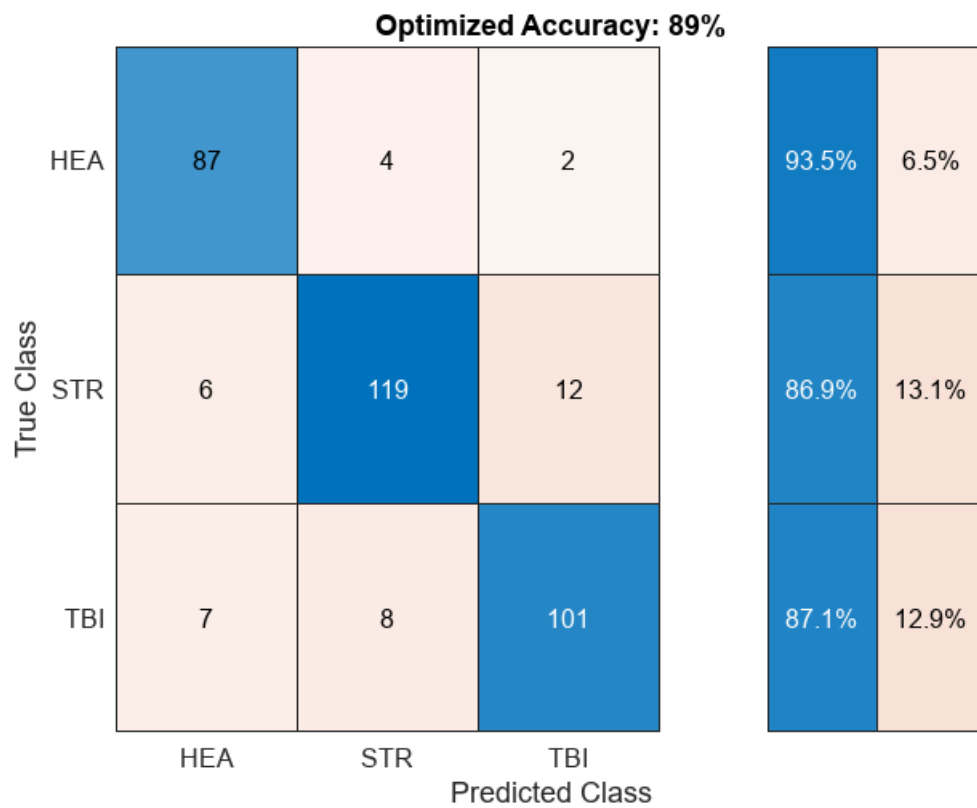
```
metrics(Snet4);
```





Data Remaining: 0.21085





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