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UCR Time Series Classification Archive

Please reference as:

Dau, Hoang Anh, Eamonn Keogh, Kaveh Kamgar, Chin-Chia Michael Yeh, Yan Zhu, Shaghayegh Gharghabi, Chotirat Ann Ratanamahatana, Yanping Chen, Bing Hu, Nurjahan Begum, Anthony Bagnall, Abdullah Mueen and Gustavo Batista (2018). “The UCR Time Series Classification Archive.” https://www.cs.ucr.edu/~eamonn/time_series_data_2018/

Welcome!

Dear Colleague,

If you are reading this, you are interested in using the UCR Time Series Classification Archive. This archive is a *superset* of, and completely replaces [8]. The current version, thereafter referred to as Fall 2018 expansion, will eventually replace Summer 2015 release [9]. The archive originally was born out of our frustration with papers reporting error rates on a single dataset, and claiming (or implicitly suggesting) that the results would generalize [6]. However, while we think the availability of previous versions of the UCR Archive has mitigated this problem to a great extent, it may have opened up other problems.

- 1) Several researchers have published papers on showing “*we win some, we lose some*” on the UCR Archive. However, there are many trivial ways to get “*win some, lose some*” type results on these datasets (For example, just smoothing the data, or generalizing from 1-NN to k -NN etc.). Using the archive can therefore *apparently* add credence to poor ideas (very sophisticated tests are required to show *small* but *true* improvement effects [3][7]). In addition Gustavo Batista has pointed out that “*win some, lose some*” is worthless unless you know *in advance* which ones you will win on! [4]. Dau et al. discuss this in great detail [10].
- 2) It could be argued that the goal of researchers should be to solve real world problems, and that improving accuracy on the UCR Archive is at best a poor proxy for such real world problems. Bing Hu has written a beautiful explanation as to why this is the case [2].

In spite of the above, the community generally finds the archive to be a very useful tool, and to date, more than 1,200 people have downloaded the UCR archive, and it has been referenced several hundred times.

We are therefore delighted to share this resource with you. We encourage you to read the paper accompanies this new archive expansion [10]. The password you need to unlock the data download is available in this document, *read on* to find it.

Best of luck with your research.

Eamonn, Anh and the Team

Data Format

Each of the datasets comes in two parts, a TRAIN partition and a TEST partition.

For example, for the **Fungi** dataset we have two files, `Fungi_TEST.txt` and `Fungi_TRAIN.txt`

The two files will be in the same format, but are generally of different sizes.

The files are in the standard ASCII format that can be read directly by most tools/languages.

For example, to read the data of **Fungi** dataset into MATLAB, we can type...

```
>> TRAIN = load('Fungi_TRAIN.txt');  
>> TEST = load('Fungi_TEST.txt');
```

...at the command line.

There is one time series exemplar per row. The first value in the row is the class label (an integer between 1 and the number of classes). The rest of the row are the data sample values. The order of time series exemplar carry no special meaning, and is in most cases random. A small number of datasets have class label starting from 0 due by legacy.

| Fungi_TEST.txt | | | | | | | |
|----------------|--------------|----------------|----------------|----------------|----------------|----------------|--|
| 1 | 1.000000e+00 | 1.1806977e+00 | 1.0871205e+00 | 9.2358964e-01 | 7.0391720e-01 | 6.0103560e-01 | |
| 2 | 1.000000e+00 | -3.3690280e-03 | 1.3979743e-01 | 2.4634900e-01 | 2.8267125e-01 | 2.4853416e-01 | |
| 3 | 1.000000e+00 | 2.9279457e-01 | 3.5135336e-01 | 4.1774429e-01 | 4.5661213e-01 | 4.5986320e-01 | |
| 4 | 1.000000e+00 | 4.1583091e-01 | 3.1032058e-01 | 2.6886606e-01 | 3.7778743e-01 | 5.3290599e-01 | |
| 5 | 1.000000e+00 | 2.8197346e-01 | 2.3803050e-01 | 2.1128170e-01 | 2.2135987e-01 | 2.2535374e-01 | |
| 6 | 1.000000e+00 | -9.0846439e-02 | -1.6569281e-02 | -3.6058030e-03 | -6.6683031e-02 | -3.4445864e-02 | |
| 7 | 1.000000e+00 | 4.8517572e-01 | 5.4267337e-01 | 6.7034509e-01 | 8.5107895e-01 | 9.1213376e-01 | |
| 8 | 2.000000e+00 | 1.2023614e+00 | 1.3947092e+00 | 1.4275090e+00 | 1.4241362e+00 | 1.4028836e+00 | |
| 9 | 2.000000e+00 | 5.1106447e-01 | 7.6259013e-01 | 9.6319197e-01 | 1.1224429e+00 | 1.2362984e+00 | |
| 10 | 2.000000e+00 | 7.5517824e-01 | 7.9050020e-01 | 8.9504039e-01 | 1.0803650e+00 | 1.1627584e+00 | |
| 11 | 2.000000e+00 | 1.9840994e-01 | 3.3180604e-01 | 5.1876476e-01 | 7.4746243e-01 | 9.3133439e-01 | |
| 12 | 2.000000e+00 | 9.2186744e-01 | 1.0271740e+00 | 1.1180091e+00 | 1.1847472e+00 | 1.1496392e+00 | |
| 13 | 2.000000e+00 | 8.8216014e-01 | 1.0909846e+00 | 1.2980519e+00 | 1.3590758e+00 | 1.2844307e+00 | |
| 14 | 2.000000e+00 | 5.2002435e-01 | 6.0897439e-01 | 7.2557887e-01 | 8.8508781e-01 | 1.0142352e+00 | |
| 15 | 2.000000e+00 | 9.7588532e-01 | 1.1256302e+00 | 1.2858246e+00 | 1.4679852e+00 | 1.6140577e+00 | |
| 16 | 2.000000e+00 | 1.6684440e-01 | 2.8908015e-01 | 4.6257987e-01 | 5.4681370e-01 | 5.7076904e-01 | |
| 17 | 2.000000e+00 | 9.8064177e-01 | 9.9478049e-01 | 1.0076349e+00 | 1.0515163e+00 | 1.0459247e+00 | |
| 18 | 2.000000e+00 | 8.3017593e-01 | 1.0461612e+00 | 1.2449432e+00 | 1.3195458e+00 | 1.3018360e+00 | |
| 19 | 3.000000e+00 | 2.7181028e-01 | 4.6021806e-01 | 6.5528037e-01 | 8.4635225e-01 | 9.5545865e-01 | |
| 20 | 3.000000e+00 | 5.3942622e-01 | 7.2130396e-01 | 9.5383293e-01 | 1.0628592e+00 | 1.0408570e+00 | |
| 21 | 3.000000e+00 | 3.2801034e-01 | 2.9006955e-01 | 2.6270711e-01 | 3.3797013e-01 | 4.3132201e-01 | |

Sanity Check

In order to make sure that you understand the data format, you should run this simple piece of code to test *SyntheticControl* dataset (you can cut and paste it, it is standard MATLAB).

Note that this is slow “teaching” code. To consider all the datasets in the archive, you will probably want to do something more sophisticated (indexing, lower bounding etc).

Nevertheless, we highly recommend you start here.

```
function UCR_time_series_test %%%%%%%% (C) Eamonn Keogh %%%%%%
TRAIN = load('SyntheticControl_TRAIN.txt'); % Only these two lines need to be changed to test a different dataset. %
TEST = load('SyntheticControl_TEST.txt'); % Only these two lines need to be changed to test a different dataset. %
%%%%%%%
TRAIN_class_labels = TRAIN(:,1); % Pull out the class labels.
TRAIN(:,1) = [];
TEST_class_labels = TEST(:,1); % Pull out the class labels.
TEST(:,1) = [];
% Remove class labels from training set.
% Remove class labels from testing set.
correct = 0; % Initialize the number we got correct
for i = 1 : length(TEST_class_labels) % Loop over every instance in the test set
    classify_this_object = TEST(i,:);
    this_objects_actual_class = TEST_class_labels(i);
    predicted_class = Classification_Algorithm(TRAIN,TRAIN_class_labels, classify_this_object);
    if predicted_class == this_objects_actual_class
        correct = correct + 1;
    end;
    disp([int2str(i), ' out of ', int2str(length(TEST_class_labels)), ' done']) % Report progress
end;
%%%%%% Create Report %%%%%%
disp(['The dataset you tested has ', int2str(length(unique(TRAIN_class_labels))), ' classes'])
disp(['The training set is of size ', int2str(size(TRAIN,1)), ', and the test set is of size ', int2str(size(TEST,1)), '.'])
disp(['The time series are of length ', int2str(size(TRAIN,2))])
disp(['The error rate was ', num2str((length(TEST_class_labels)-correct)/length(TEST_class_labels))])
%%%%%% End Report %%%%%%
%%%%%%%
% Here is a sample classification algorithm, it is the simple (yet very competitive) one-nearest
% neighbor using the Euclidean distance.
% If you are advocating a new distance measure you just need to change the line marked "Euclidean distance"
%%%%%
function predicted_class = Classification_Algorithm(TRAIN,TRAIN_class_labels,unknown_object)
best_so_far = inf;
for i = 1 : length(TRAIN_class_labels)
    compare_to_this_object = TRAIN(i,:);
    distance = sqrt(sum((compare_to_this_object - unknown_object).^2)); % Euclidean distance
    if distance < best_so_far
        predicted_class = TRAIN_class_labels(i);
        best_so_far = distance;
    end
end;
```

```
>> UCR_time_series_test
1 out of 300 done
2 out of 300 done
...
299 out of 300 done
300 out of 300 done
The dataset you tested has 6 classes
The training set is of size 300, and the test set is of size 300.
The time series are of length 60
The error rate was 0.12
```

In this package we have produced a spreadsheet that gives basic information about the datasets (number of classes, size of train/test splits, length of time series etc)

In addition, we have computed the error rates for:

- Euclidean distance
- DTW, unconstrained
- DTW, after learning the best constraint in from the train set*
- Default rate (that is, *the most probable class*). To be consistent, we display default error rate, which is $(1 - \text{default_rate})$.

*Note that our simple method for learning the constraint is not necessarily the best (as explained in the next slide).

You can download the entire spreadsheet displayed below in [CSV](#) format or [Excel](#) format.

| ID | Type | Name | Train | Test | Class | Length | ED (w=0) | DTW (learned_w) | DTW (w=100) | Default rate | Data donor/editor |
|----|-----------|------------------------------|-------|------|-------|--------|----------|-----------------|-------------|--------------|-----------------------------------|
| 1 | Image | Adiac | 390 | 391 | 37 | 176 | 0.3890 | 0.3913 (3) | 0.3960 | 0.9591 | A. Jilba |
| 2 | Image | ArrowHead | 36 | 175 | 3 | 251 | 0.2000 | 0.2000 (0) | 0.2970 | 0.6971 | L. Ye & E. Keogh |
| 3 | Spectro | Beef | 30 | 30 | 5 | 470 | 0.3330 | 0.3333 (0) | 0.3670 | 0.8000 | K. Kemsley & A. Bagnall |
| 4 | Image | BeetleFly | 20 | 20 | 2 | 512 | 0.2500 | 0.3000 (7) | 0.3000 | 0.5000 | J. Hills & A. Bagnall |
| 5 | Image | BirdChicken | 20 | 20 | 2 | 512 | 0.4500 | 0.3000 (6) | 0.2500 | 0.5000 | J. Hills & A. Bagnall |
| 6 | Sensor | Car | 60 | 60 | 4 | 577 | 0.2670 | 0.2333 (1) | 0.2670 | 0.6833 | J. Gao |
| 7 | Simulated | CBF | 30 | 900 | 3 | 128 | 0.1478 | 0.0044 (11) | 0.0030 | 0.6644 | N. Saito |
| 8 | Sensor | ChlorineConcentration | 467 | 3840 | 3 | 166 | 0.3500 | 0.3500 (0) | 0.3520 | 0.4675 | L. Li & C. Faloutsos |
| 9 | Sensor | CinCECGTorso | 40 | 1380 | 4 | 1639 | 0.1030 | 0.0696 (1) | 0.3490 | 0.7464 | physionet.org |
| 10 | Spectro | Coffee | 28 | 28 | 2 | 286 | 0.0000 | 0.0000 (0) | 0.0000 | 0.5357 | K. Kemsley & A. Bagnall |
| 11 | Device | Computers | 250 | 250 | 2 | 720 | 0.4240 | 0.3800 (12) | 0.3000 | 0.5000 | J. Lines & A. Bagnall |
| 12 | Motion | CricketX | 390 | 390 | 12 | 300 | 0.4230 | 0.2282 (10) | 0.2460 | 0.8974 | A. Mueen & E. Keogh |
| 13 | Motion | CricketY | 390 | 390 | 12 | 300 | 0.4330 | 0.2410 (17) | 0.2560 | 0.9051 | A. Mueen & E. Keogh |
| 14 | Motion | CricketZ | 390 | 390 | 12 | 300 | 0.4130 | 0.2538 (5) | 0.2460 | 0.8974 | A. Mueen & E. Keogh |
| 15 | Image | DiatomSizeReduction | 16 | 306 | 4 | 345 | 0.0650 | 0.0654 (0) | 0.0330 | 0.6928 | ADIAC project |
| 16 | Image | DistalPhalanxOutlineAgeGroup | 400 | 139 | 3 | 80 | 0.3741 | 0.3741 (0) | 0.2302 | 0.5324 | L. Davis & A. Bagnall |
| 17 | Image | DistalPhalanxOutlineCorrect | 600 | 276 | 2 | 80 | 0.2826 | 0.2754 (1) | 0.2826 | 0.4167 | L. Davis & A. Bagnall |
| 18 | Image | DistalPhalanxTW | 400 | 139 | 6 | 80 | 0.3669 | 0.3669 (0) | 0.4101 | 0.7194 | L. Davis & A. Bagnall |
| 19 | Sensor | Earthquakes | 322 | 139 | 2 | 512 | 0.2878 | 0.2734 (6) | 0.2806 | 0.7482 | A. Bagnall |
| 20 | ECG | ECG200 | 100 | 100 | 2 | 96 | 0.1200 | 0.1200 (0) | 0.2300 | 0.3600 | R. Olszewski |
| 21 | ECG | ECG5000 | 500 | 4500 | 5 | 140 | 0.0750 | 0.0749 (1) | 0.0760 | 0.4162 | Y. Chen & E. Keogh |
| 22 | ECG | ECGFiveDays | 23 | 861 | 2 | 136 | 0.2030 | 0.2033 (0) | 0.2320 | 0.4971 | physionet.org, Y. Chen & E. Keogh |
| 23 | Device | ElectricDevices | 8926 | 7711 | 7 | 96 | 0.4483 | 0.3806 (14) | 0.3990 | 0.7463 | A. Bagnall & J. Lines |

Worked Example

We can use the Archive to answer the following question. *Is DTW better than Euclidean distance for all/most/some/any problems?*

As explained in [4], if DTW is only better on *some* datasets, this is not very useful unless we know ahead of time that it will be better. To test this we can build a Texas Sharpshooter plot (see [4] for details).

In brief, after computing the baseline (here, the Euclidean distance) we then compute the **expected improvement** we would get using DTW (at this stage, learning any parameters and settings), then compute the **actual improvement** obtained (using these now hardcoded parameters and settings).

When we create the Texas Sharpshooter plot , each dataset fall into one of four possibilities.

In our worked example, we will try to optimize the performance of DTW, *looking only at the training data* and predict its improvement (which could be negative), in a very simple way.

Expected Improvement: We will search over different warping window constraints, from 0% to 100%, in 1% increments, looking for the warping window size that gives the highest 1-NN training accuracy (if there are ties, we choose the smaller warping window size).

Actual Improvement: Using the warping window size we learned in the last phase, we test the holdout test data on the training set with 1-NN.

Note that there are better ways to do this (learn with increments smaller than 1%, use k -NN instead of 1-NN, do cross validation within the test set etc). However, as the next slides show, the results are pretty unambiguous even for this simple effort.

Texas Sharpshooter Plot [4]

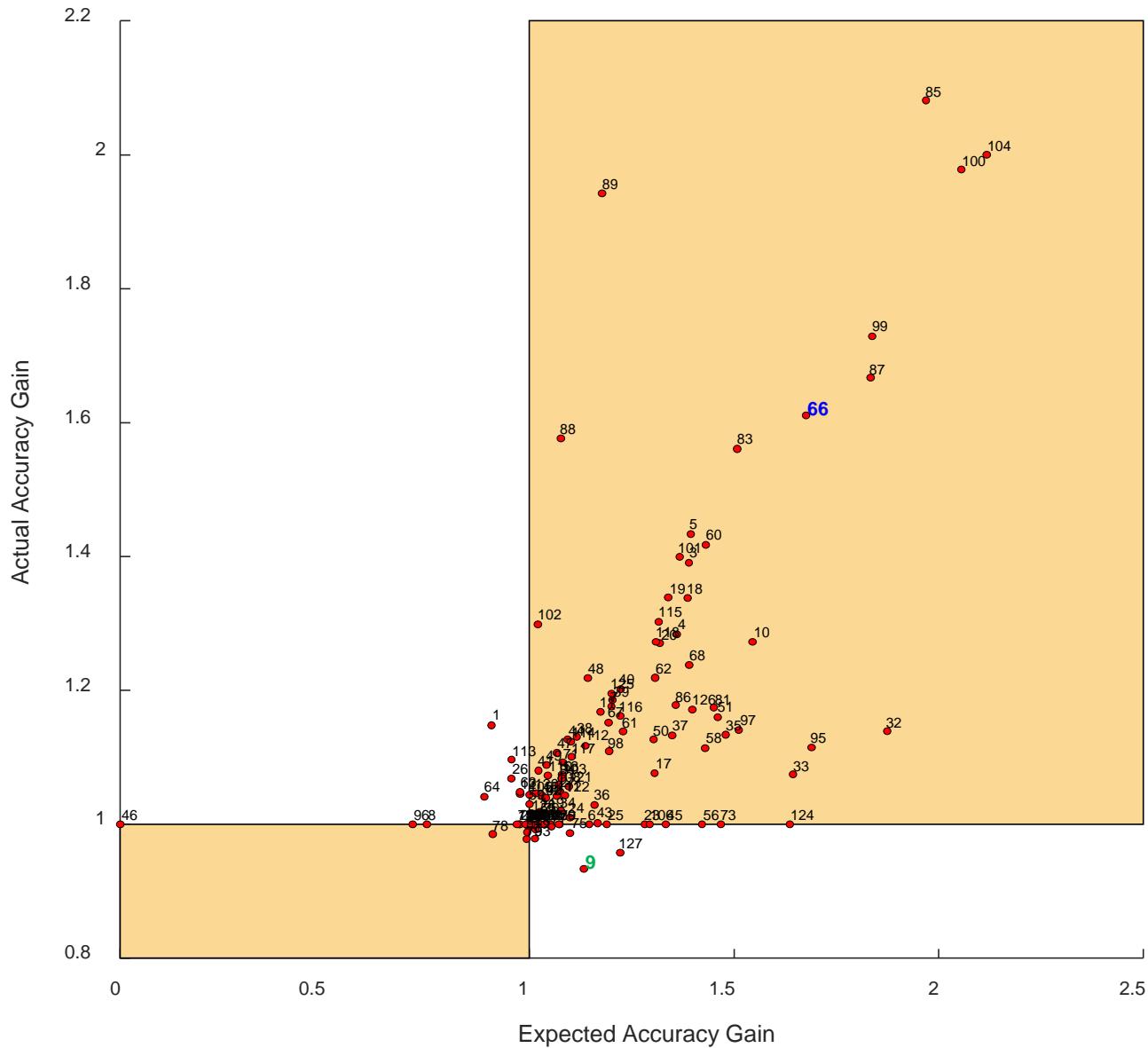


The results are strongly supportive of the claim
“DTW better than Euclidean distance for most problems”

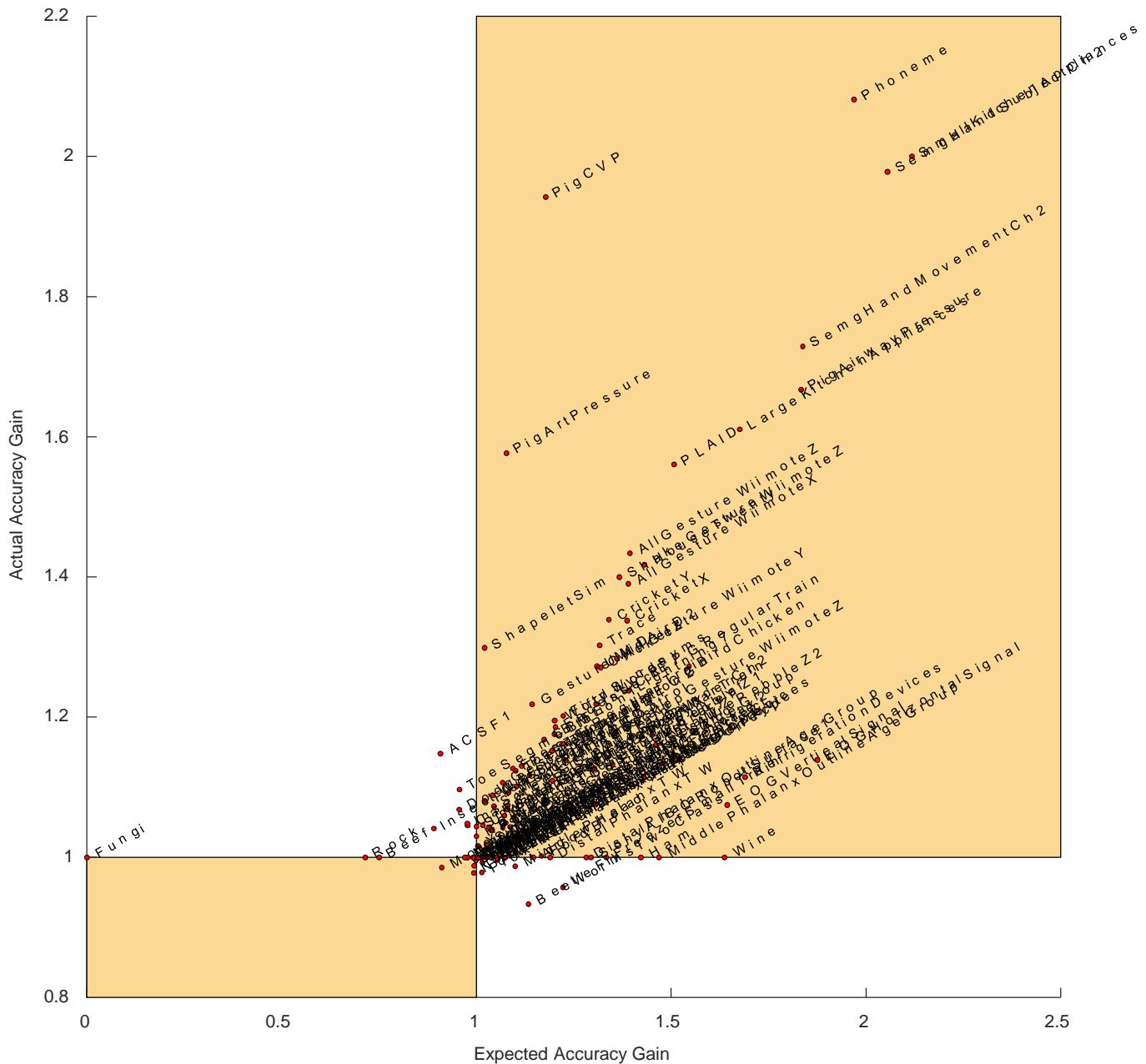
We sometimes had difficulty in predicting *when* DTW would be better/worse, but many of the training sets are tiny, making such tests very difficult.

For example, **9** is BeetleFly, with just 20 train and 20 test instances. Here we expected to do a little better, but we did a little worse.

In contrast, for **66** (LargeKitchenAppliances) we had 375 train and 375 test instances, and were able to more accurately predict a large improvement.



(after plotting in MATLAB, the code is in Appendix A, you can zoom in to avoid the visual clutter seen to the right).



Suggested Best Practices/Hints

1. If you modify the data in anyway (add noise, add warping etc), please give the modified data back to the archive before you submit your paper (we will host it, and that way a diligent reviewer can test your claims while the paper is under review).
2. Where possible, we strongly advocate testing and publishing results **on all datasets** (to avoid cherry-picking), unless of course you are making an explicit claim for only a certain type of data (i.e. classifying **short** time series). In the event you don't have space in your paper, we suggest you create an extended tech report online and point to it. Please see [4] (esp. Fig 14) for some ideas on how to visualize the accuracy results on so many datasets.
3. If you have additional datasets, we ask that you donate them to the archive in our simple format.
4. When you write your paper, please make *reproducibility* your goal. In particular, explicitly state all parameters. A good guiding principle is to ask yourself Could a smart grad student get the exact same results as claimed in this paper with a days effort?. If the answer is no, we believe that something is wrong. Help the imaginary grad student by rewriting your paper.
5. Where possible, make your code available (as we have done), it will makes the reviewers task easier.
6. If you are advocating a new distance/similarity measure, we strongly recommend you test and report the 1-NN accuracy (as we have done). Note that this does **not** preclude the addition of other tests (we strongly encourage additional test), however the 1-NN test has the advantage of having no parameters and allowing comparisons between methods.
7. Note that for 85 datasets of Summer 2015 release, the data are z-normalized by legacy. Paper [7] explains why this is very important. For 43 datasets of Fall 2018 expansion (this release), data are kept as is unless they were already z-normalized by donating source.

Suggested Reading

1. Wang, Xiaoyue, et al. "Experimental comparison of representation methods and distance measures for time series data." *Data Mining and Knowledge Discovery* 26.2 (2013): 275-309.
2. Hu, Bing, Yanping Chen, and Eamonn Keogh. "Time series classification under more realistic assumptions." *Proceedings of the 2013 SIAM International Conference on Data Mining*. Society for Industrial and Applied Mathematics, 2013.
3. Hills, Jon, et al. "Classification of time series by shapelet transformation." *Data Mining and Knowledge Discovery* 28.4 (2014): 851-881.
4. Batista, Gustavo EAPA, Xiaoyue Wang, and Eamonn J. Keogh. "A complexity-invariant distance measure for time series." *Proceedings of the 2011 SIAM international conference on data mining*. Society for Industrial and Applied Mathematics, 2011.
5. Keogh, Eamonn, and Shruti Kasetty. "On the need for time series data mining benchmarks: a survey and empirical demonstration." *Data Mining and knowledge discovery* 7.4 (2003): 349-371.
6. Rakthanmanon, Thanawin, et al. "Addressing big data time series: Mining trillions of time series subsequences under dynamic time warping." *ACM Transactions on Knowledge Discovery from Data (TKDD)* 7.3 (2013): 10. If you are claiming that DTW is too slow... Maybe, but read this first.
7. Lines, Jason, Sarah Taylor, and Anthony Bagnall. "Time Series Classification with HIVE-COTE: The Hierarchical Vote Collective of Transformation-Based Ensembles." *ACM Transactions on Knowledge Discovery from Data (TKDD)* 12.5 (2018): 52.
8. Keogh, E., Zhu, Q., Hu, B., Hao, Y., Xi, X., Wei, L. & Ratanamahatana, C. A. (2011). "The UCR Time Series Classification/Clustering Homepage".
9. Chen, Yanping, Eamonn Keogh, Bing Hu, Nurjahan Begum, Anthony Bagnall, Abdullah Mueen, and Gustavo Batista. 2015. "The UCR Time Series Classification Archive." https://www.cs.ucr.edu/~eamonn/time_series_data/
10. Dau, Hoang Anh, Anthony Bagnall, Kaveh Kamgar, Chin-Chia Michael Yeh, Yan Zhu, Shaghayegh Gharghabi, Chotirat Ann Ratanamahatana and Eamonn Keogh, "The UCR Time Series Archive." 2018 <https://arxiv.org/abs/1810.07758> Early adopters (late 2018) please cite this, after early 2019, please check for a peer-reviewed version of this paper.
11. Bagnall, Anthony, et al. "The great time series classification bake off: a review and experimental evaluation of recent algorithmic advances." *Data Mining and Knowledge Discovery* 31.3 (2017): 606-660.

Appendix A: Sharpshooter Plots

Here is the code we used to produce the Sharpshooter plots.

```
function[] = plot_texas_sharpshooter()
% Compute a Texas Sharpshooter plot of DTW over Euclidean Distance. See
% Batista, Wang and Keogh (2011) A Complexity-Invariant Distance Measure
% for Time Series. SDM 2011
% Last updated October 2018 by Hoang Anh Dau

% For example, if we want to construct the figure for comparison between
% Euclidean distance (ED) and DTW
% expected_accuracy_gain = DTW_train_accuracy / ED_train_accuracy
% actual_accuracy_gain = DTW_test_accuracy / ED_test_accuracy
% Because we are using 1-NN classifier, there is no training; therefore
% for ED, we use test result only; for DTW, there is train result from
% leave-one-out cross-validation to learn the warping constraint.

% read in result sheet
result_file = 'texas_plot_2018.csv';
result = importdata(result_file, ',', 1);
error_rates = result.data;

% Note that the order of texas_names and texas_values must be the same.
texas_names = result.textdata(2:end, 1);
% Note that here we convert error to accuracy, by subtracting from 1
texas_values = 1 - error_rates;

expected_accuracy_gain = texas_values(:,2)./texas_values(:,1);
actual_accuracy_gain = texas_values(:,3)./texas_values(:,1);

% Produce plot just so we can get Xlim and Ylim
plot(expected_accuracy_gain,actual_accuracy_gain,'r.');
Xaxis = get(gca,'XLim');
Yaxis = get(gca,'YLim');

clf
hold on;
axis square;

% Bottom left quadrant
patch([Xaxis(1) 1 1 Xaxis(1)], [Yaxis(1) Yaxis(1) 1 1], [0.9843 0.8471 0.5765]);
% Top right quadrant
patch([1 Xaxis(2) Xaxis(2) 1], [1 1 Yaxis(2) Yaxis(2)], [0.9843 0.8471 0.5765]);

plot(expected_accuracy_gain,actual_accuracy_gain, 'r.');

xlabel('Expected Accuracy Gain');
ylabel('Actual Accuracy Gain');

% plot with symbol as number
for i = 1: length(texas_values(:,1))
    text(expected_accuracy_gain(i),actual_accuracy_gain(i),int2str(i))
end

% plot with symbol as dataset name
% for i = 1: length(texas_values(:,1))
%
text(expected_accuracy_gain(i),actual_accuracy_gain(i),texas_names(i,:),'rotation',+30)
% end

end
```

Here the result summary file for making the Texas Sharpshooter plot.

texas_plot_2018.csv

- First column is dataset name
- Second column is Euclidean distance test error rate
- Third column is DTW train error rate
- Last column is DTW test error rate

| Name, ED, DTW train, DTW test |
|--|
| ACSF1, 0.4600, 0.5100, 0.3800 |
| Adiac, 0.3887, 0.3897, 0.3913 |
| AllGestureWiimoteX, 0.4843, 0.2833, 0.2829 |
| AllGestureWiimoteY, 0.4314, 0.2267, 0.2700 |
| AllGestureWiimoteZ, 0.5457, 0.3667, 0.3486 |
| ArrowHead, 0.2000, 0.0833, 0.2000 |
| BME, 0.1667, 0.0000, 0.0200 |
| Beef, 0.3333, 0.5000, 0.3333 |
| BeetleFly, 0.2500, 0.1500, 0.3000 |
| BirdChicken, 0.4500, 0.1500, 0.3000 |
| CBF, 0.1478, 0.0000, 0.0044 |
| Car, 0.2667, 0.2833, 0.2333 |
| Chinatown, 0.0464, 0.0500, 0.0464 |
| ChlorineConcentration, 0.3500, 0.3662, 0.3500 |
| CinCECGTorso, 0.1029, 0.0750, 0.0645 |
| Coffee, 0.0000, 0.0000, 0.0000 |
| Computers, 0.4240, 0.2480, 0.3800 |
| CricketX, 0.4231, 0.2000, 0.2282 |
| CricketY, 0.4333, 0.2410, 0.2410 |
| CricketZ, 0.4128, 0.2256, 0.2538 |
| Crop, 0.2883, 0.2928, 0.2883 |
| DiatomSizeReduction, 0.0654, 0.0625, 0.0654 |
| DistalPhalanxOutlineAgeGroup, 0.3741, 0.1975, 0.3741 |
| DistalPhalanxOutlineCorrect, 0.2826, 0.2117, 0.2754 |
| DistalPhalanxTW, 0.3669, 0.2475, 0.3669 |
| DodgerLoopDay, 0.4500, 0.4744, 0.4125 |
| DodgerLoopGame, 0.1159, 0.0500, 0.0725 |
| DodgerLoopWeekend, 0.0145, 0.0000, 0.0217 |
| ECG200, 0.1200, 0.1400, 0.1200 |
| ECG5000, 0.0751, 0.0640, 0.0760 |
| ECGFiveDays, 0.2033, 0.1739, 0.2033 |
| EOGHorizontalSignal, 0.5829, 0.2182, 0.5249 |
| EOGVerticalSignal, 0.5580, 0.2735, 0.5249 |
| Earthquakes, 0.2878, 0.2329, 0.2734 |
| ElectricDevices, 0.4492, 0.1851, 0.3753 |
| EthanolLevel, 0.7260, 0.6825, 0.7180 |
| FaceAll, 0.2864, 0.0375, 0.1917 |
| FaceFour, 0.2159, 0.1250, 0.1136 |
| FacesUCR, 0.2307, 0.0750, 0.0878 |
| FiftyWords, 0.3692, 0.2289, 0.2418 |
| Fish, 0.2171, 0.2000, 0.1543 |
| FordA, 0.3348, 0.3091, 0.3091 |
| FordB, 0.3938, 0.2929, 0.3926 |
| FreezerRegularTrain, 0.1951, 0.1200, 0.0930 |
| FreezerSmallTrain, 0.3302, 0.1071, 0.3302 |
| Fungi, 0.1774, 1.0000, 0.1774 |
| GestureMidAirD1, 0.4231, 0.3846, 0.3615 |
| GestureMidAirD2, 0.5077, 0.4375, 0.4000 |
| GestureMidAirD3, 0.6538, 0.6394, 0.6231 |
| GesturePebbleZ1, 0.2674, 0.0455, 0.1744 |
| GesturePebbleZ2, 0.3291, 0.0205, 0.2215 |
| GunPoint, 0.0867, 0.0400, 0.0867 |
| GunPointAll, 0.1013, 0.0306, 0.0313 |

The Password

- As noted above. My one regret about creating the UCR Archive is that some researchers see improving accuracy on it as *sufficient* task to warrant a publication. I am not convinced that this should be the case (unless the improvements are very significant, or the technique is so novel/interesting it might be of independent interest).
- However, the archive is in a very contrived format. In many cases, taking a real world dataset, and putting it into this format, is a *much* harder problem than classification itself!
- Bing Hu explains this nicely in the introduction to her paper [2], I think it should be required reading for anyone working in this area.
- The password is the missing words from this sentence “*Why would ***** use the archive and not acknowledge it?*”
- The sentence is on the second page of [10]. The paper is available for download on the UCR Archive webpage or at <https://arxiv.org/abs/1810.07758>

Personal note from Eamonn

I am somewhat bemused by the hundreds of papers that use the UCR Archive, but do not acknowledge or thank the archivists.

Many such papers thank funding agencies, people that donated CPU time, friends that gave feedback etc. But many of these papers could not have been written without access to dozens of labeled time series datasets.

These dozens of labeled datasets were provided, completely for free! And these datasets represent (now) at least a thousand hours of work by my students and collaborators, to create or collect, to clean and annotate, to compute benchmarks etc.

It does seem like an acknowledgment would be classy ;-)

Acknowledgments

The authors would like to thank Prof. Eamonn Keogh and all the people who have contributed to the UCR time series classification archive for their selfless work. We also thank the anonymous reviewers for their valuable advice.

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About the baseline results reported – Before you ask

- Did you z-normalize the data before passing to the algorithm?
- There can be different implementations of DTW. Some implementations divide the distance by the warping path length; some use a different step patterns etc. We use MATLAB implementation of DTW [r1].

```
dist = dtw(time_series_1, time_series_2, window_size, 'squared');
```

- We use MATLAB implementation of k -NN [r2]

```
mdl = fitcknn(train_data, train_label, 'Standardize', 0, 'NSMethod', 'exhaustive');
```

- We use leave-one-out cross-validation to learn the warping constraint

```
cross_validation = crossval(mdl, 'LeaveOut', 'on');
```

- For constrained warping, if the percentage of time series length results in a real number, you can round up or round down. We round up.
- We round the error rate to four decimal places. For a more comprehensive result comparison and other resources, we recommend the UEA & UCR Time Series Classification Repository [r3].

[r1] <https://www.mathworks.com/help/signal/ref/dtw.html>

[r2] <https://www.mathworks.com/help/stats/classificationknn.html>

[r3] <http://www.timeseriesclassification.com/index.php>

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| Shiyuan Liu, Li Lv. Thiago Santos Quirino, Mei-Ling Shyu Pierre-François Marteau, Cosmin Boianu, Lancaster University. Yueguo Chen, Anthony K.H. Tung, Beng Chin Ooi, National University of Singapore. Vernon Rego, Vernon Rego, Purdue University. Mislav Malenica, Tomislav Smuc Man Hon WONG, ZHOU Mi, The Chinese University of Hong Kong. Guillaume Bouchard Xerox Research Centre Europe. Hoia Vo and David Joslin Seattle University. Carlotta Orsenigo , University degli Studi di Milano. Dr. Paolo Ciaccia Xiaoping Wang, Jiaotong University. Longin Jan Latecki and Qiang Wang, Temple University. 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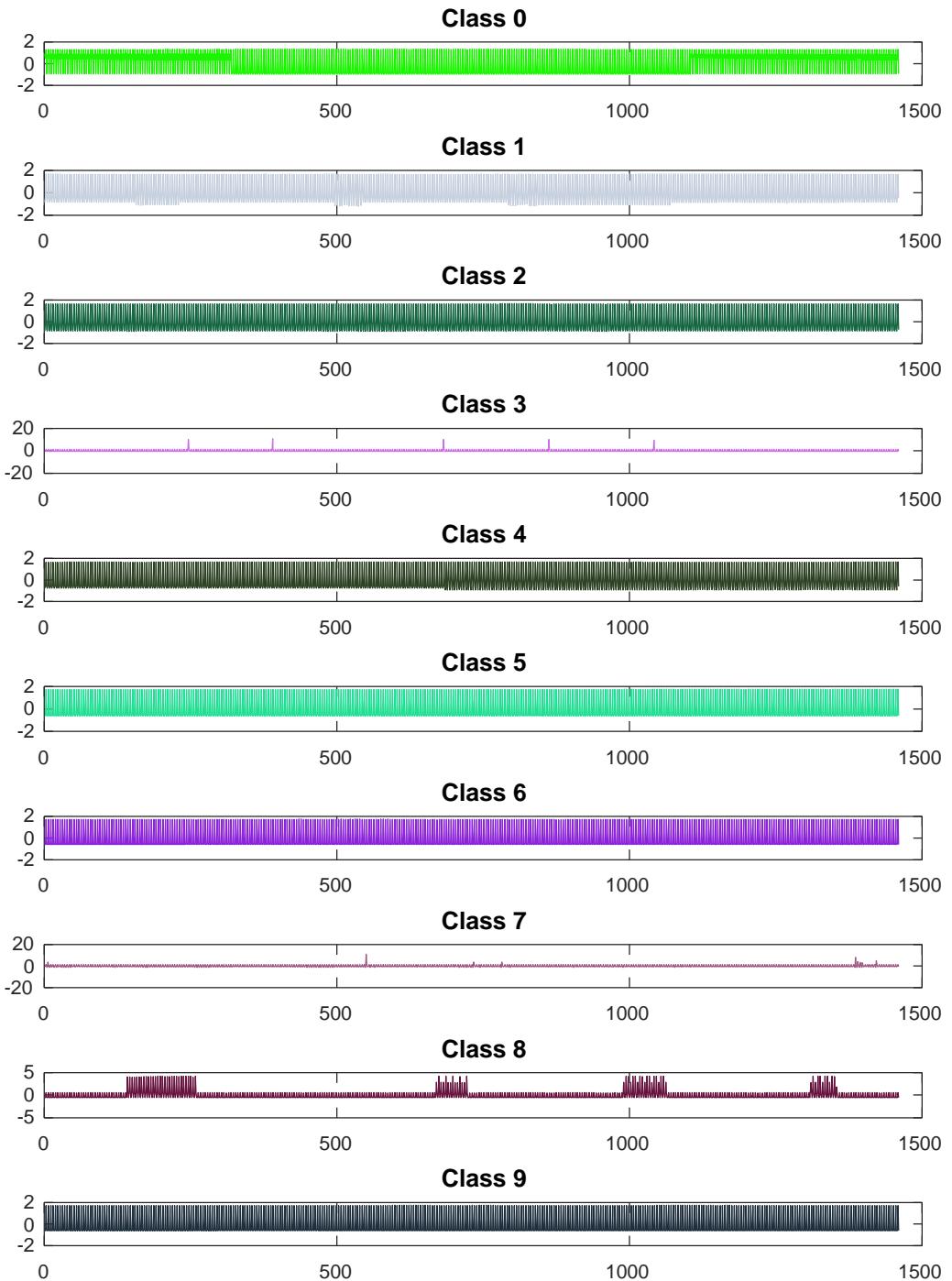
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| André Gensler | Jonas Richardi | Andriod MinkuMichele Dallachiesa and Themis Palpanas | Chen Qiang | |
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| Conceição Amado and Diogo Silva | | Aleksandar Pechkov | Anuj Srivastava and J. Derek Tucker | |
| Zhang, Zhipei and Qi, Hairong | | Myat Su Yin | Ajithkumar Warrier | |
| Diego Rivera Garcia. | | | Kyle Johnston, and Adrian Peter | |

43 datasets added in Summer 2018

The figures follow are intended to offer a quick inspection of the data. For readability, depending on the scenario, the data may be normalized or may be not, the number of exemplars per class may be one, three or many.

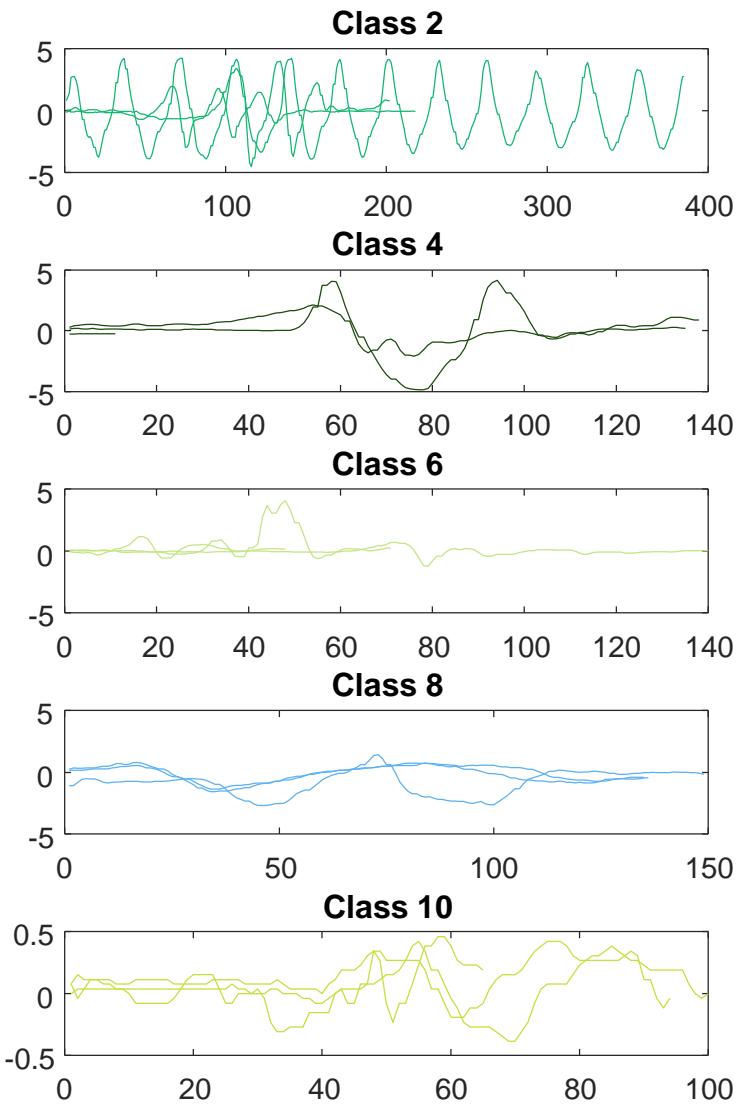
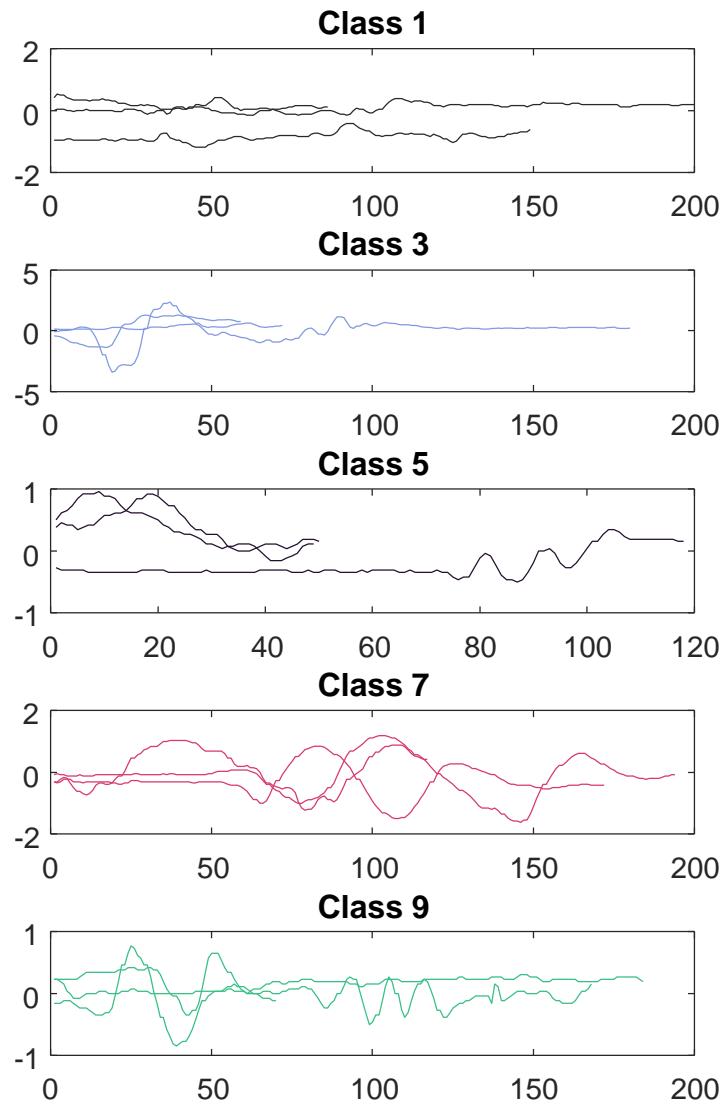
ACSF1

One exemplar per class,
with z-normalization



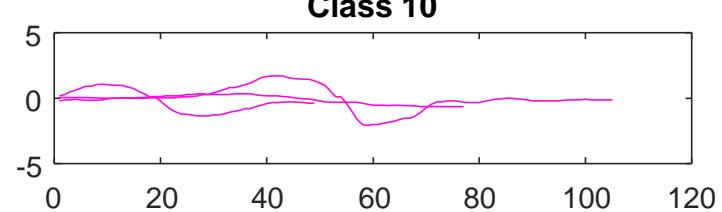
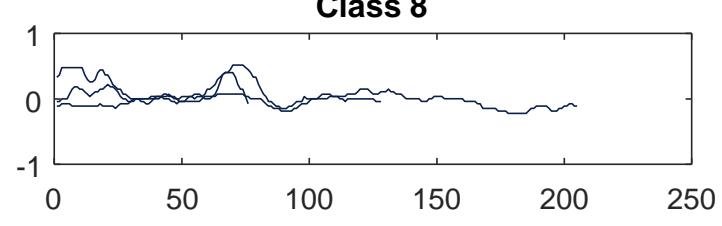
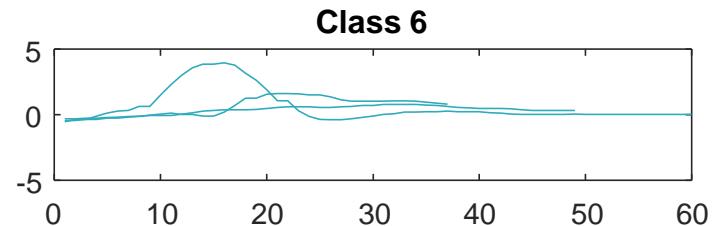
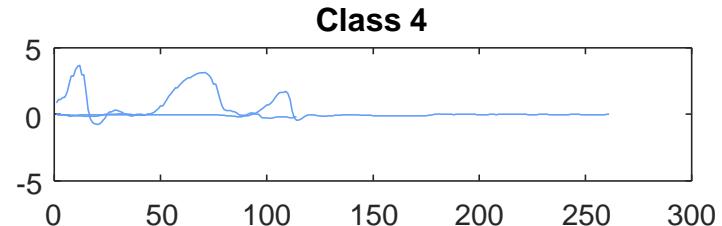
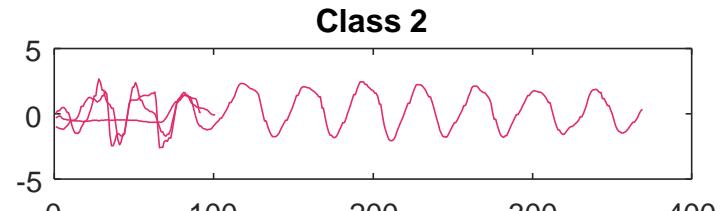
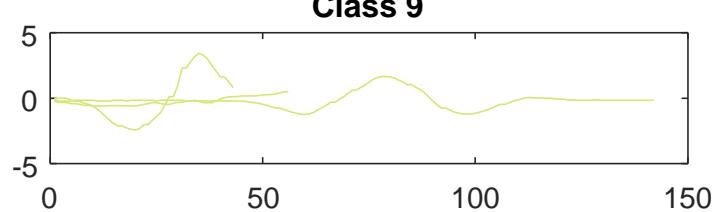
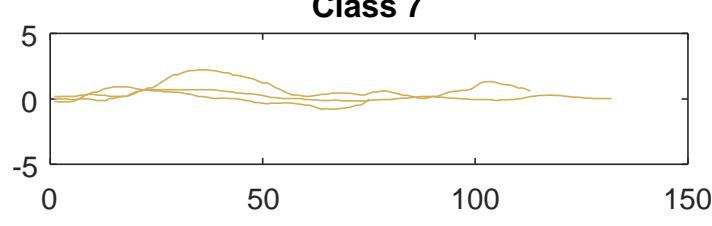
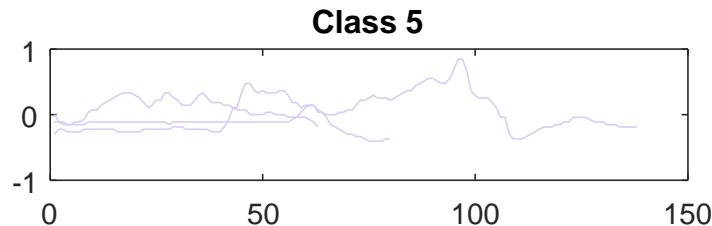
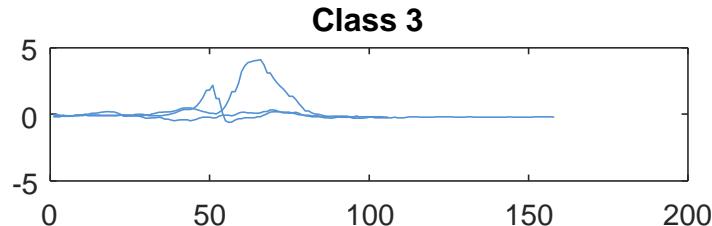
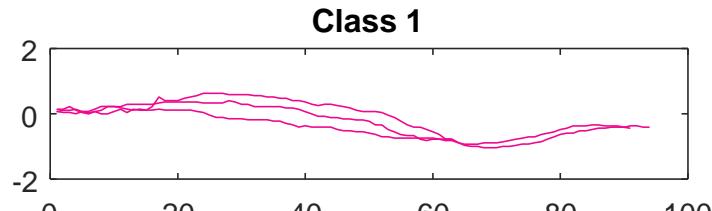
AllGestureWiimoteX

Three exemplars per class,
without z-normalization



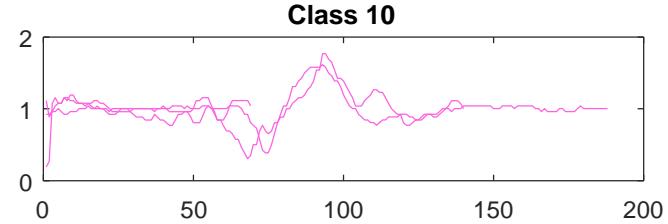
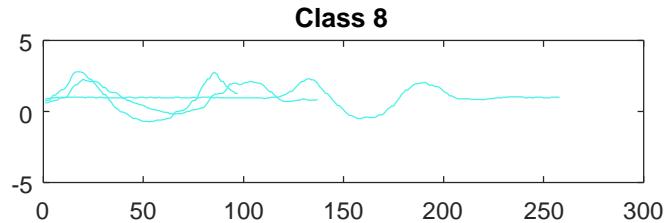
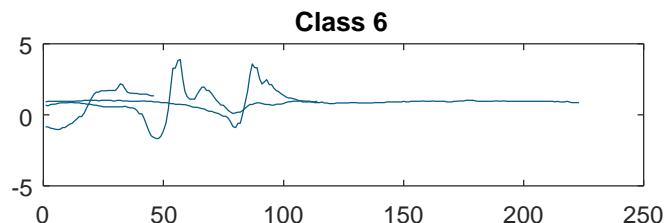
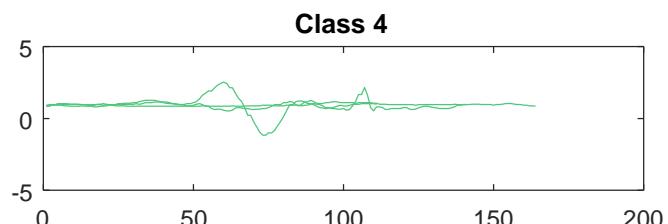
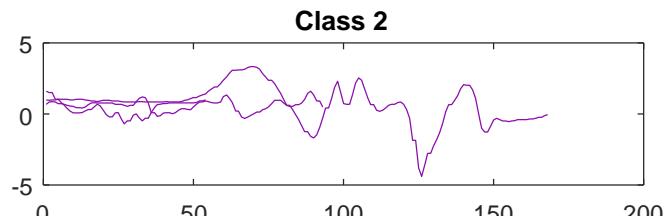
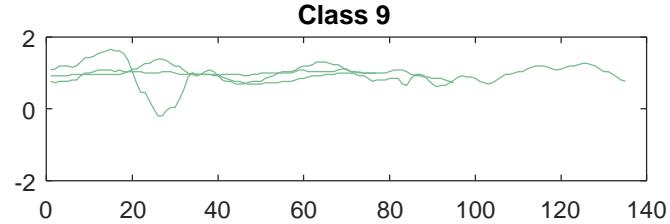
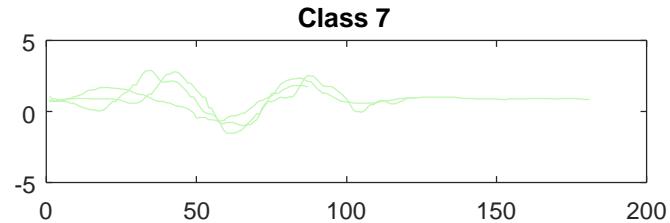
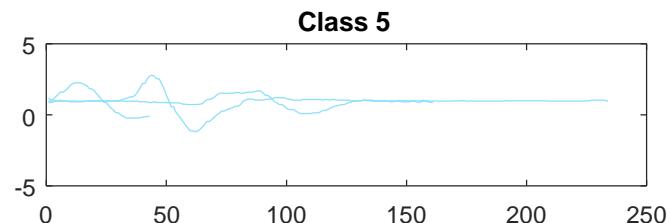
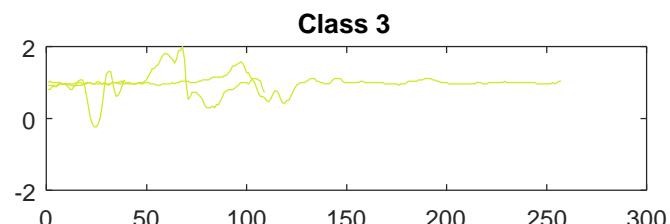
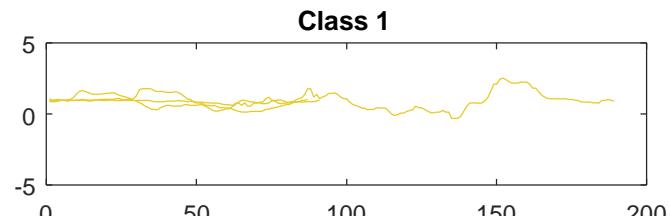
AllGestureWiimoteY

Three exemplars per class,
without z-normalization



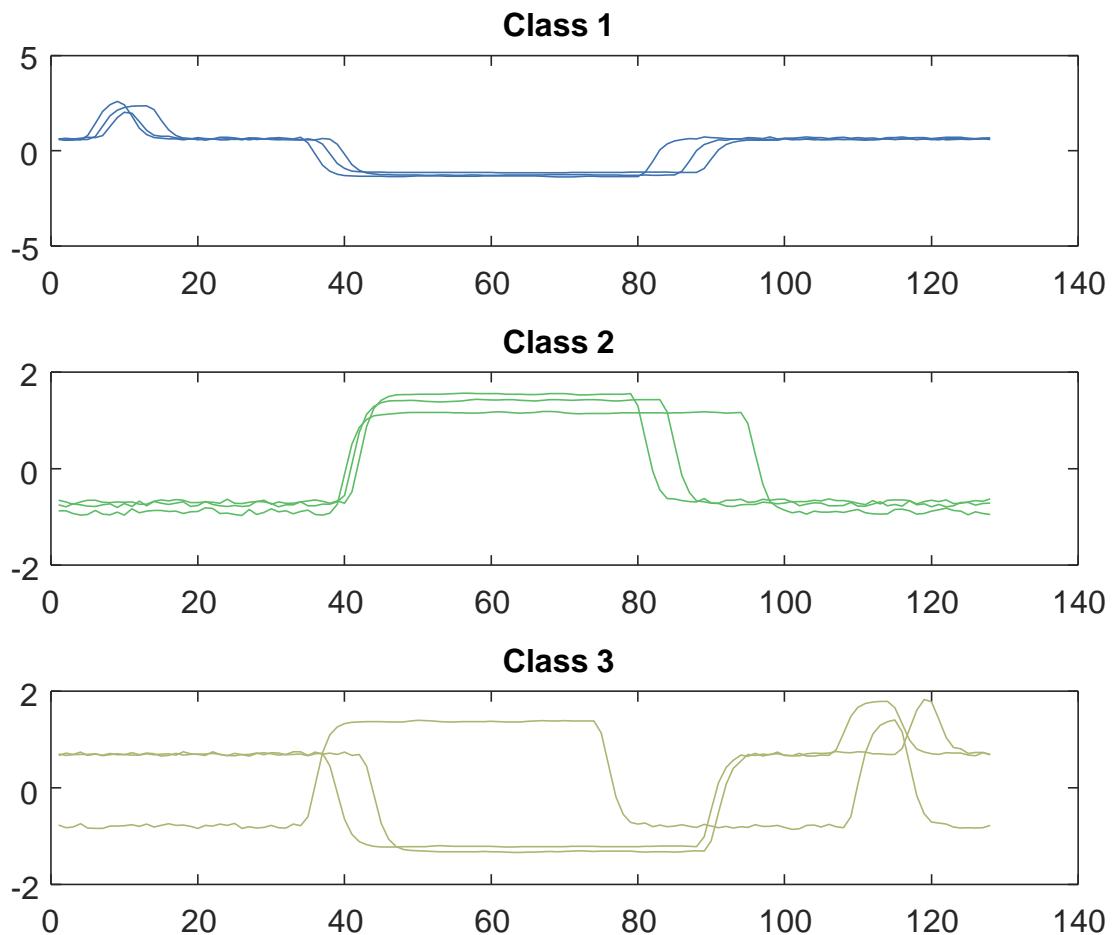
AllGestureWiimoteZ

Three exemplars per class,
without z-normalization



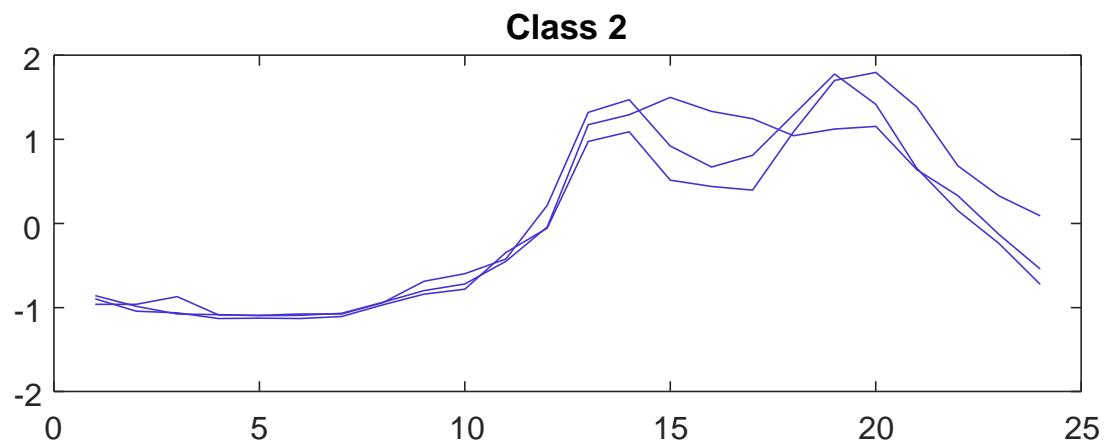
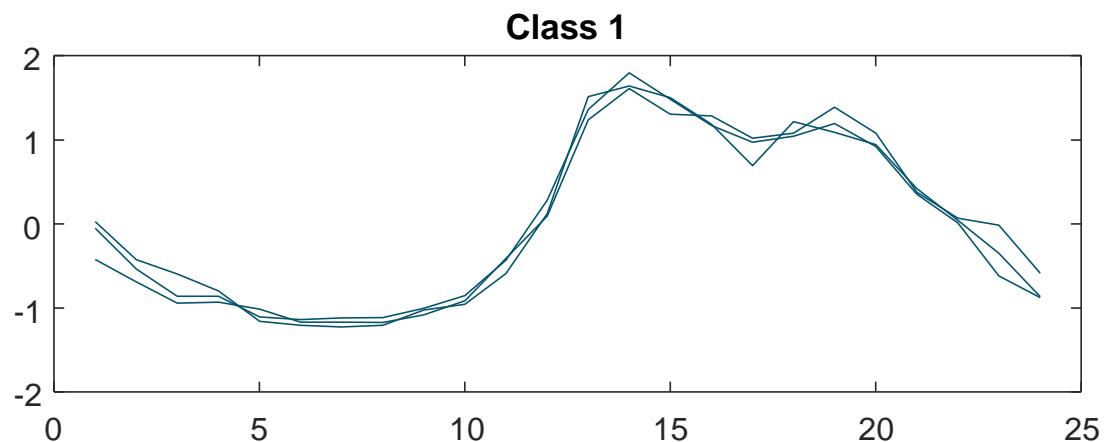
BME

Three exemplars per class,
with z-normalization



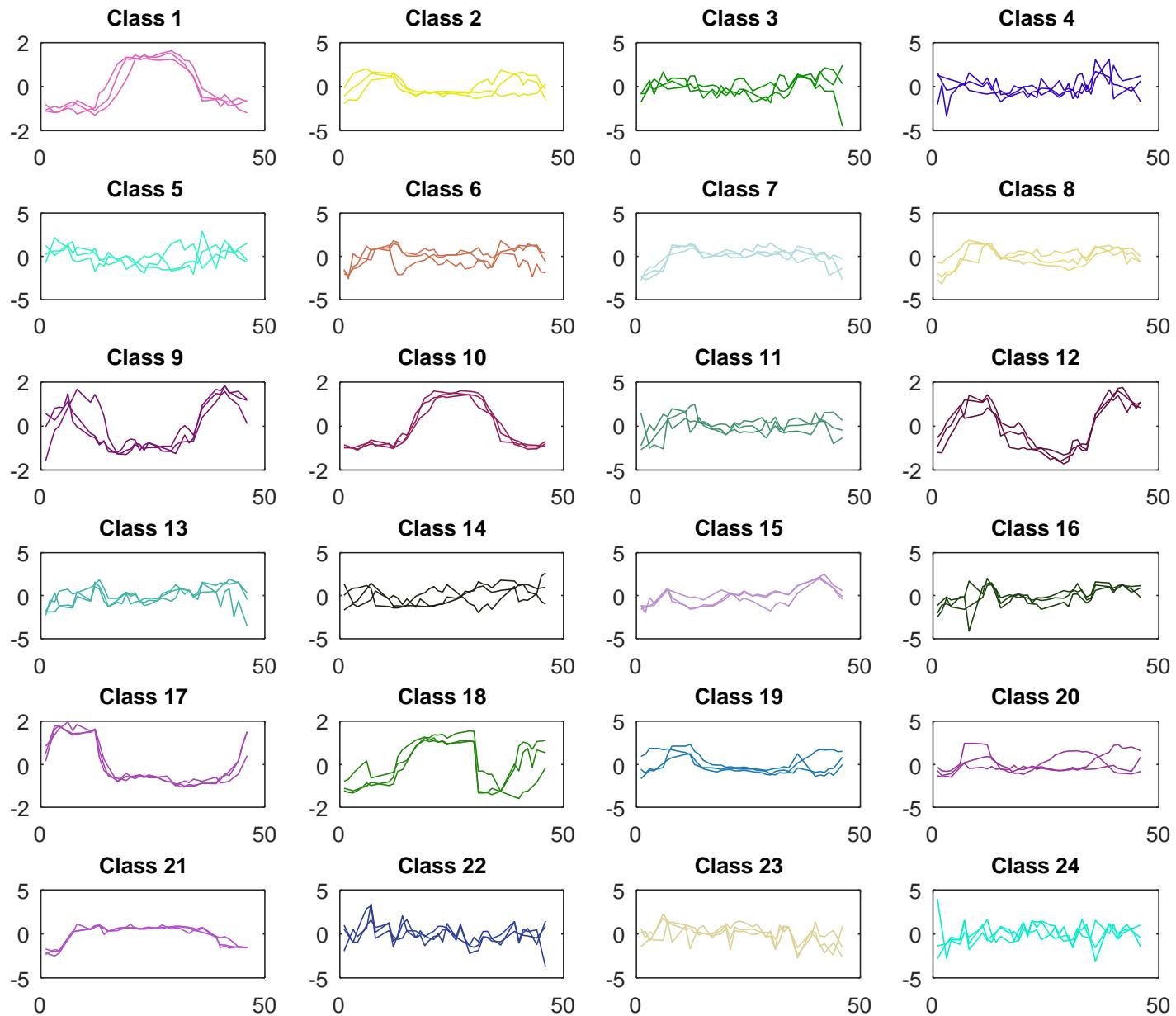
Chinatown

Three exemplars per class,
with z-normalization



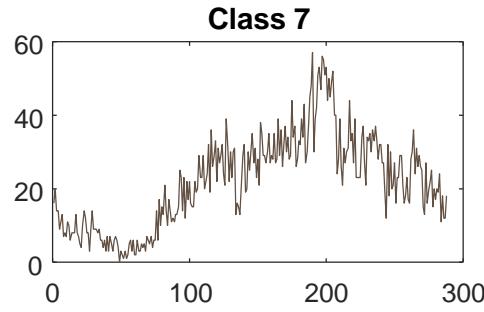
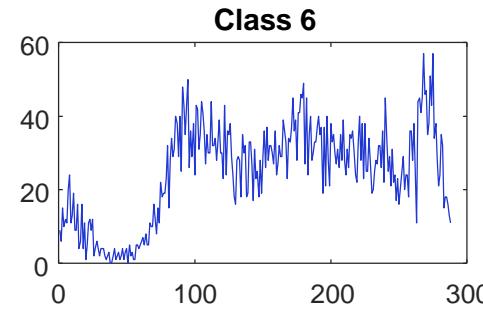
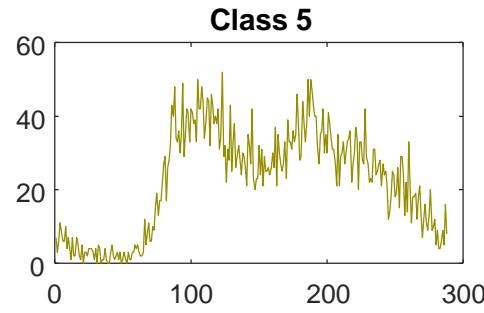
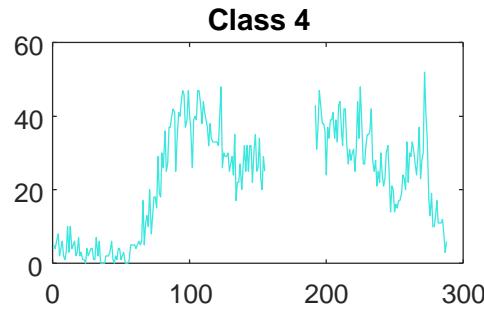
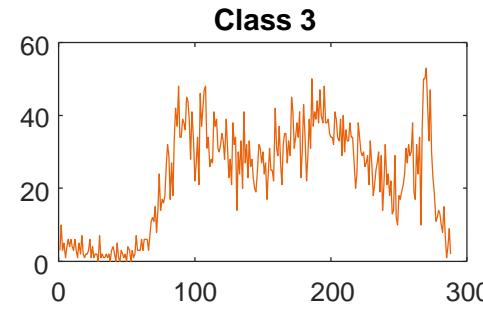
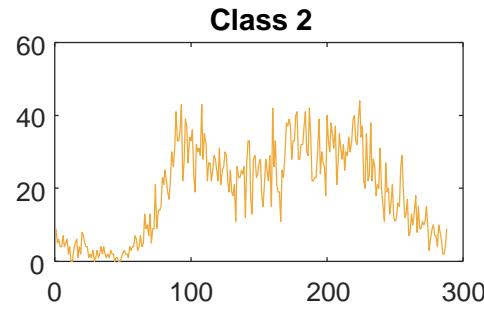
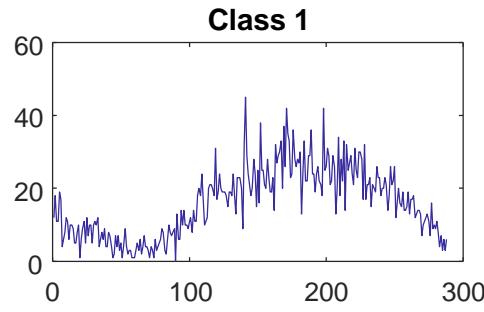
Crop

Three exemplars per class, with z-normalization



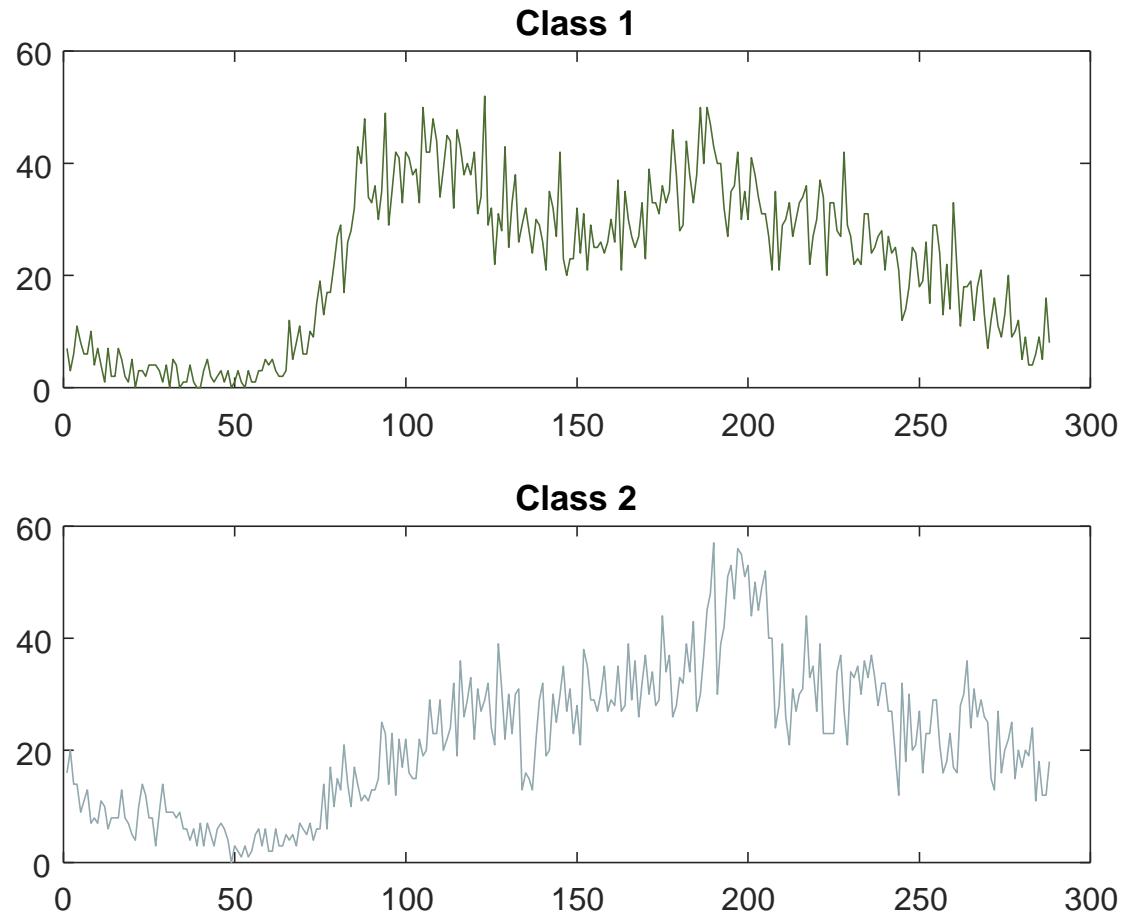
DodgerLoopDay

One exemplar per class,
with z-normalization



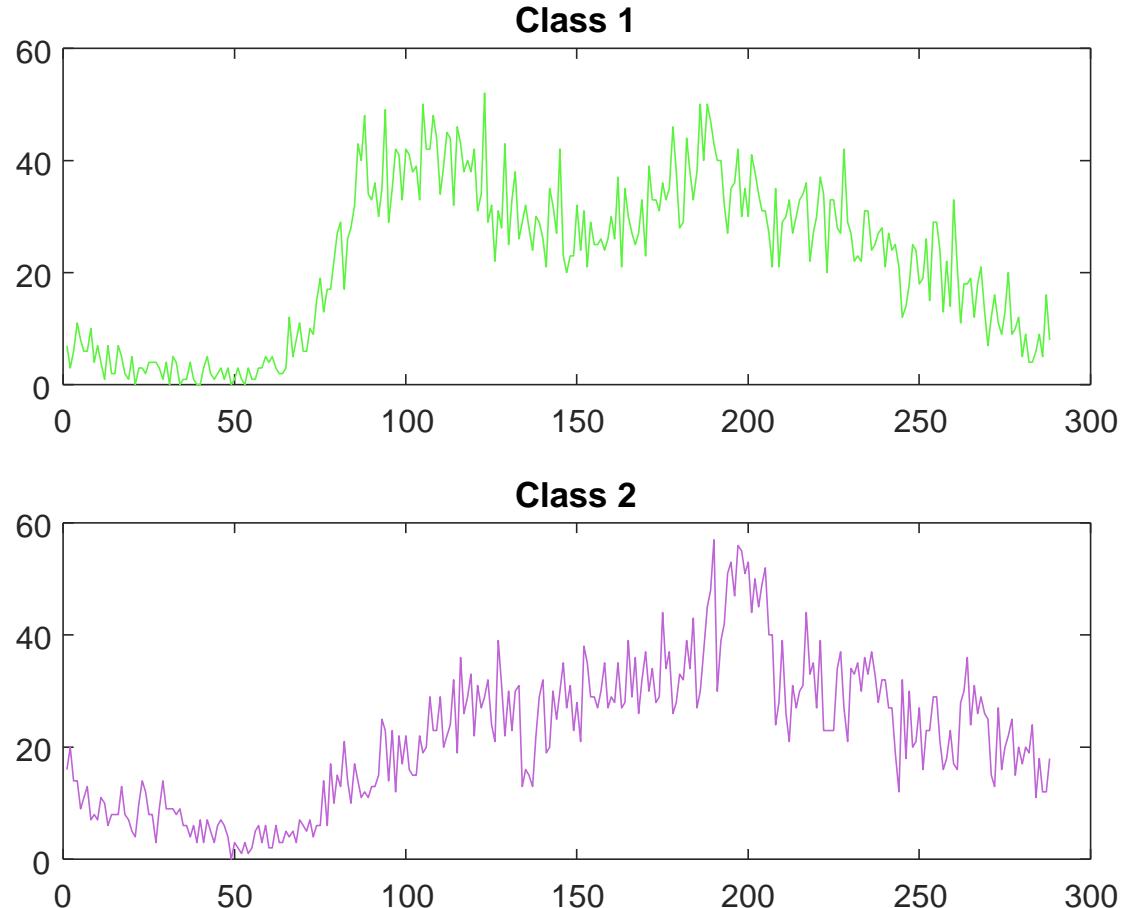
DodgerLoopGame

One exemplar per class,
without z-normalization



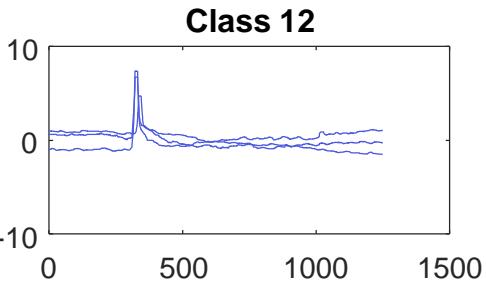
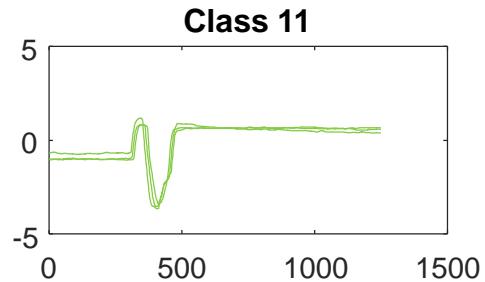
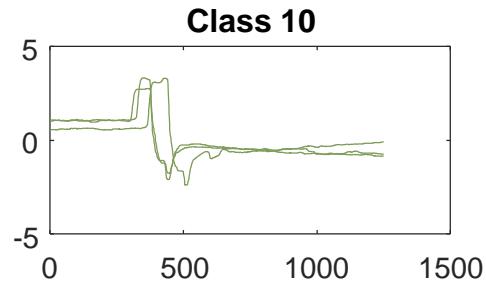
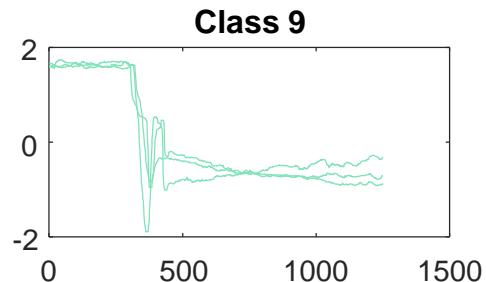
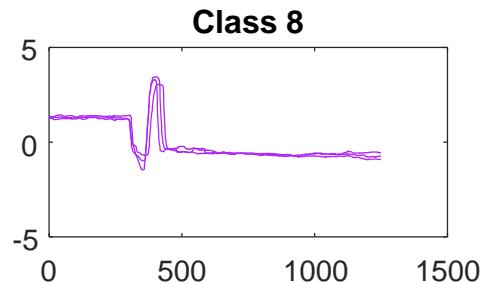
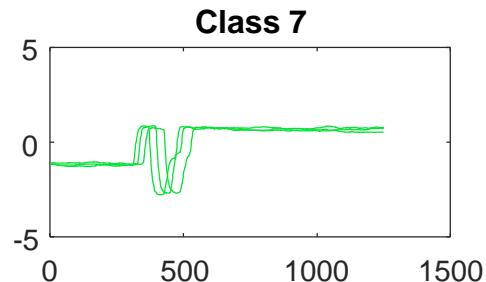
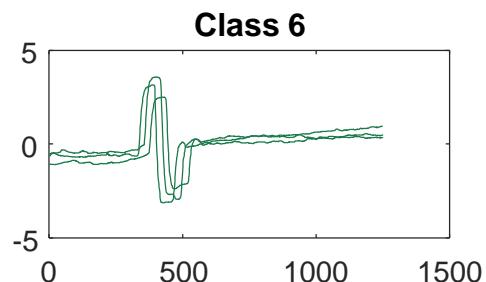
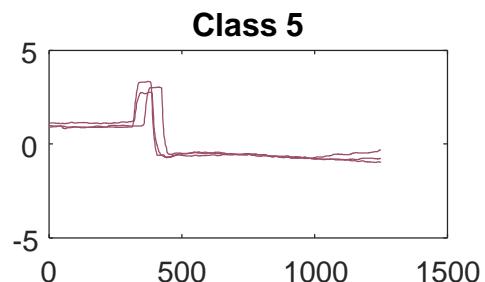
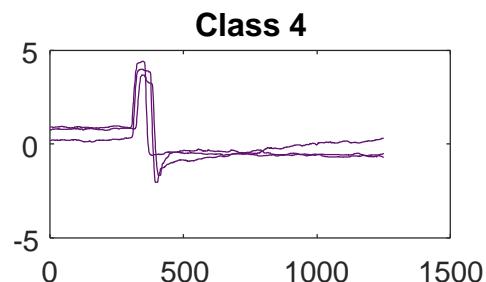
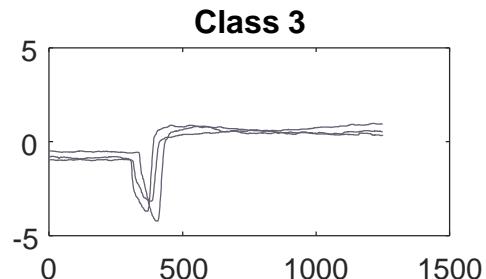
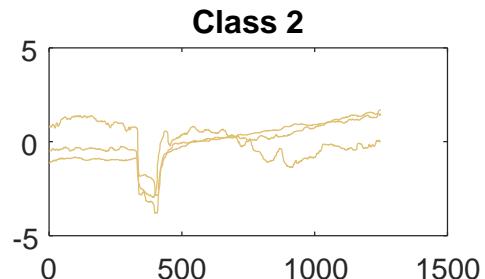
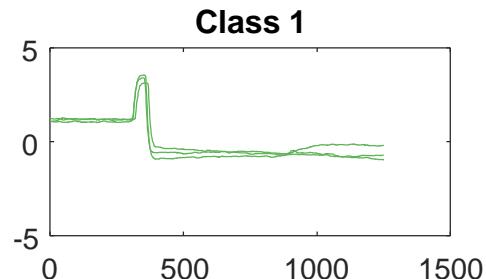
DodgerLoopWeekend

One exemplar per class,
without z-normalization



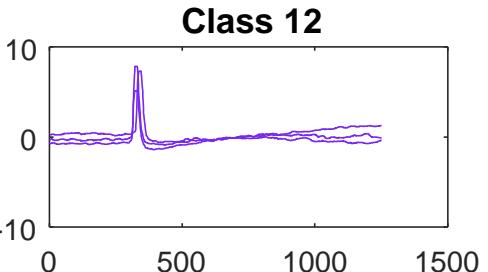
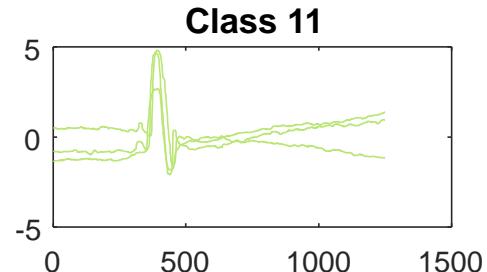
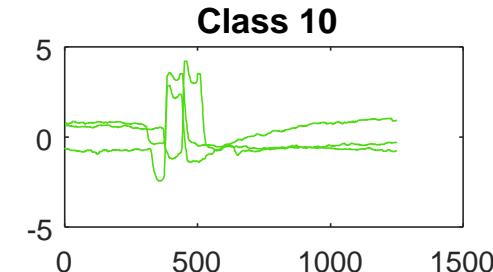
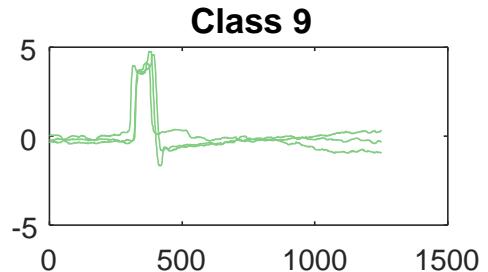
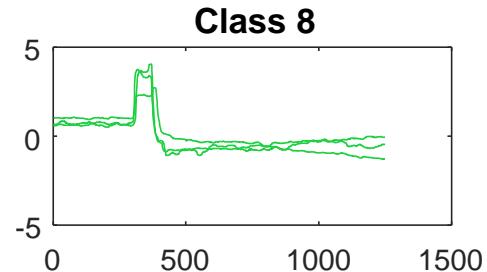
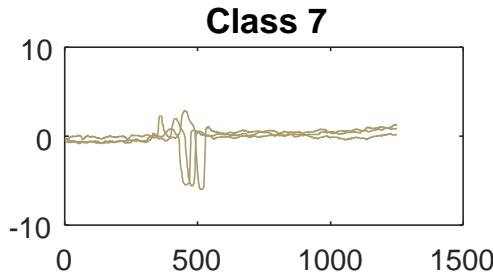
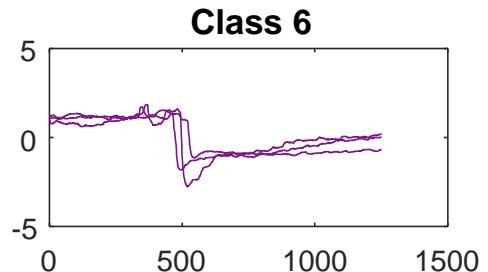
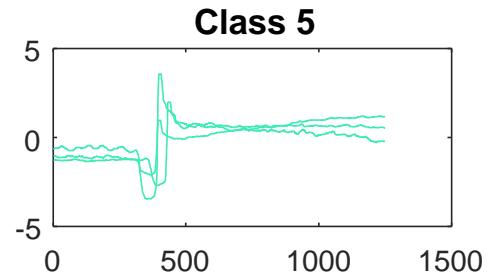
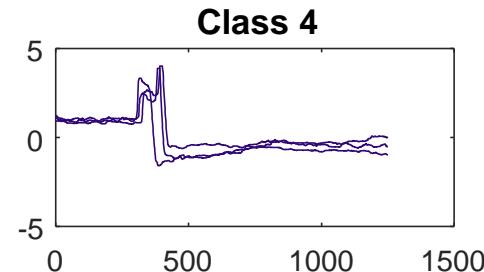
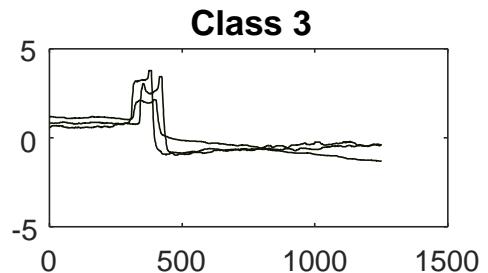
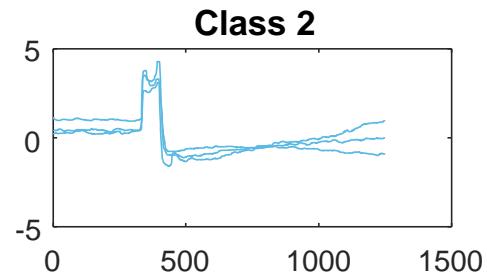
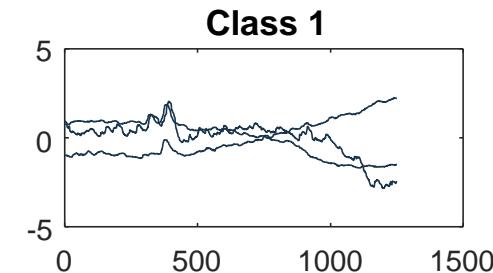
EOGHorizontalSignal

Three exemplars per class,
with z-normalization



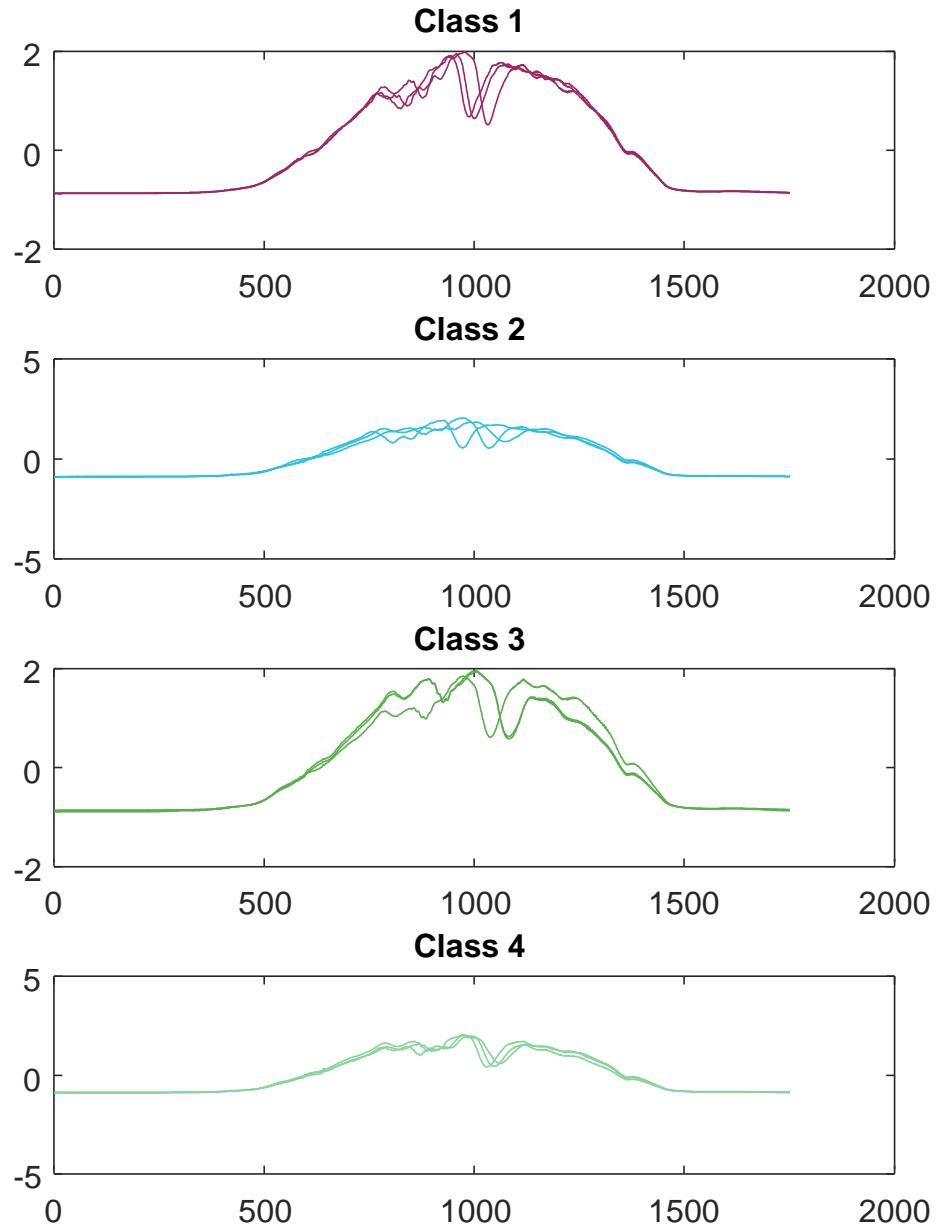
EOGVerticalSignal

Three exemplars per class,
with z-normalization



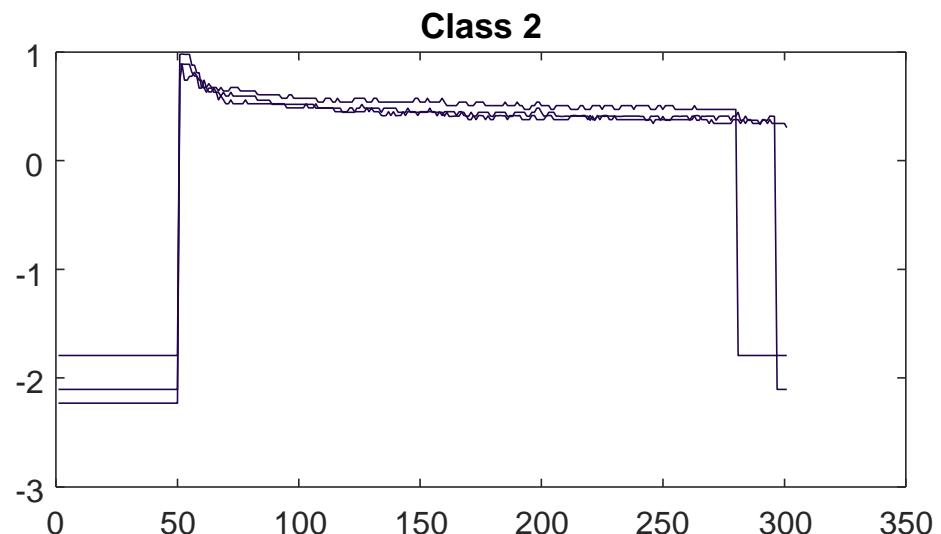
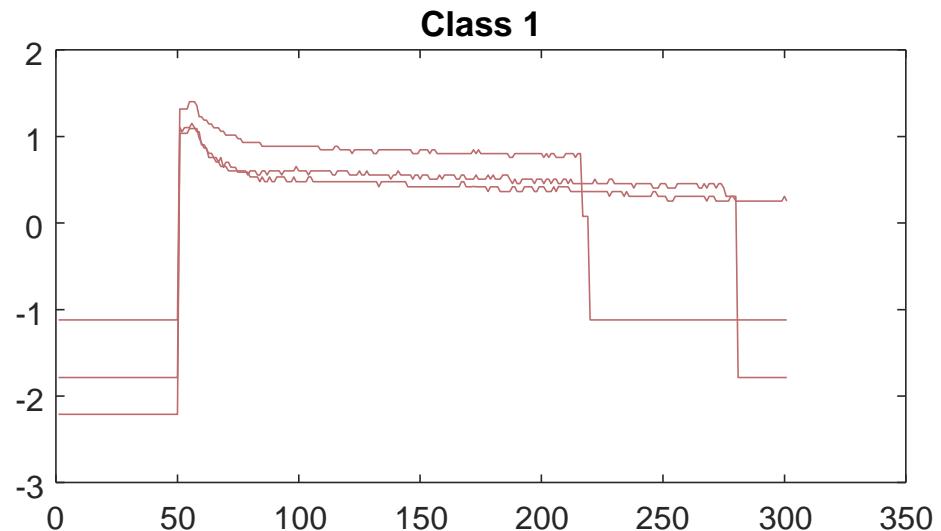
EthanolLevel

Three exemplars per class,
with z-normalization



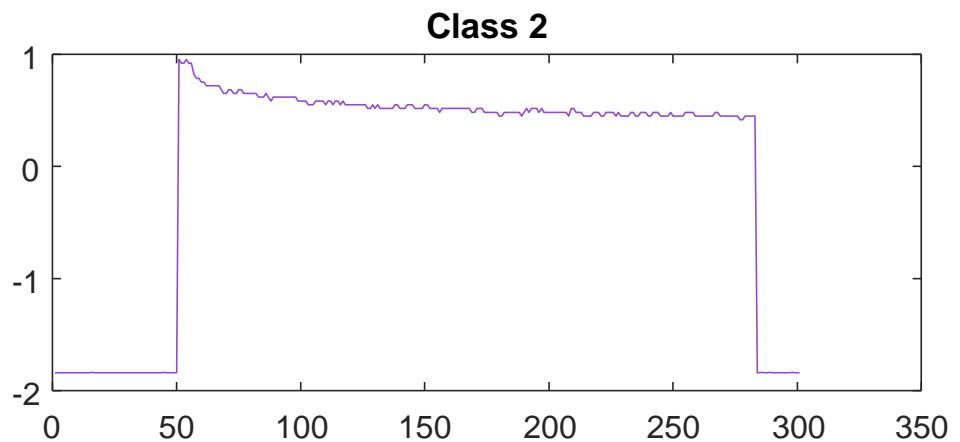
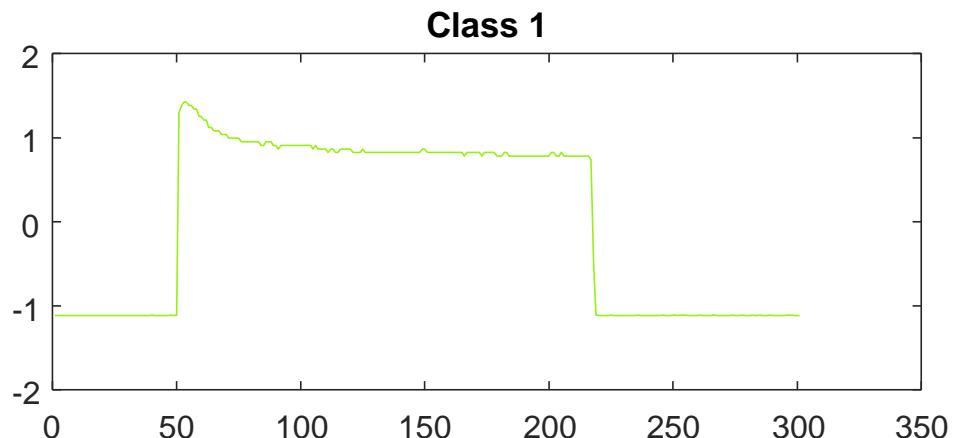
FreezerRegularTrain

Three exemplars per class,
with z-normalization



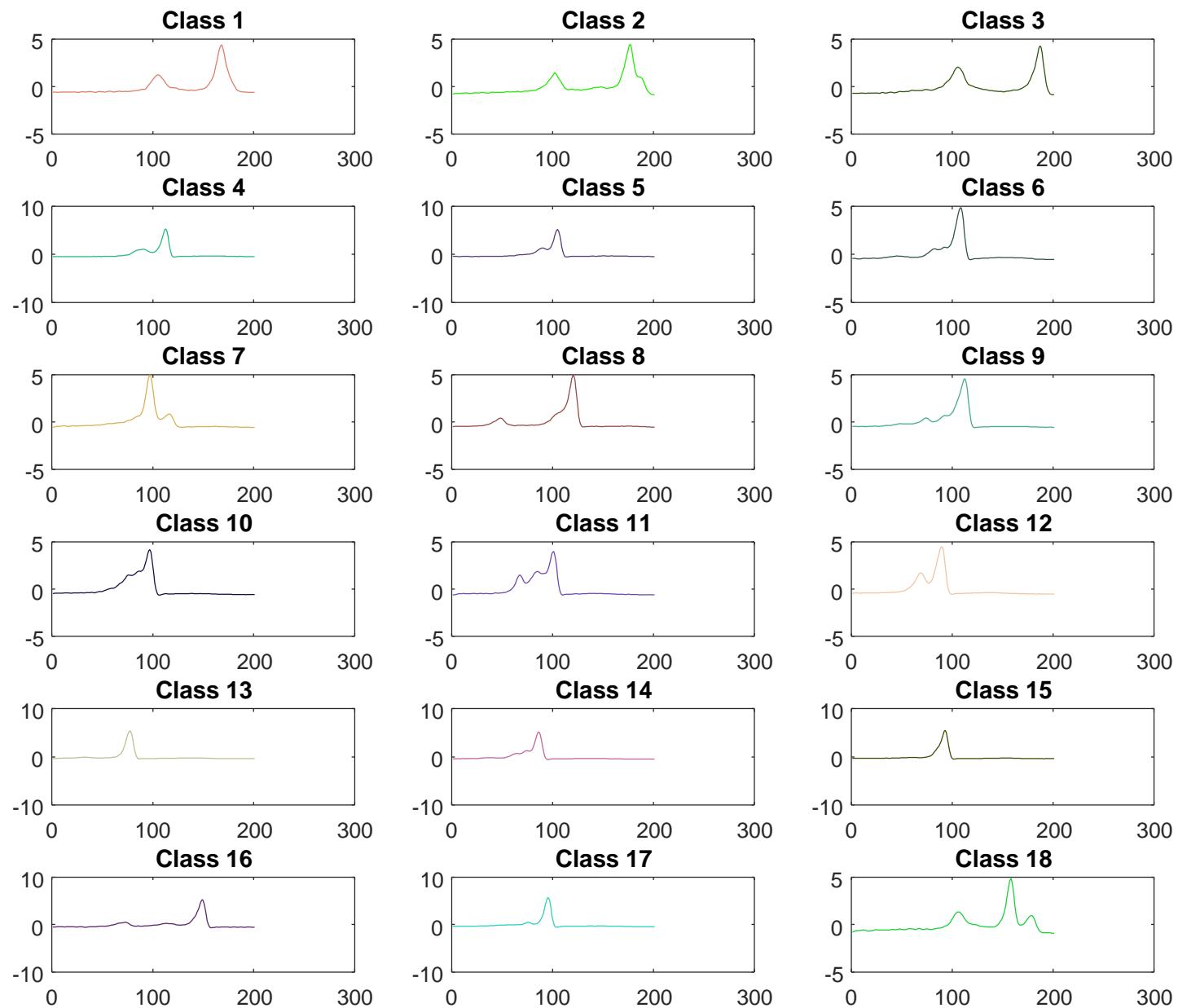
FreezerSmallTrain

One exemplar per class,
with z-normalization



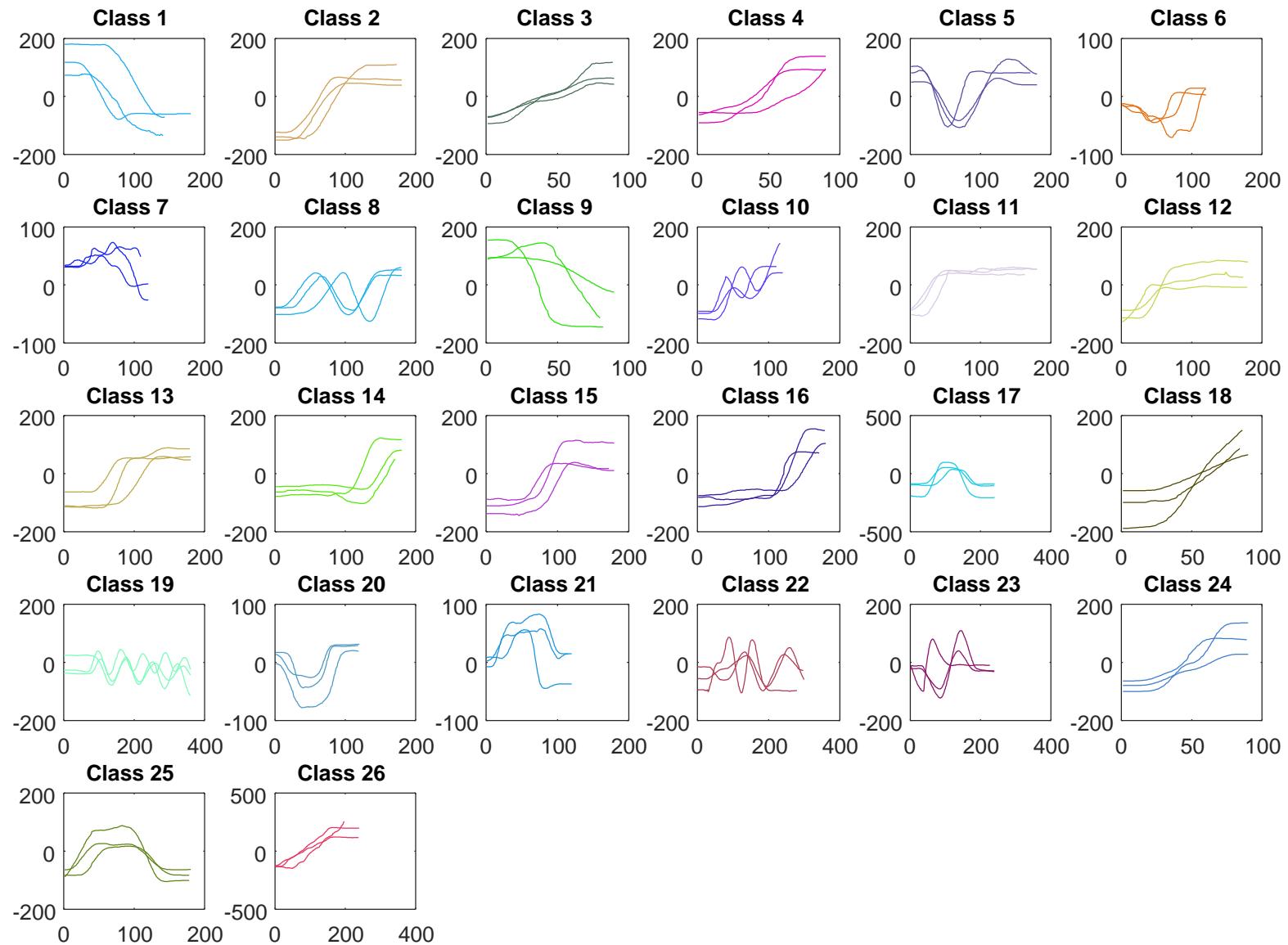
Fungi

One exemplar per class, with z-normalization



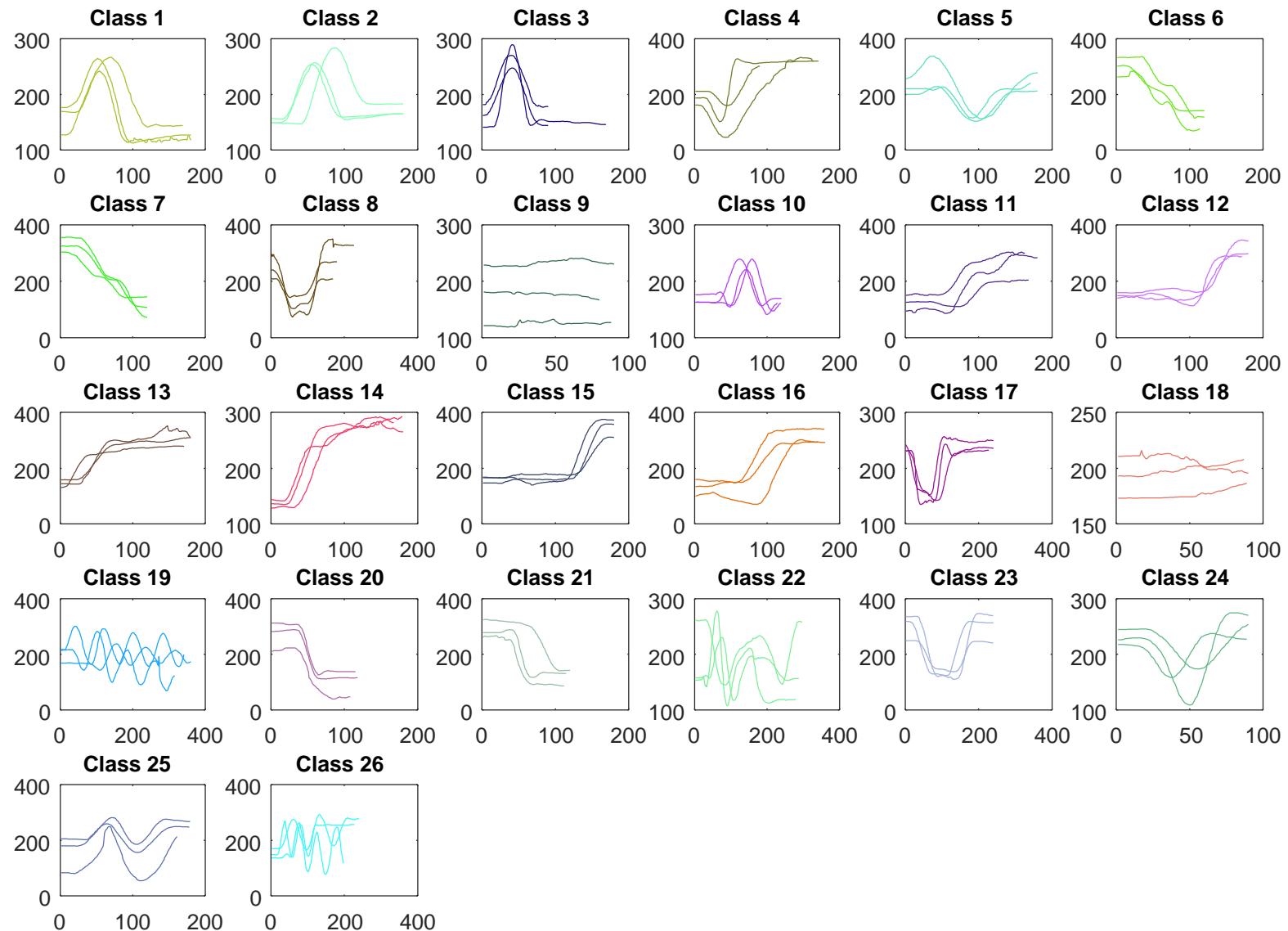
GestureMidAirD1

Three exemplars per class,
without z-normalization



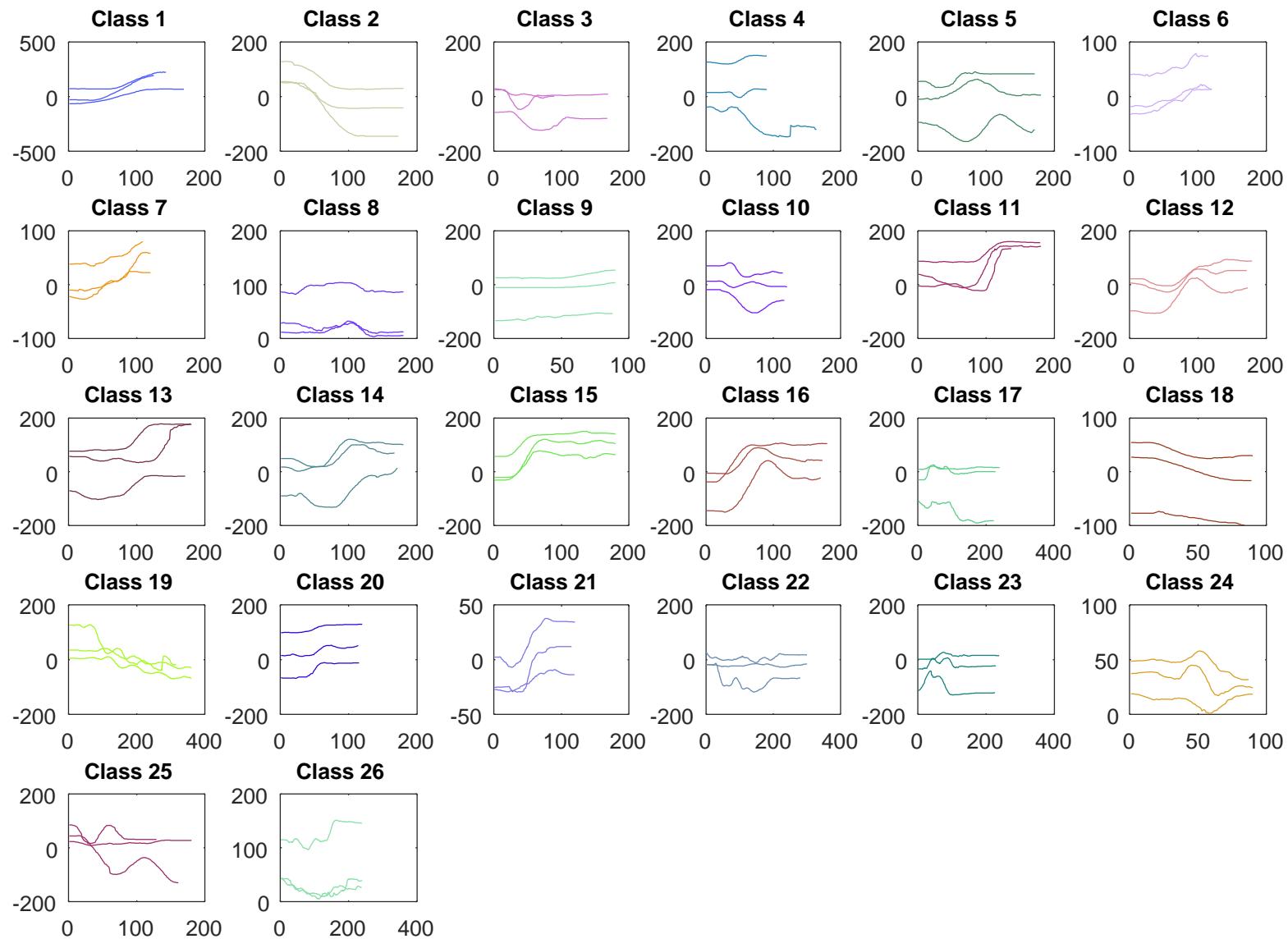
GestureMidAirD2

Three exemplars per class,
without z-normalization



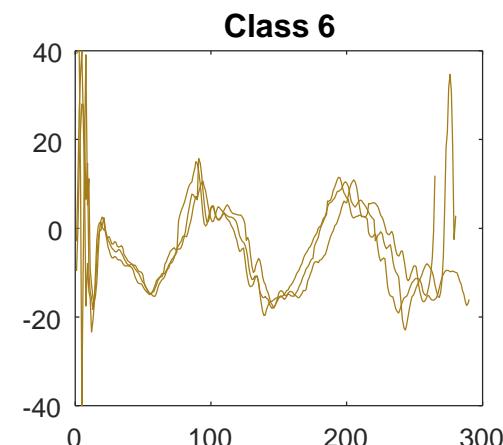
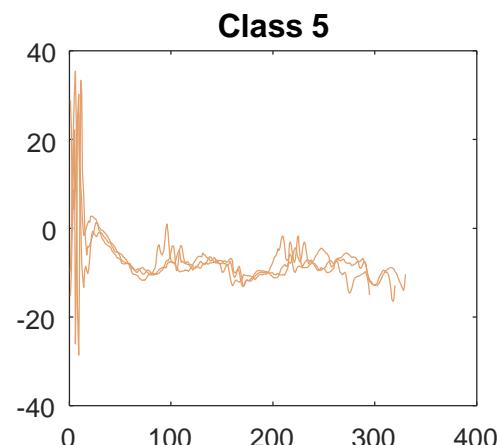
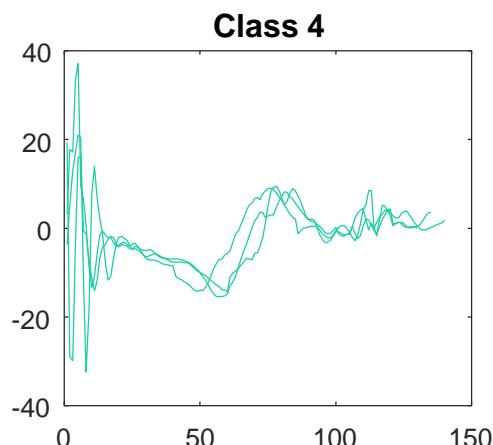
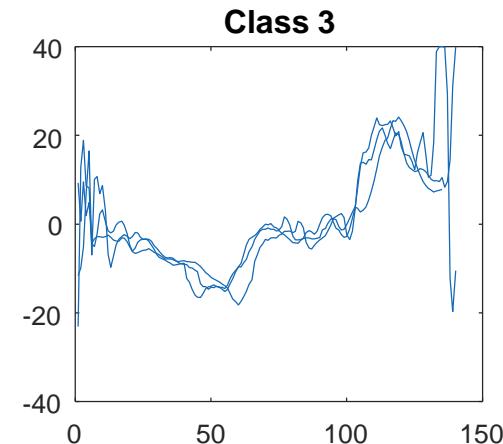
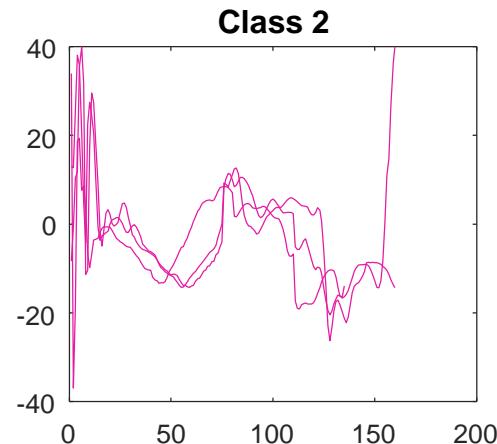
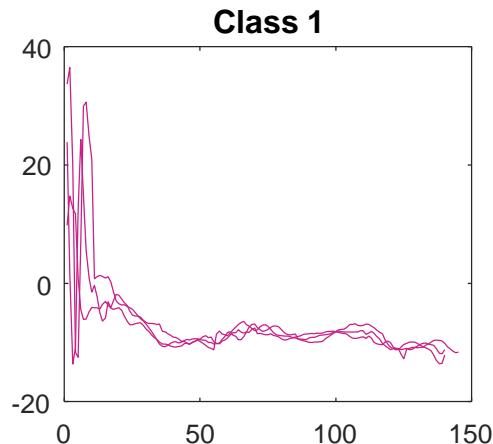
GestureMidAirD3

Three exemplars per class,
without z-normalization



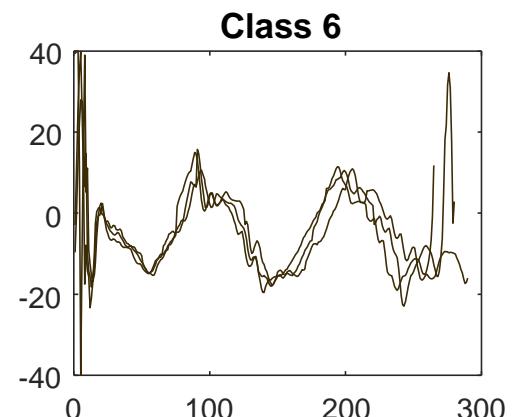
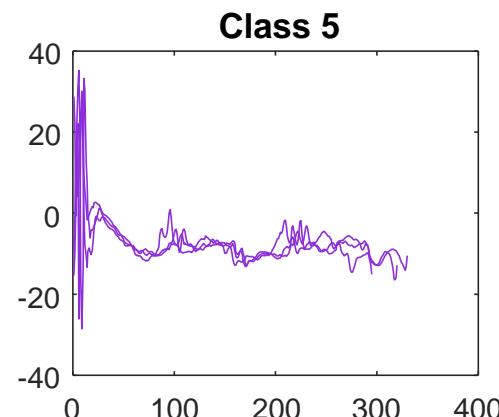
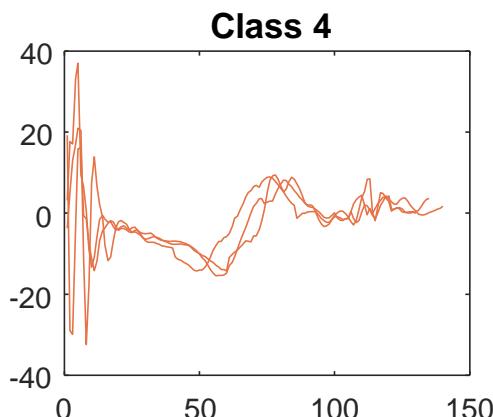
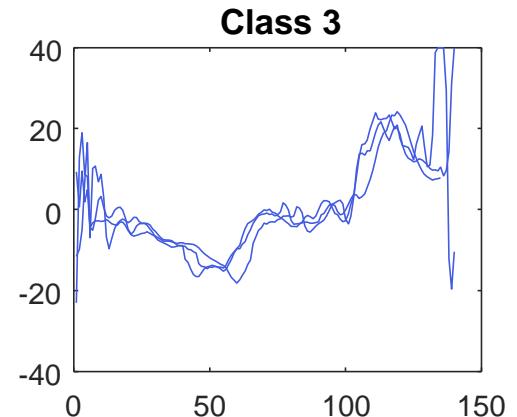
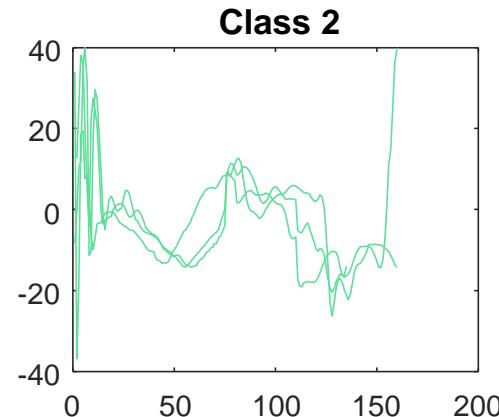
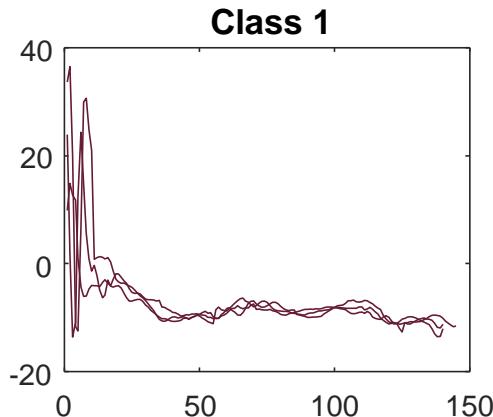
GesturePebbleZ1

Three exemplars per class,
without z-normalization



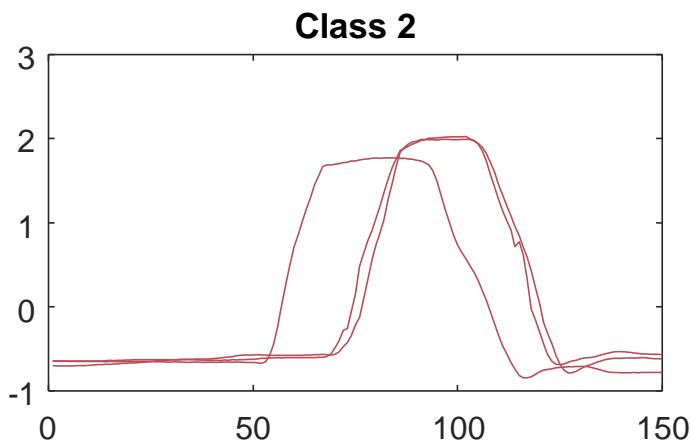
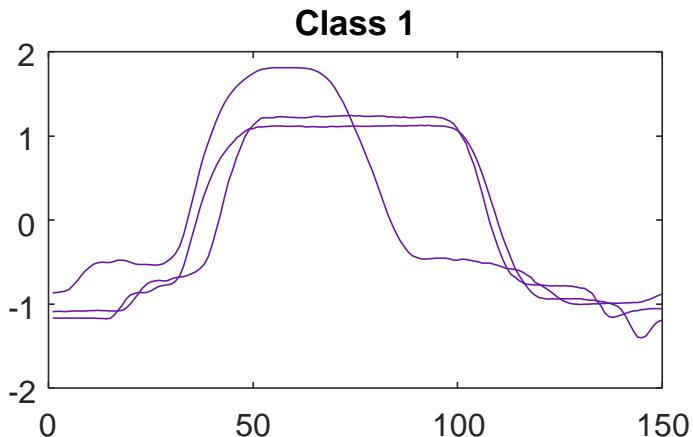
GesturePebbleZ2

Three exemplars per class,
without z-normalization



GunPointAgeSpan

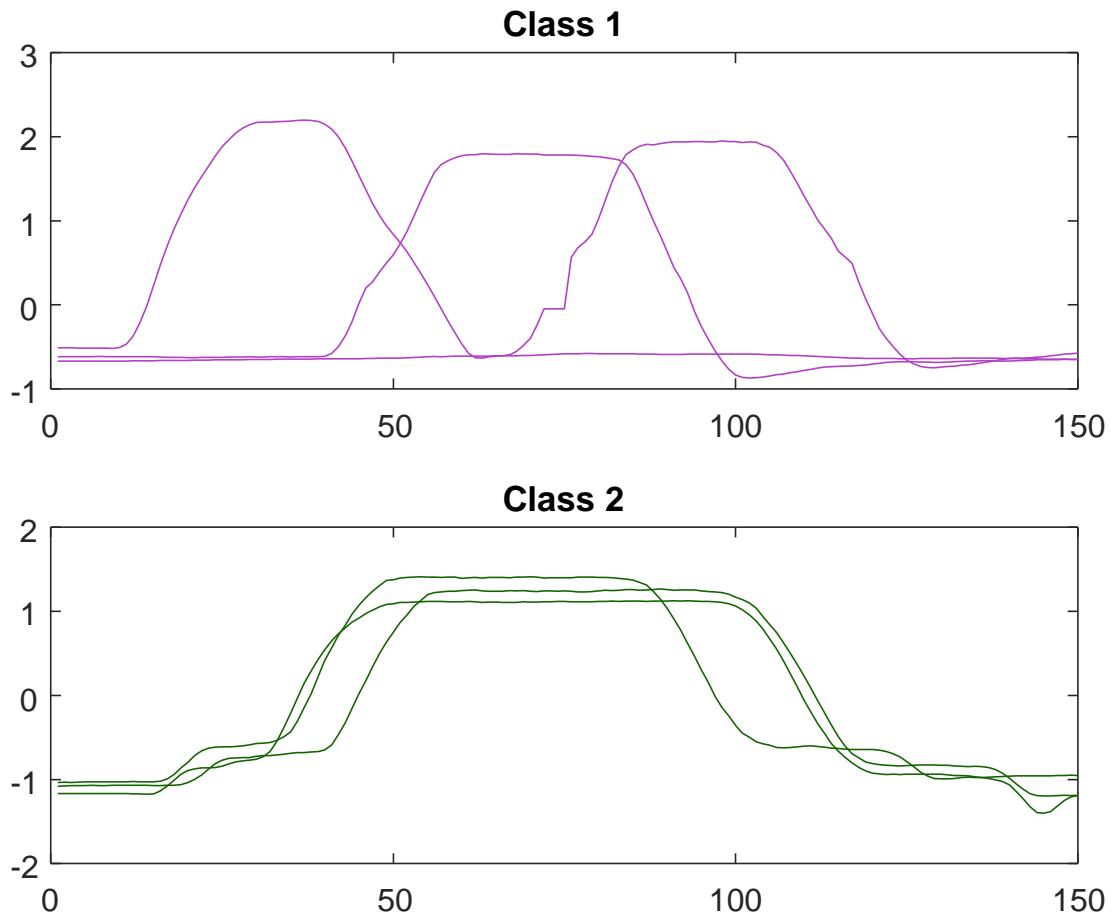
Three exemplars per class,
with z-normalization



Left) GunPoint recording of 2003, *right)* GunPoint recording of 2018.
Top) Ann Ratanamahatana, *bottom)* Eamonn Keogh.
The female and male actors are the same individuals recorded fifteen years apart.

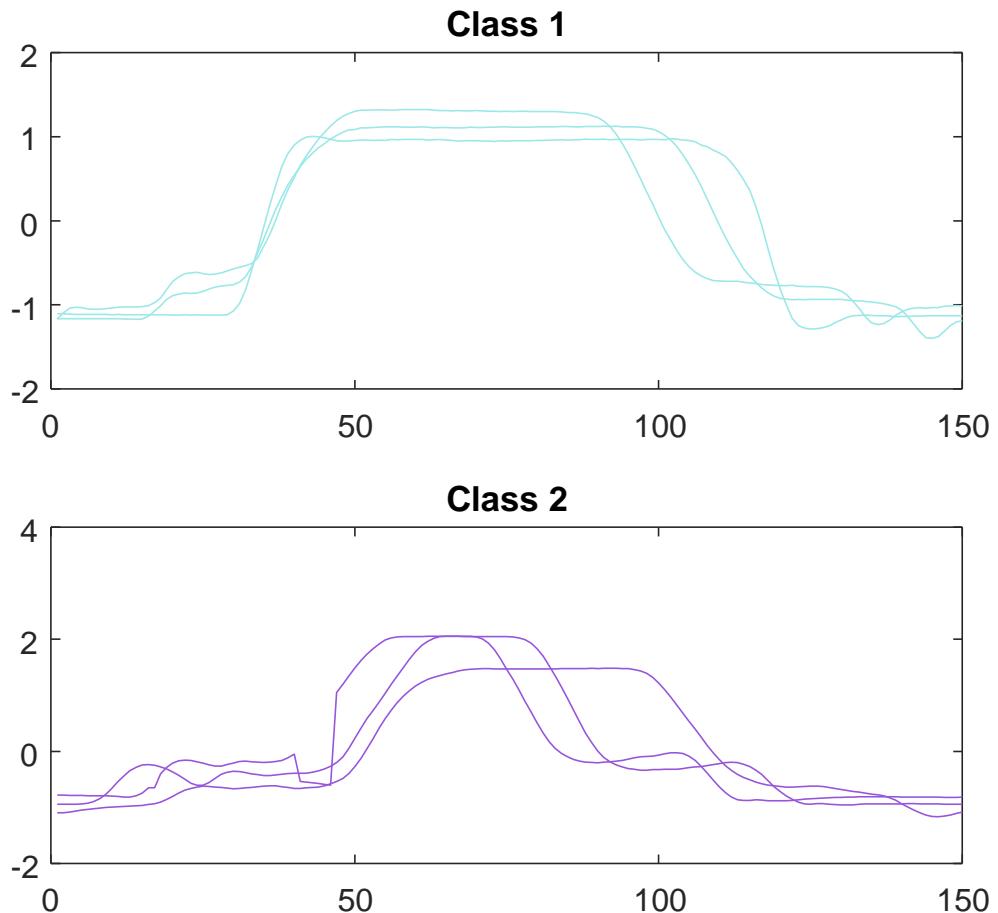
GunPointMaleVersusFemale

Three exemplars per class,
with z-normalization



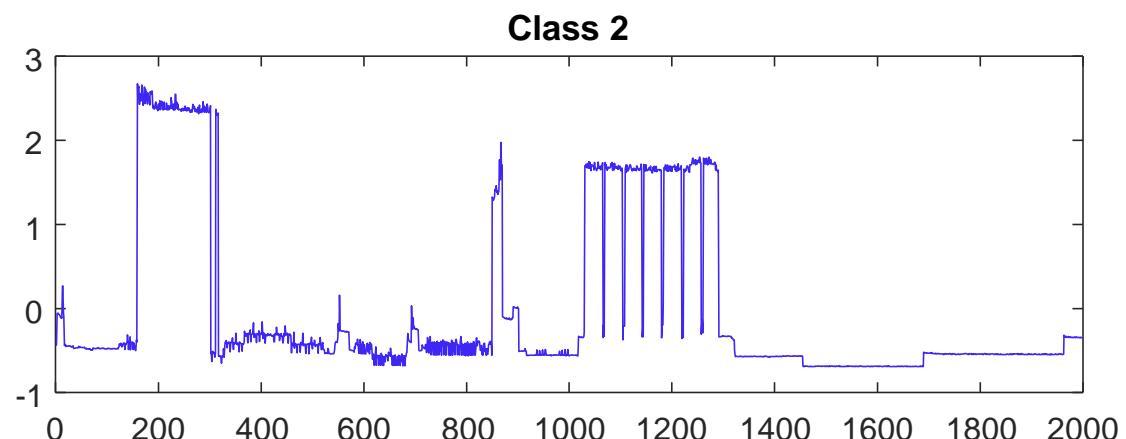
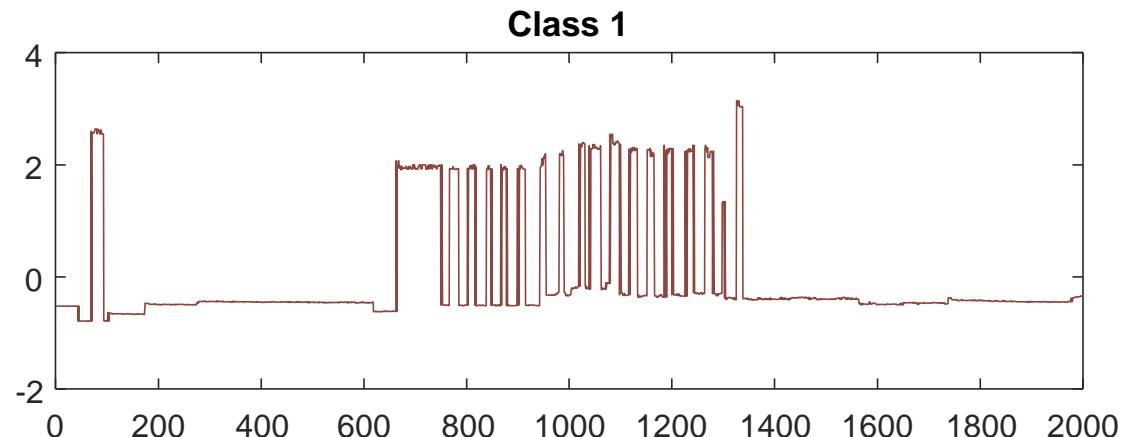
GunPointOldVersusYoung

Three exemplars per class,
with z-normalization



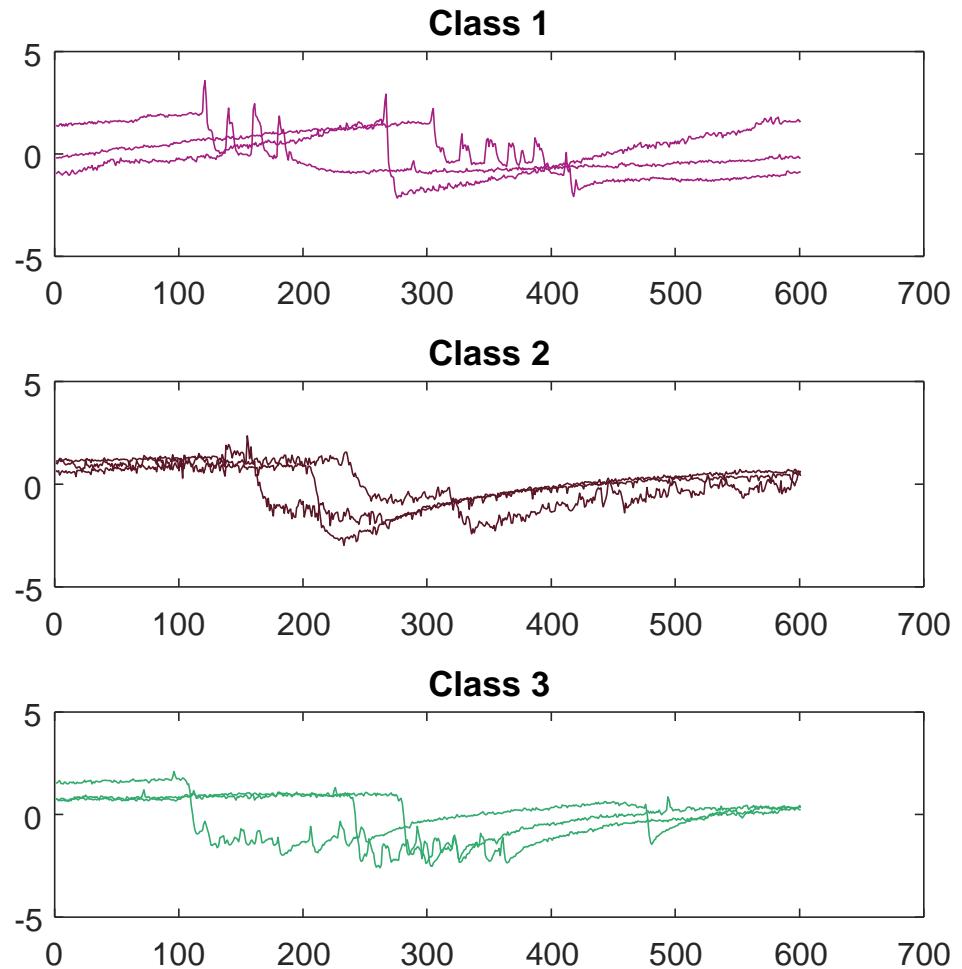
HouseTwenty

One exemplars per class,
with z-normalization



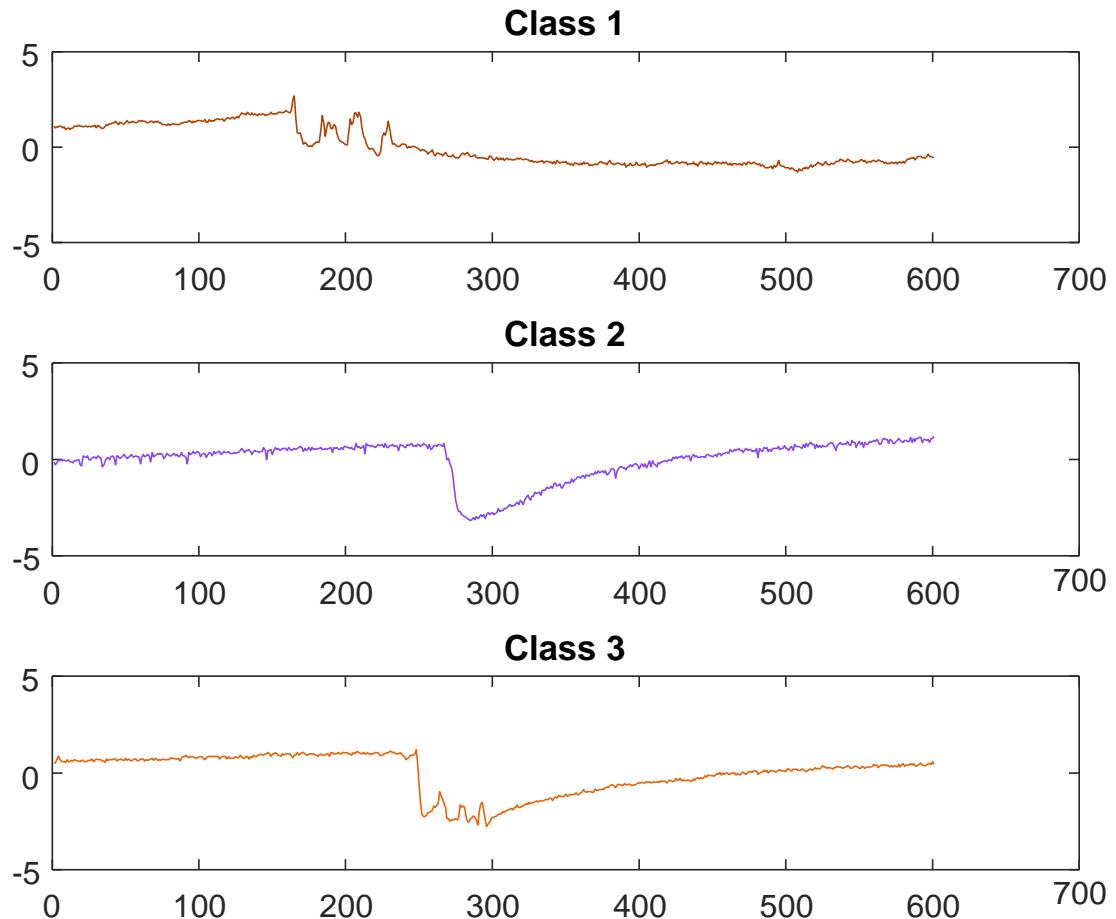
InsectEPGRegularTrain

Three exemplars per class,
with z-normalization



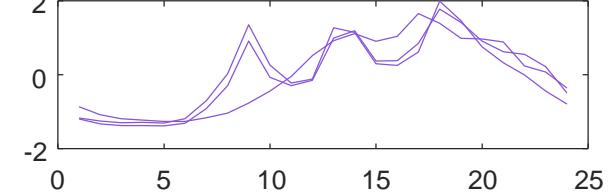
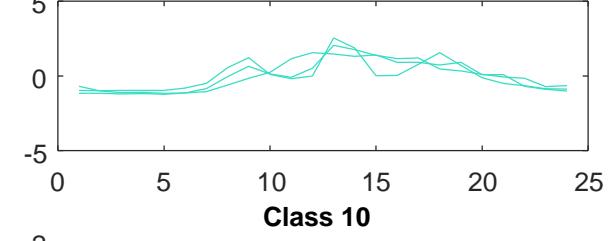
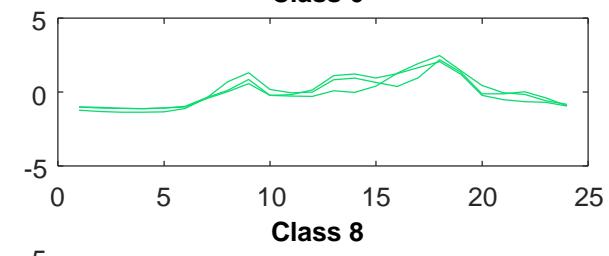
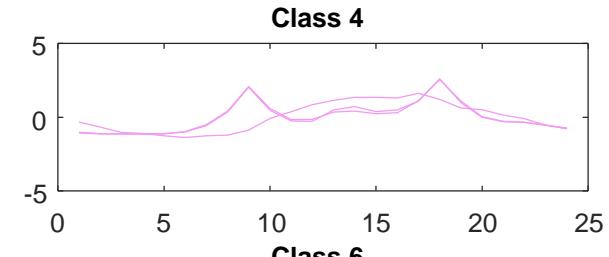
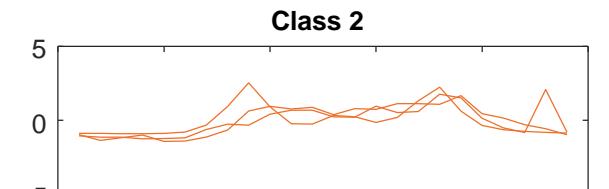
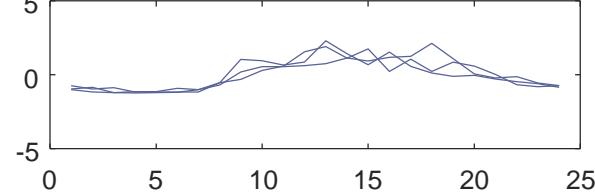
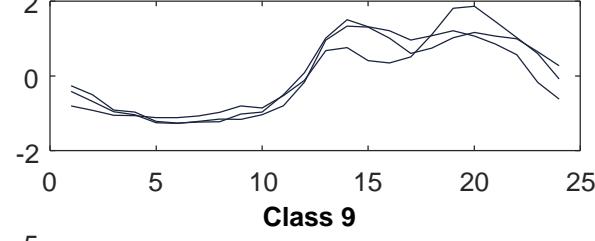
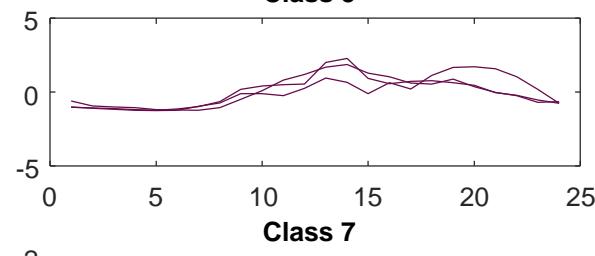
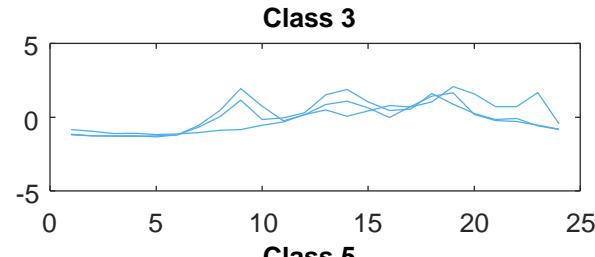
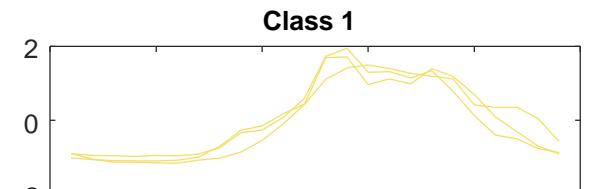
InsectEPGSmallTrain

One exemplars per class,
with z-normalization



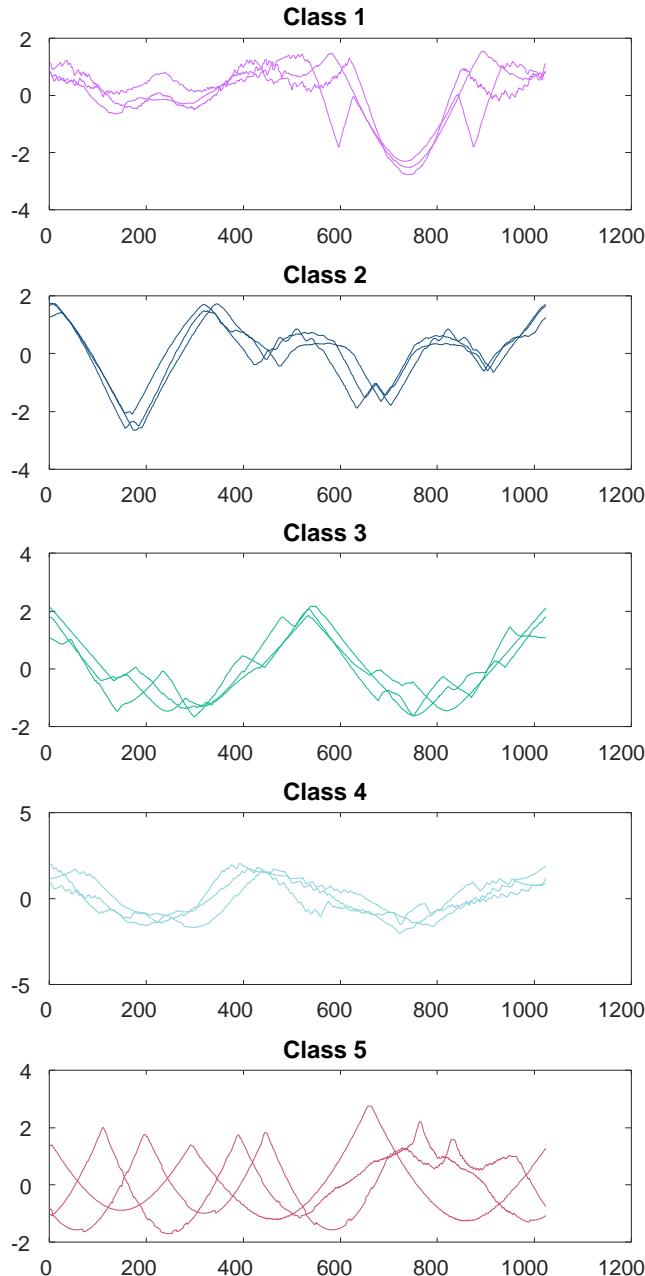
MelbournePedestrian

Three exemplars per class,
with z-normalization



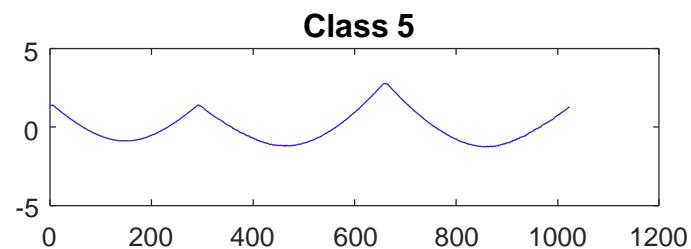
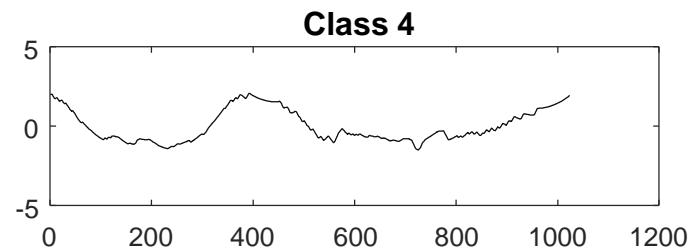
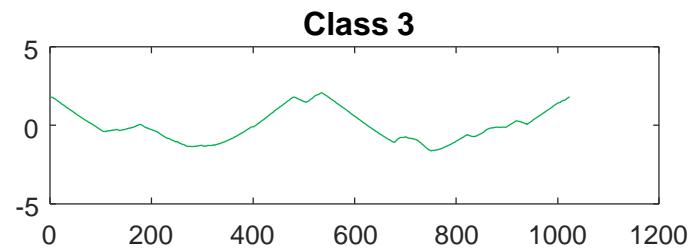
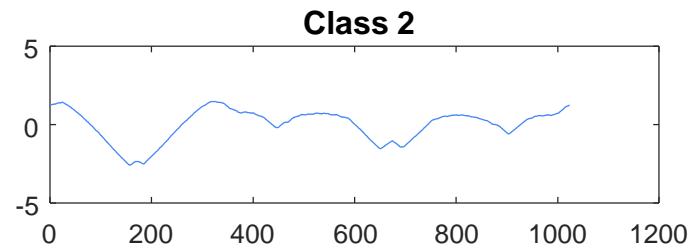
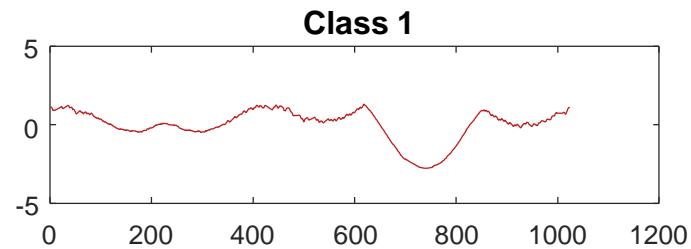
MixedShapesRegularTrain

Three exemplars per class,
with z-normalization



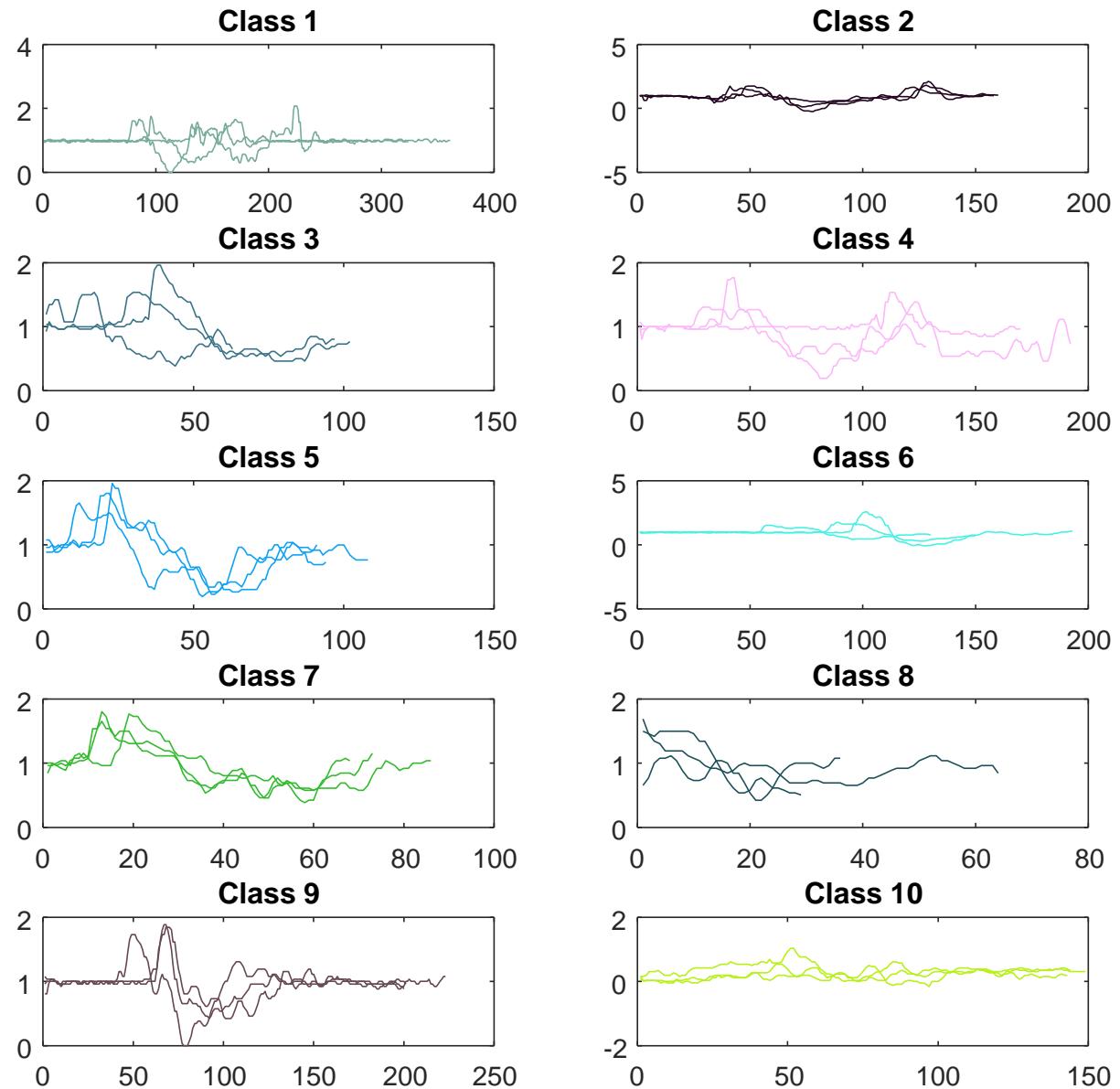
MixedShapesSmallTrain

One exemplar per class,
with z-normalization



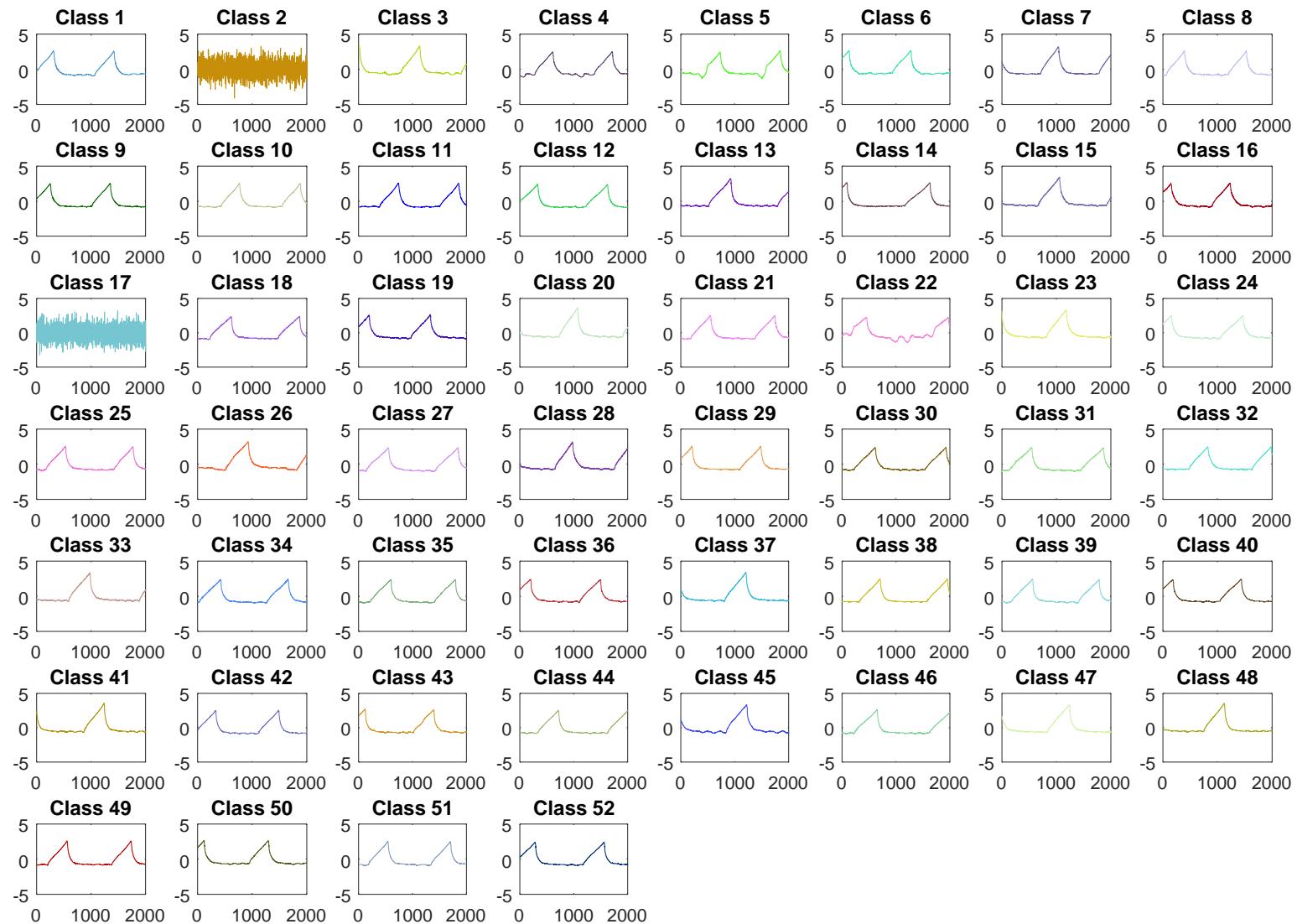
PickupGestureWiimoteZ

Three exemplars per class,
without z-normalization



PigAirwayPressure

One exemplar per class,
with z-normalization



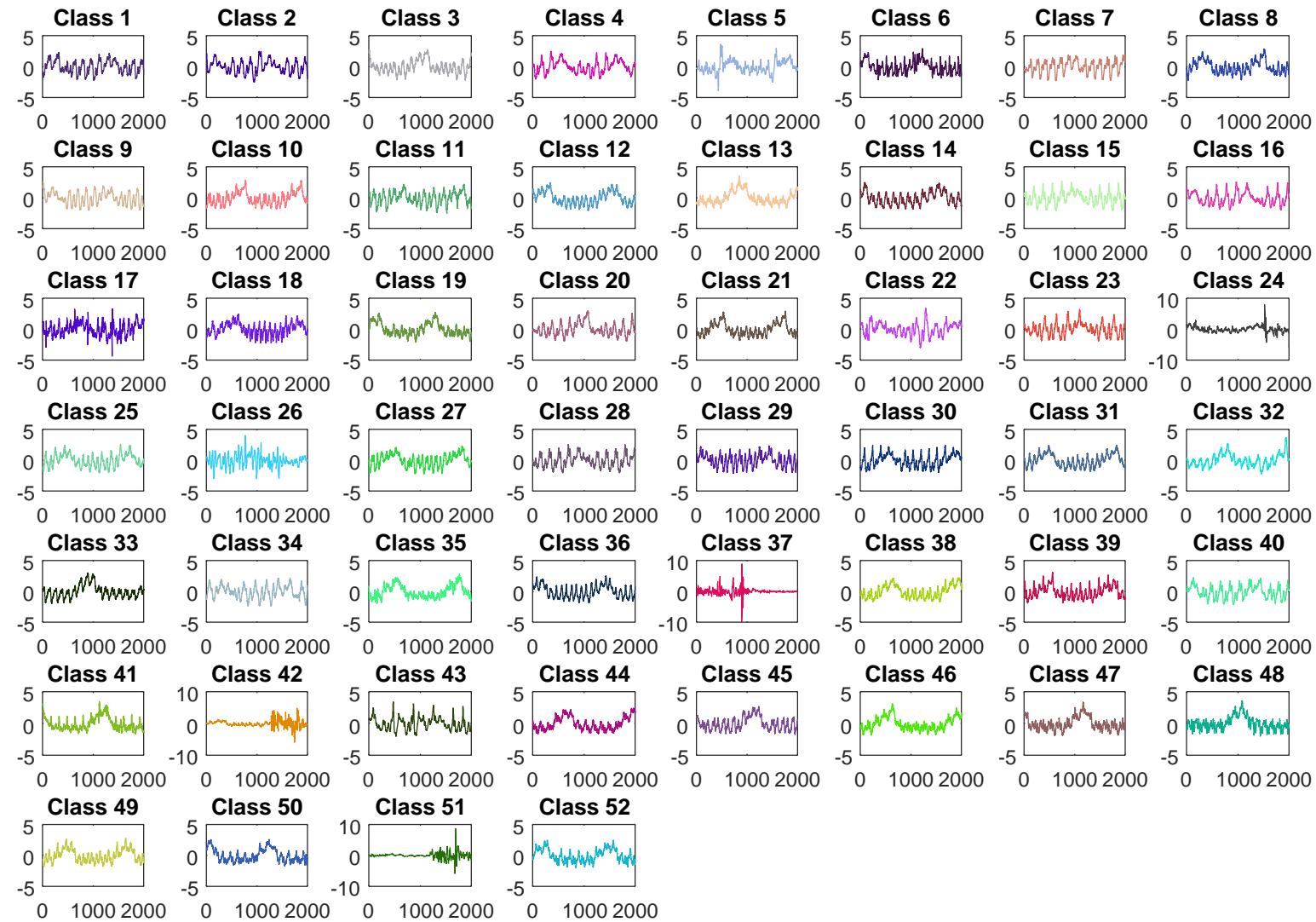
PigArtPressure

One exemplar per class,
with z-normalization



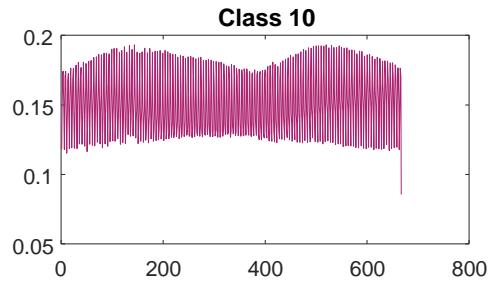
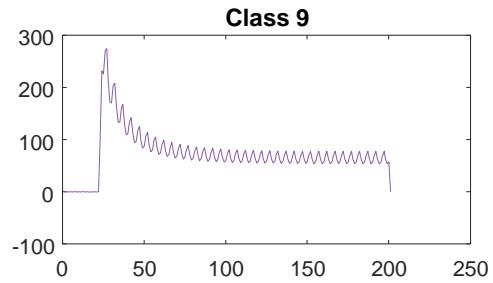
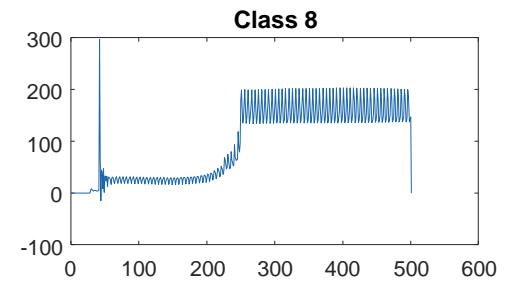
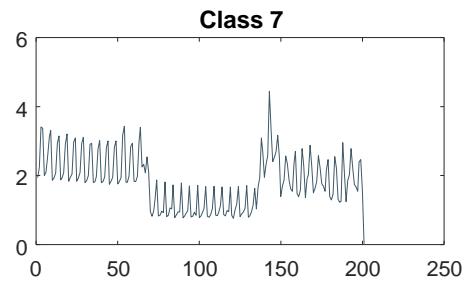
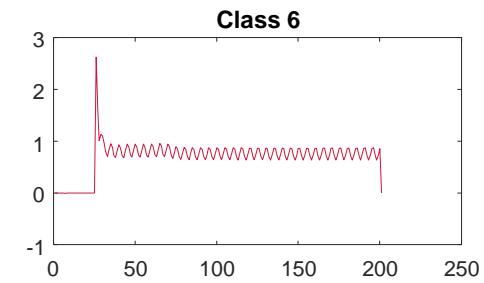
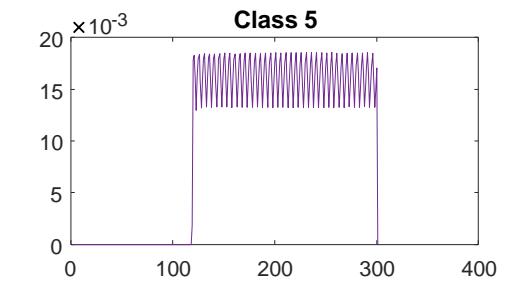
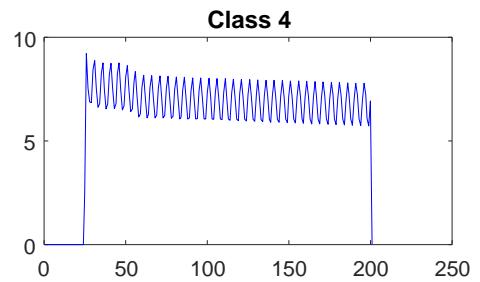
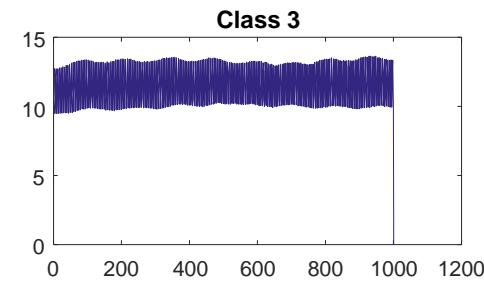
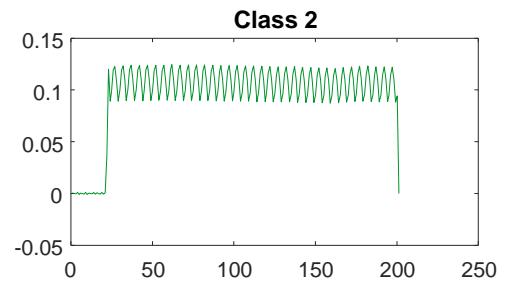
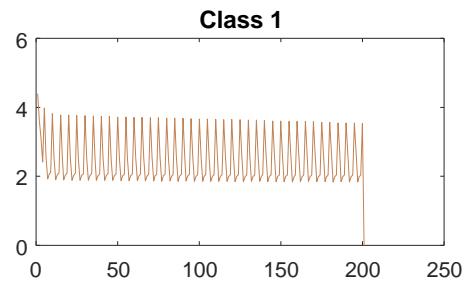
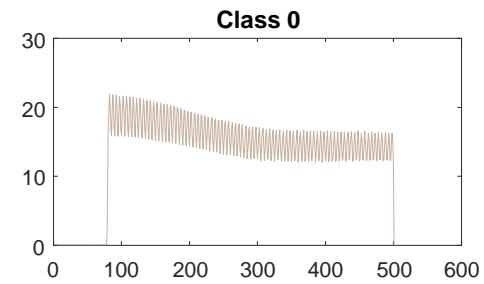
PigCVP

One exemplar per class,
with z-normalization



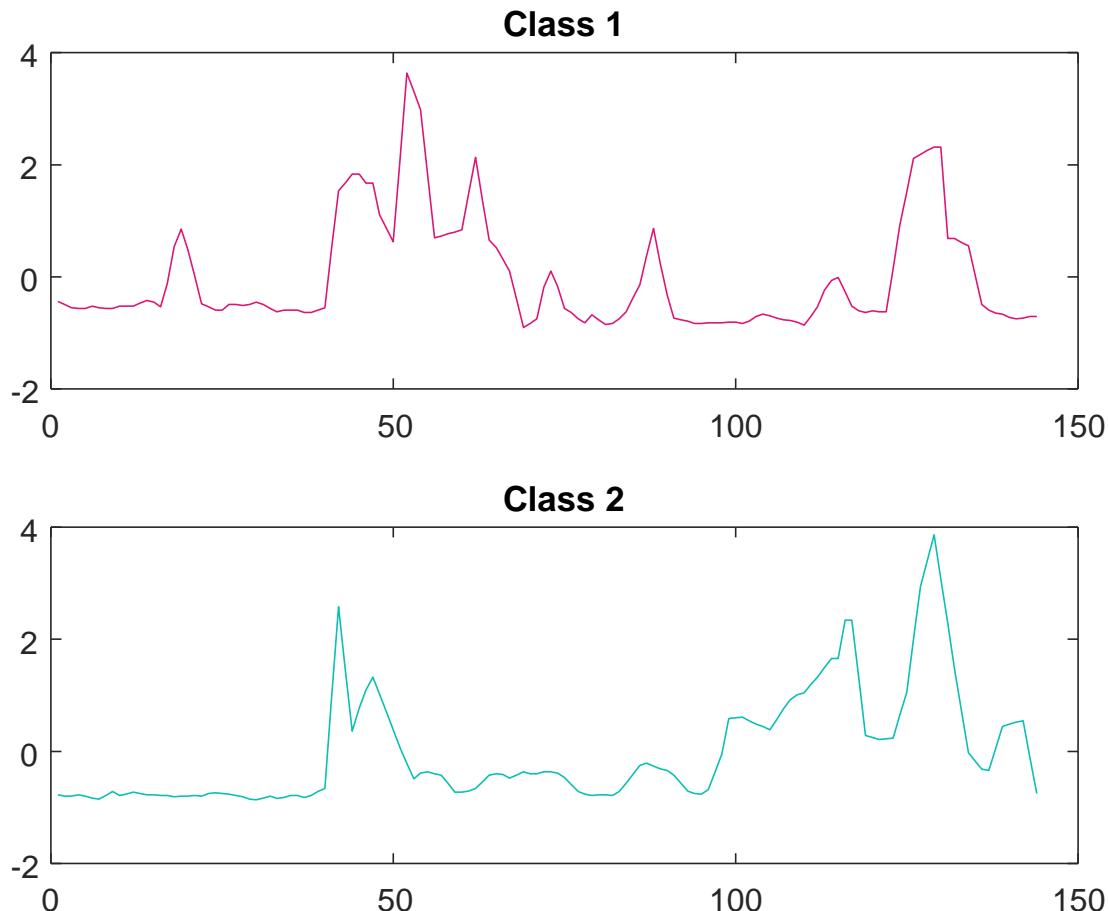
PLAID

One exemplar per class,
without z-normalization



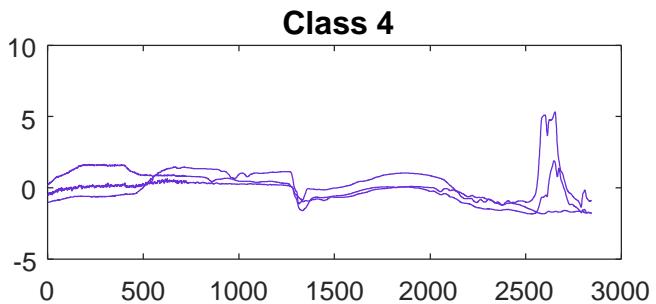
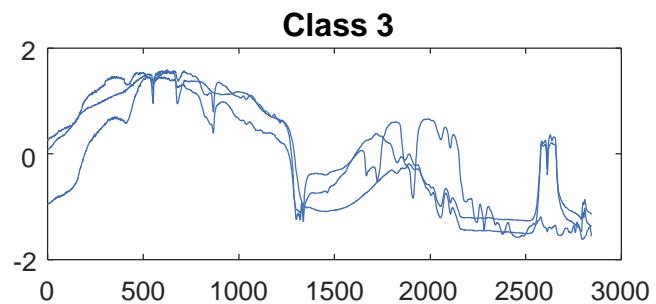
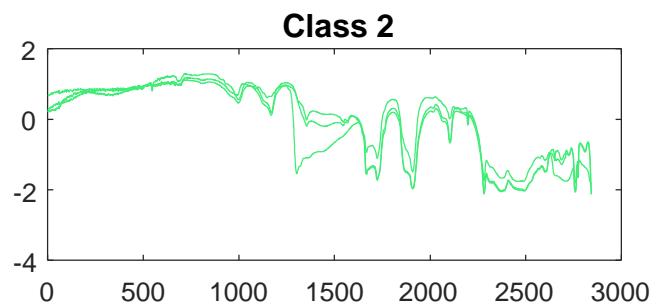
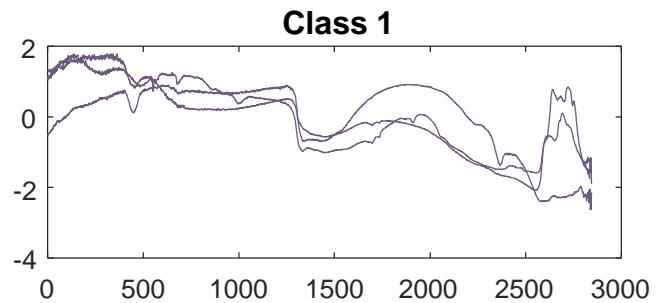
PowerCons

One exemplar per class,
with z-normalization



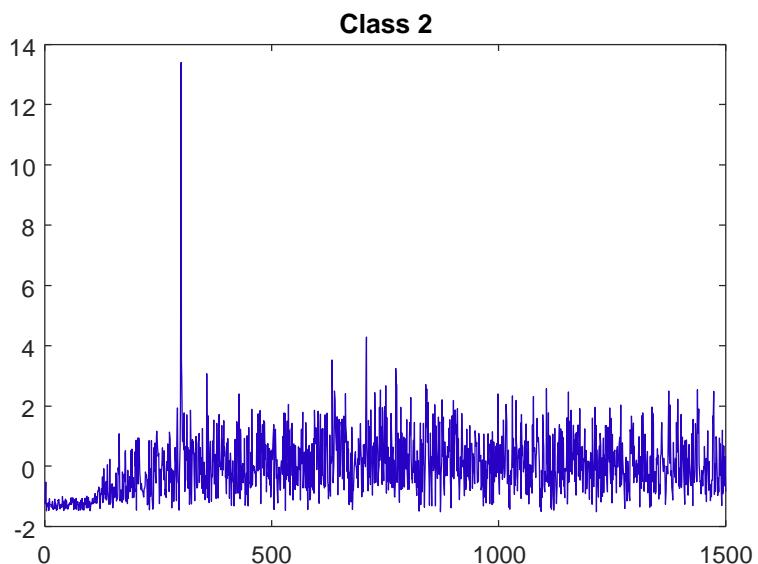
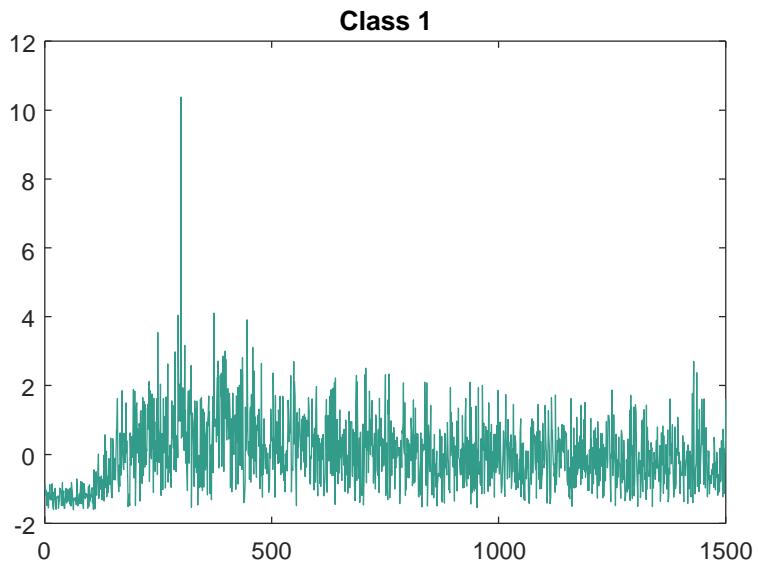
Rock

Three exemplars per class,
with z-normalization



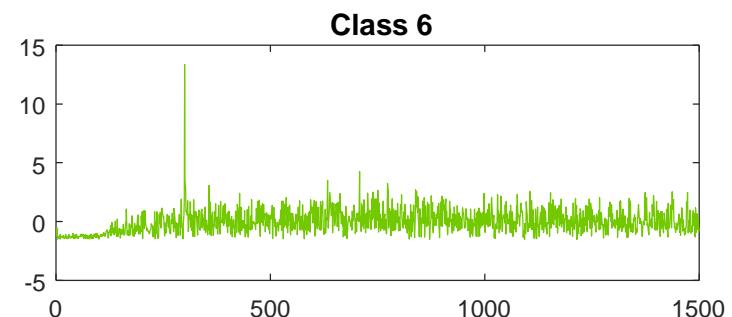
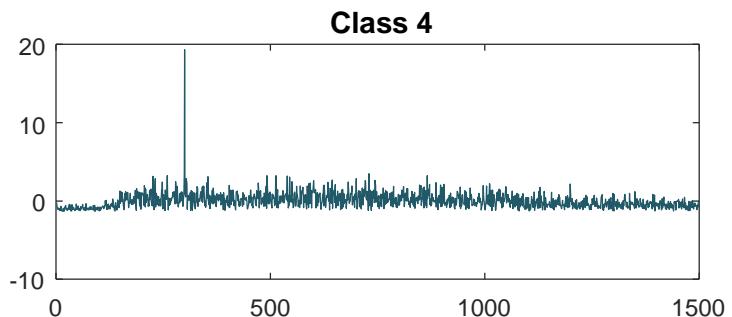
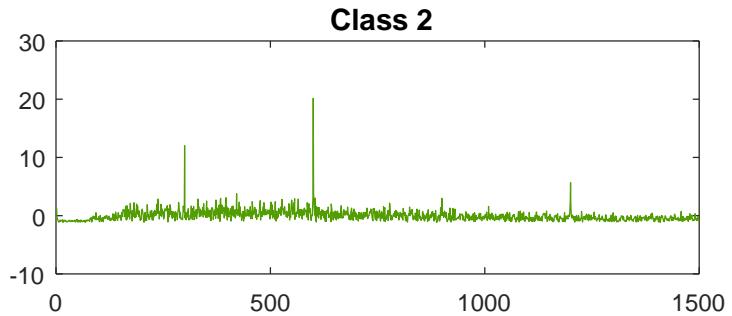
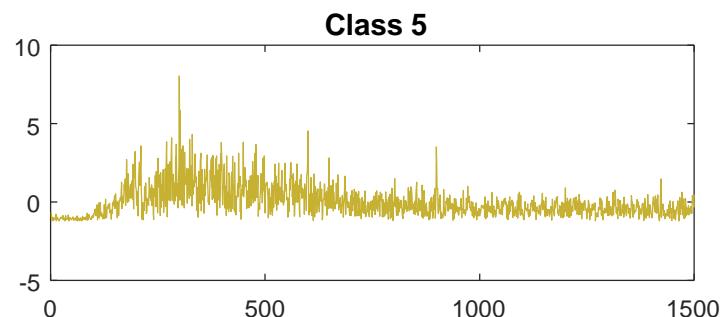
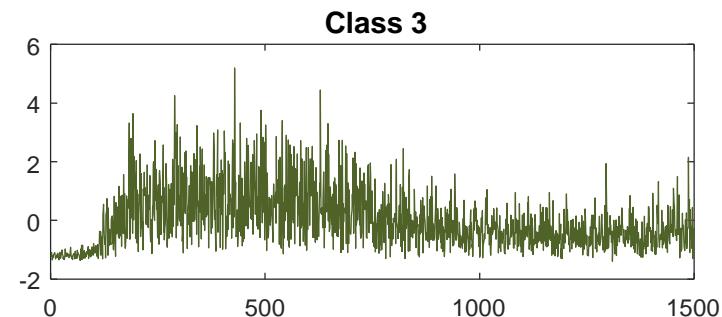
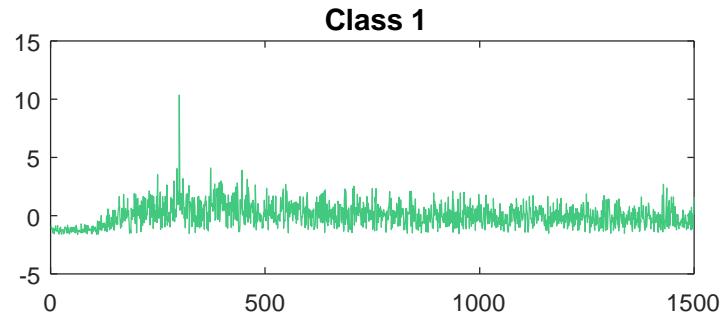
SemgHandGenderCh2

One exemplar per class,
with z-normalization



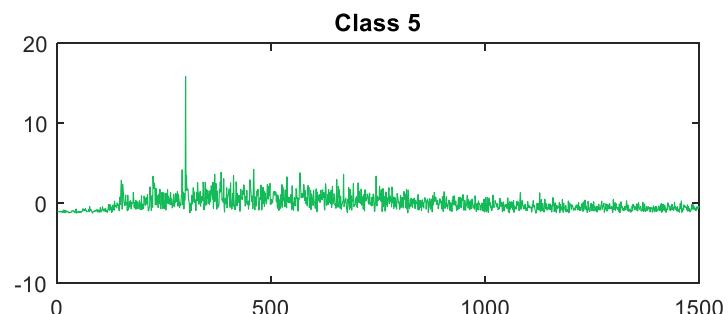
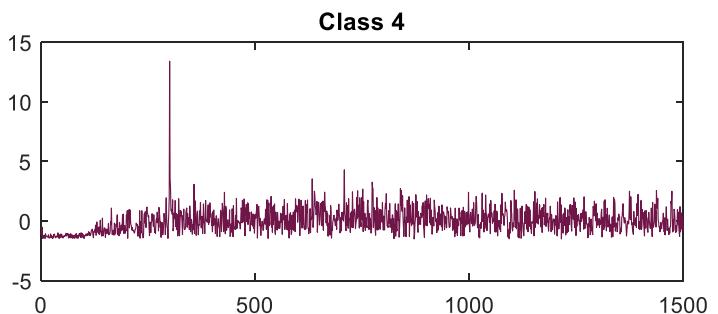
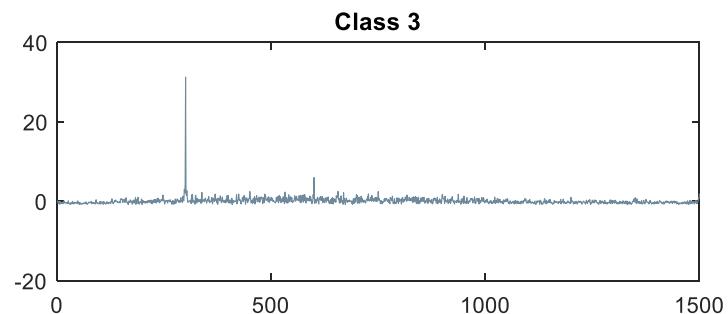
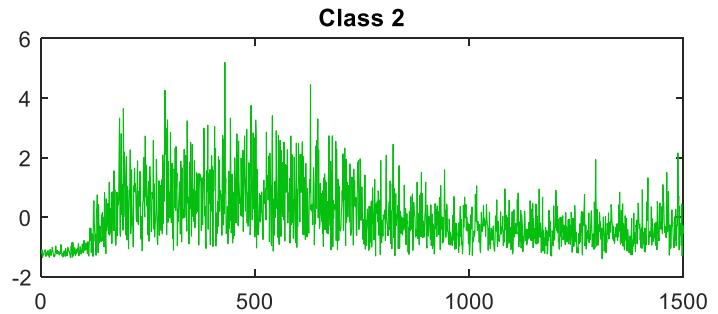
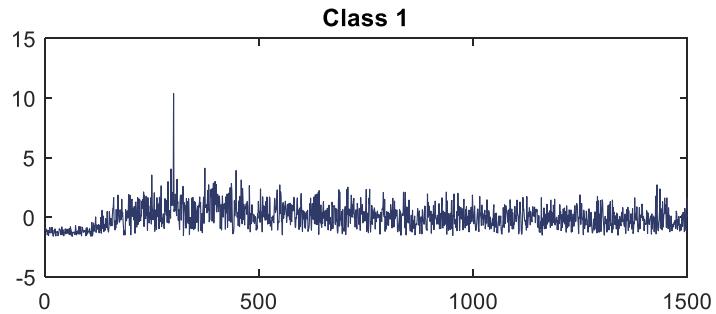
SemgHandMovementCh2

One exemplar per class,
with z-normalization



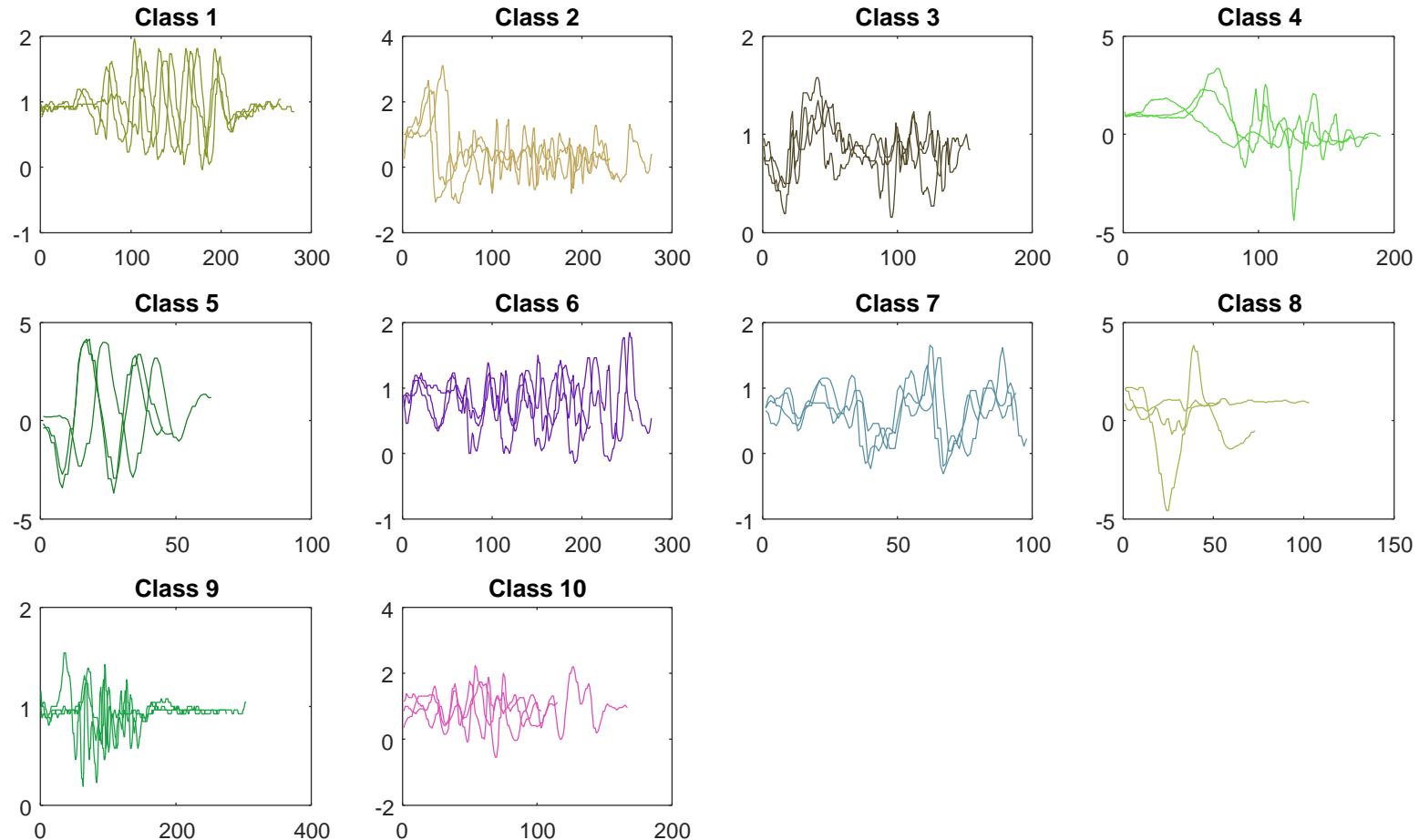
SemgHandSubjectCh2

One exemplar per class,
with z-normalization



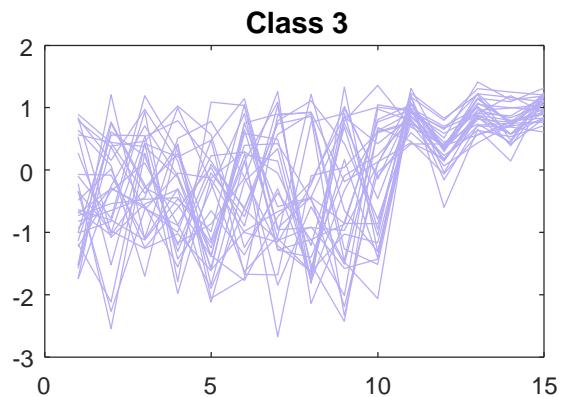
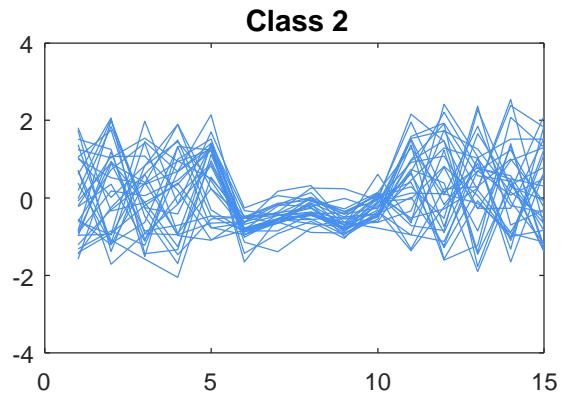
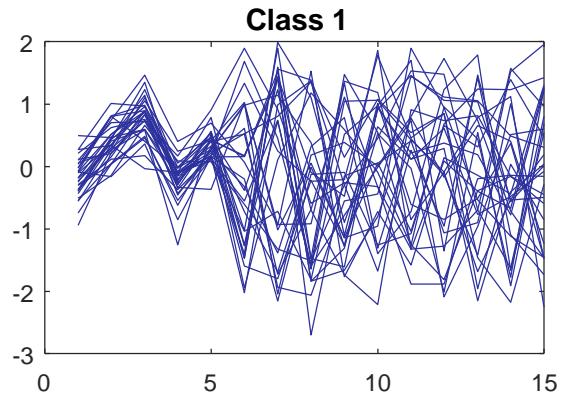
ShakeGestureWiimoteZ

Three exemplars per class,
without z-normalization



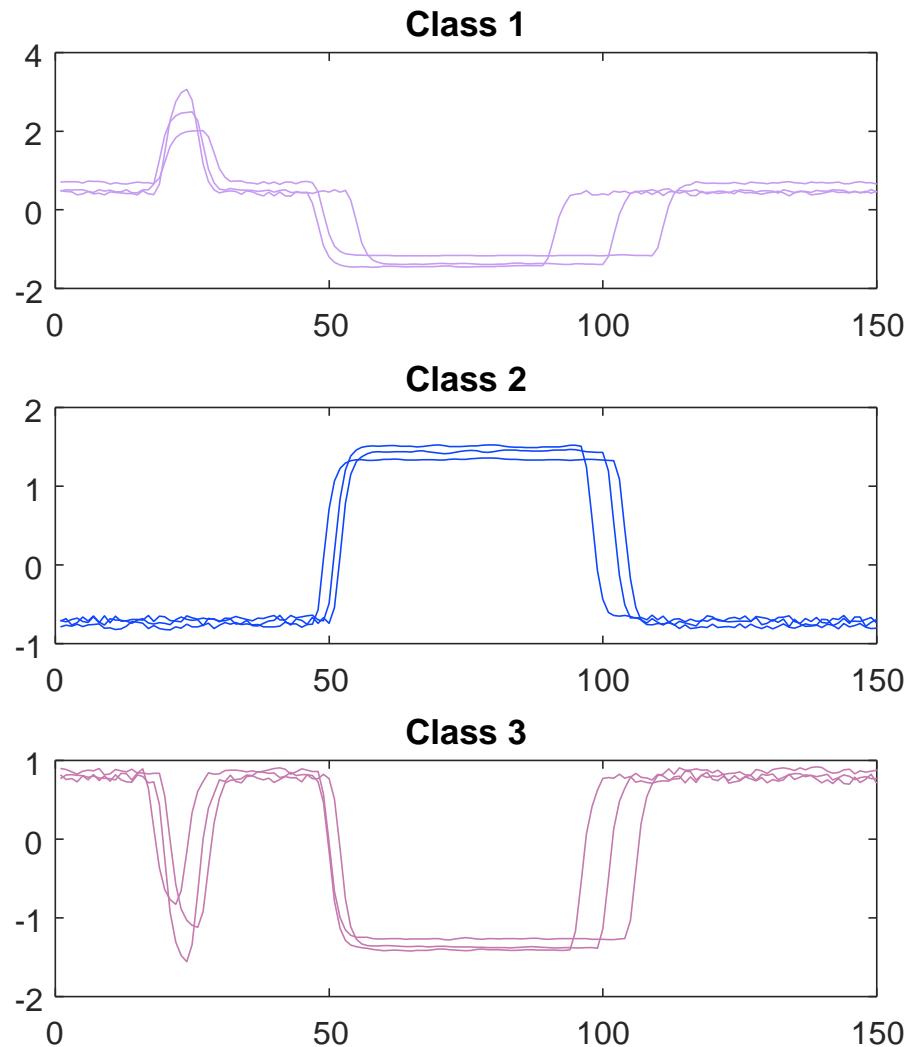
SmoothSubspace

Thirty exemplars per class,
with z-normalization



UMD

Three exemplars per class,
with z-normalization

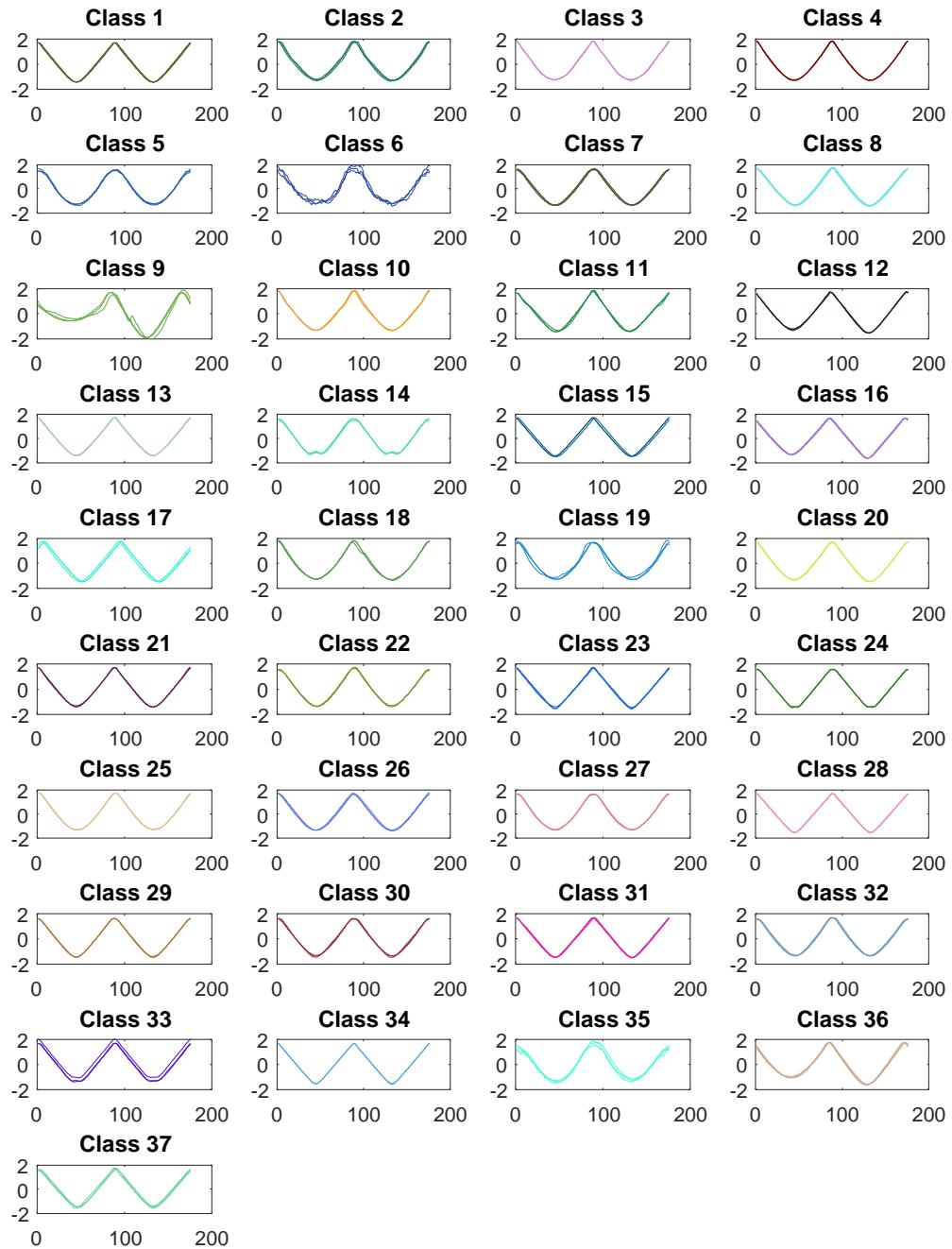


85 datasets from Fall 2015 release

The figures follow are intended to offer a quick inspection of the data. For readability, depending on the scenario, the data may be normalized or may be not, the number of exemplars per class may be one, three or many.

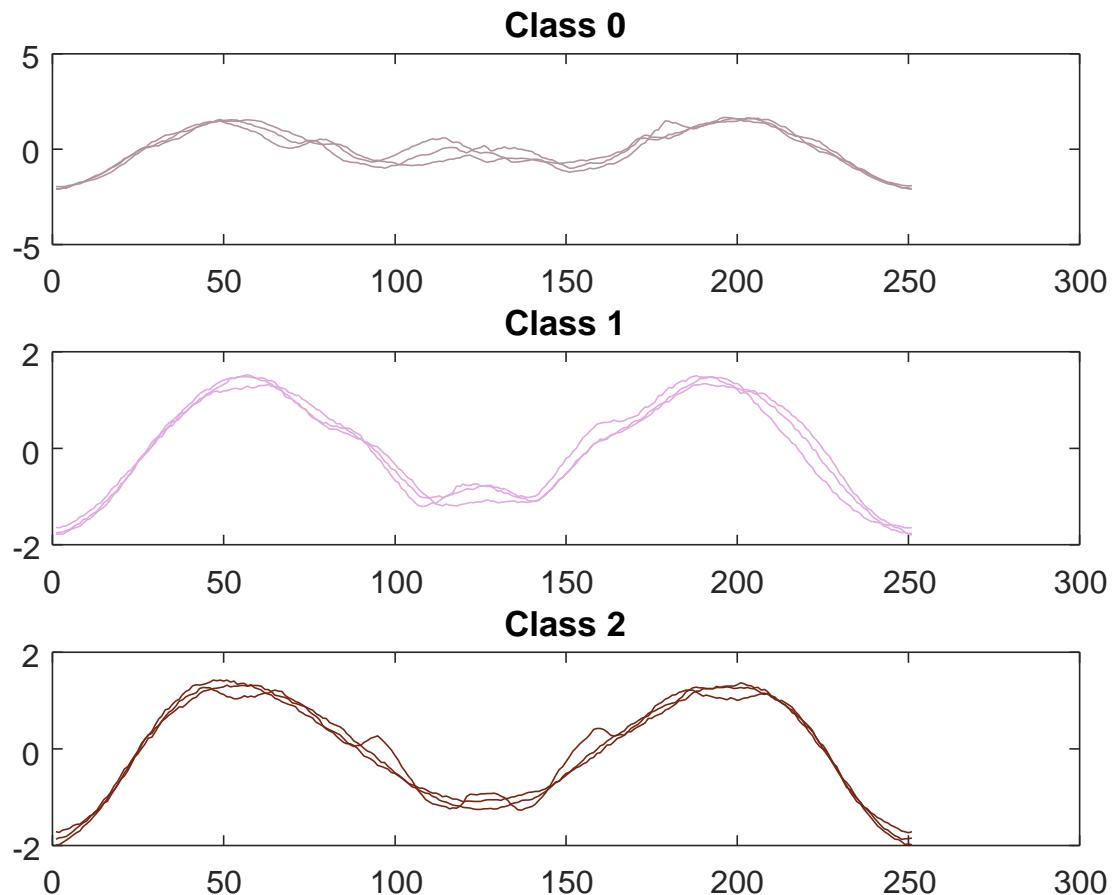
Adiac

Three exemplars per class,
with z-normalization



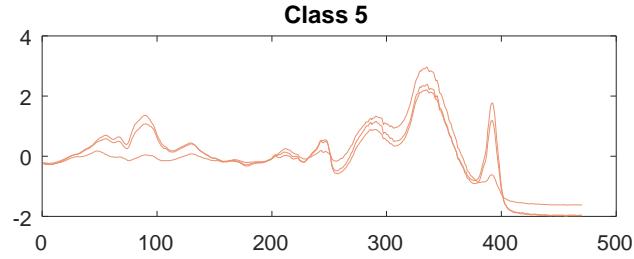
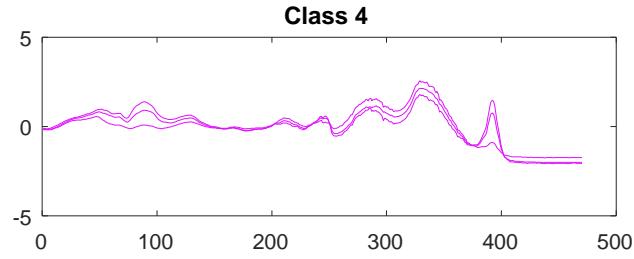
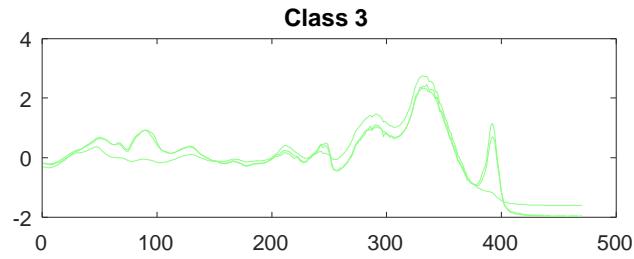
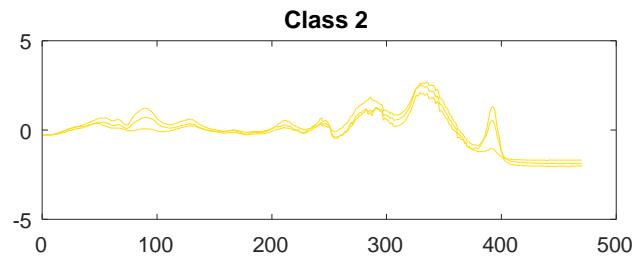
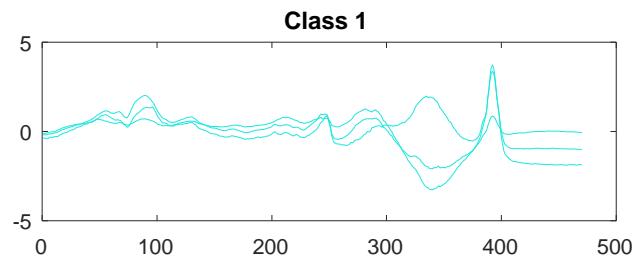
ArrowHead

Three exemplars per class,
with z-normalization



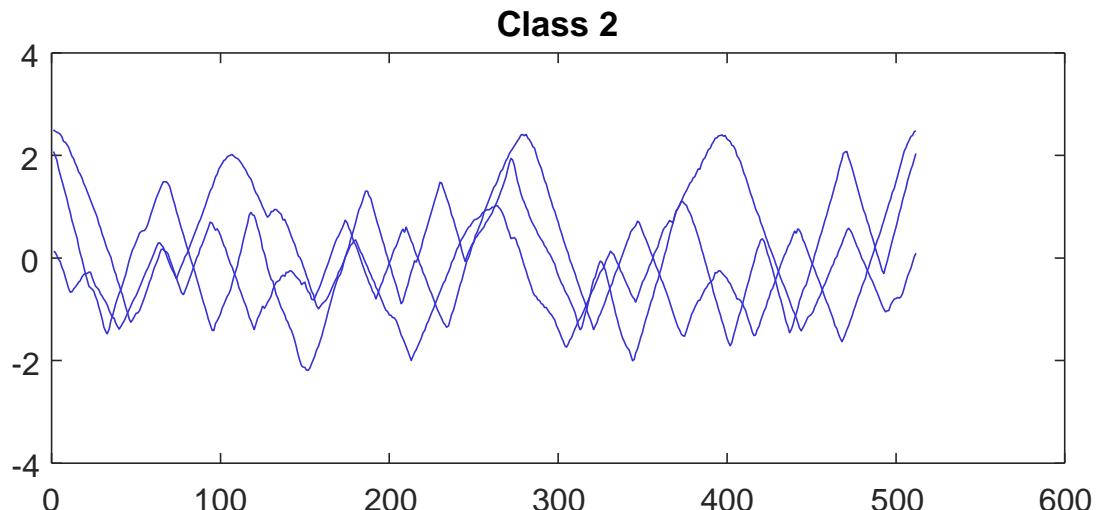
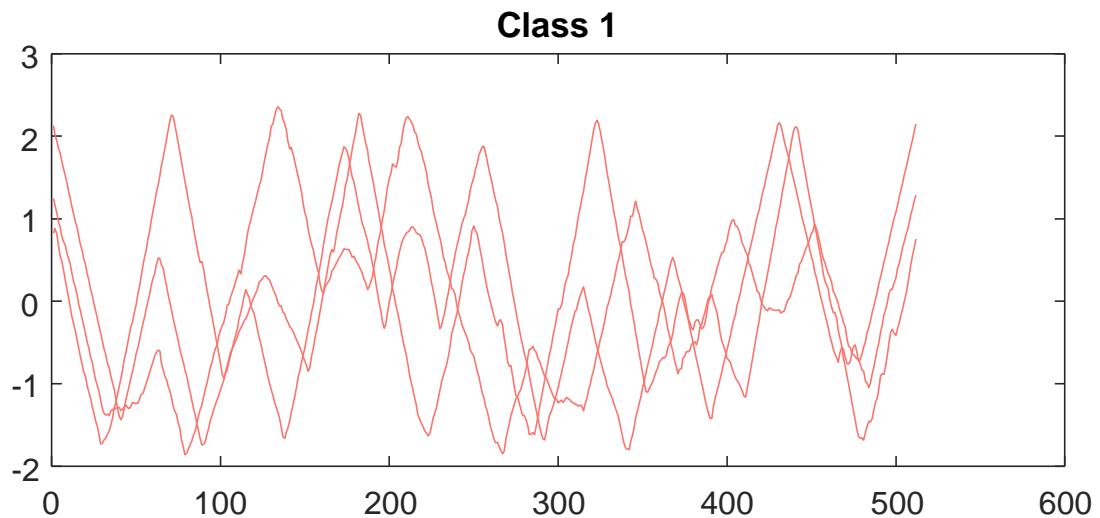
Beef

Three exemplars per class,
with z-normalization



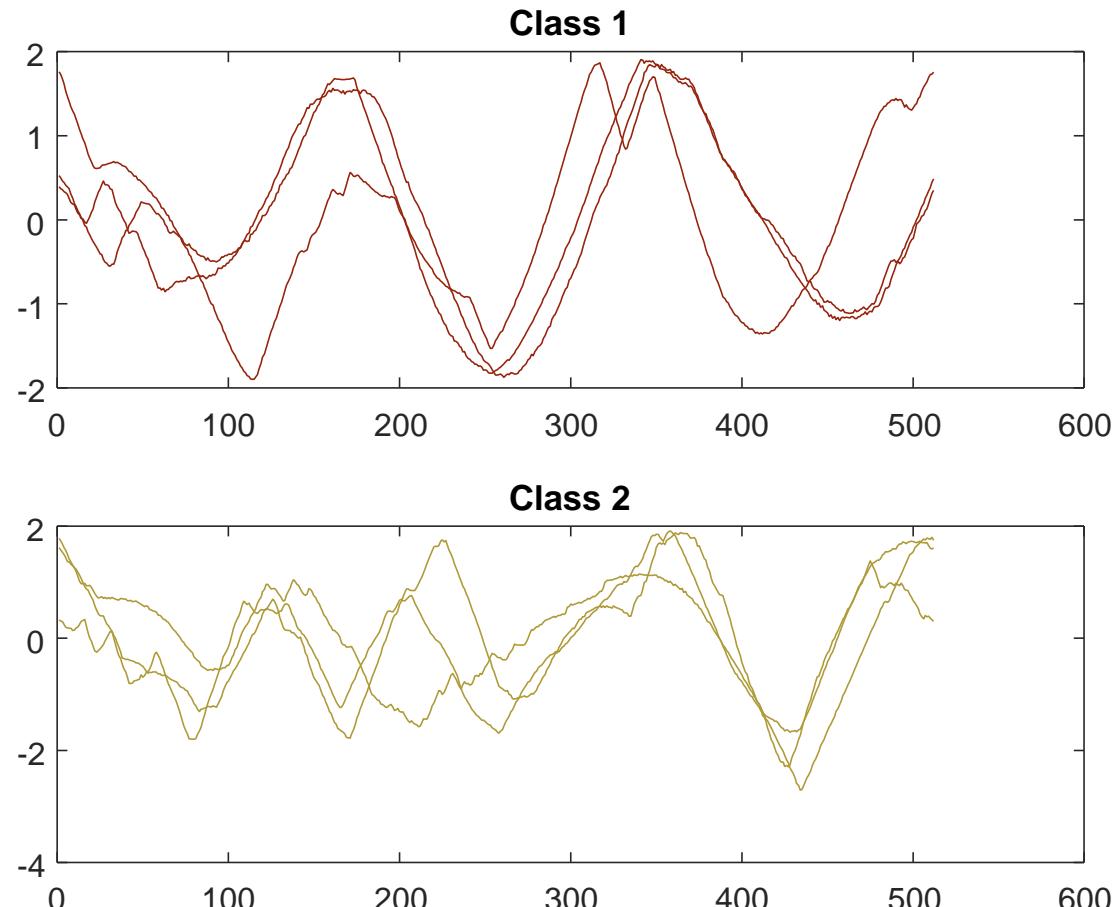
BeetleFly

Three exemplars per class,
with z-normalization



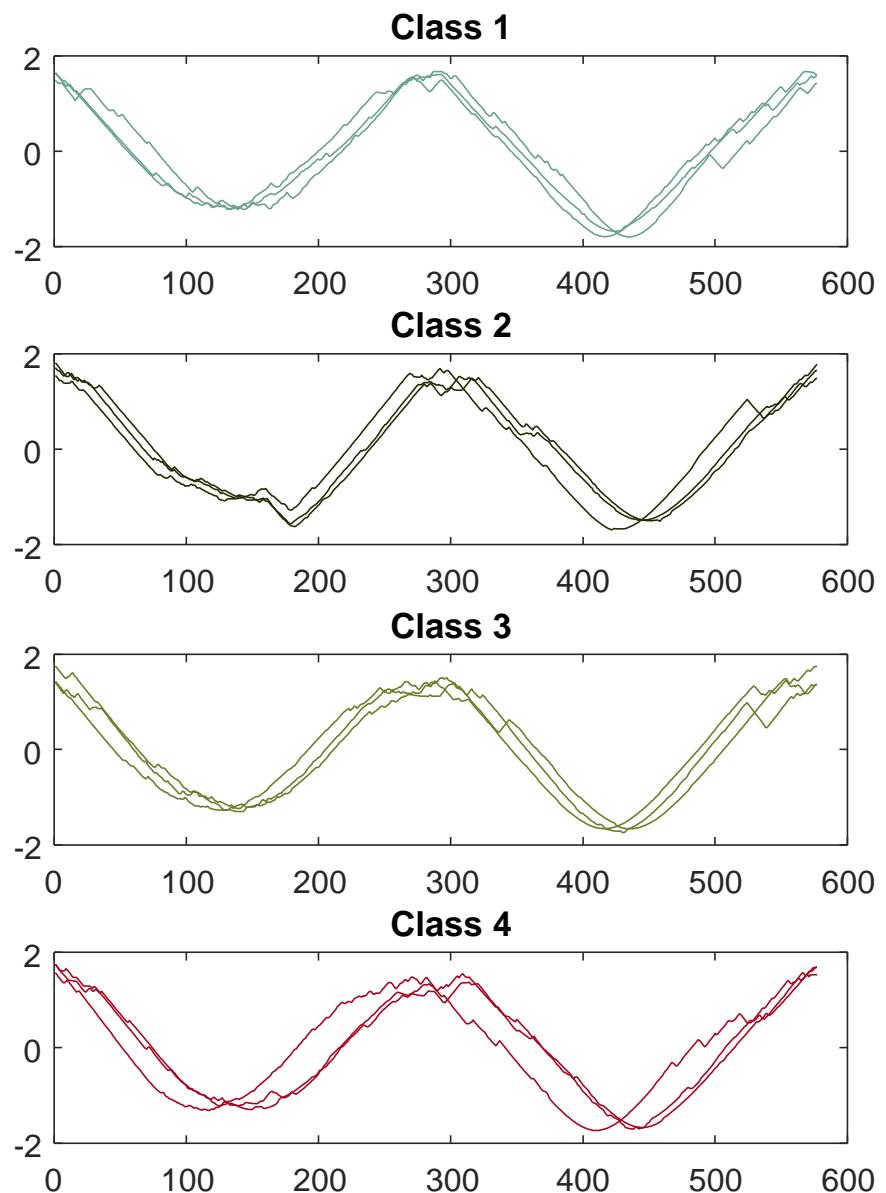
BirdChicken

Three exemplars per class,
with z-normalization



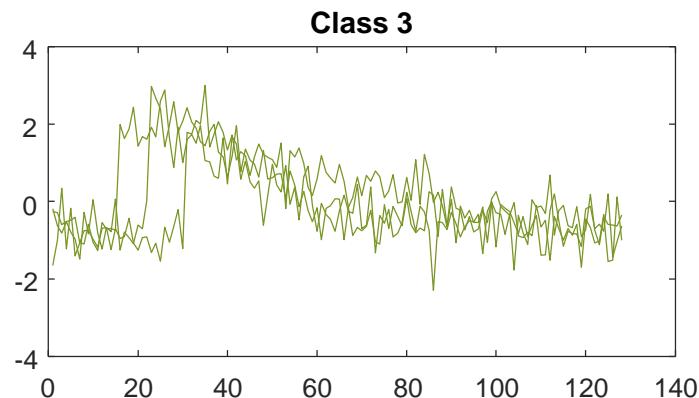
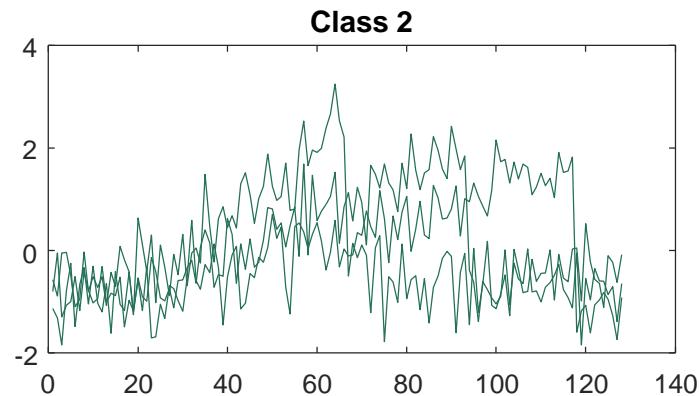
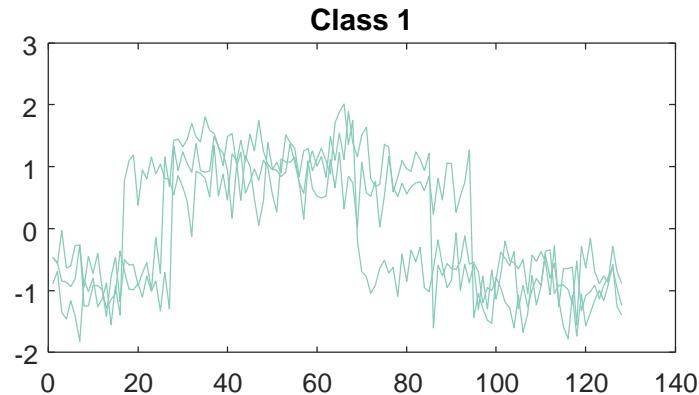
Car

Three exemplars per class,
with z-normalization



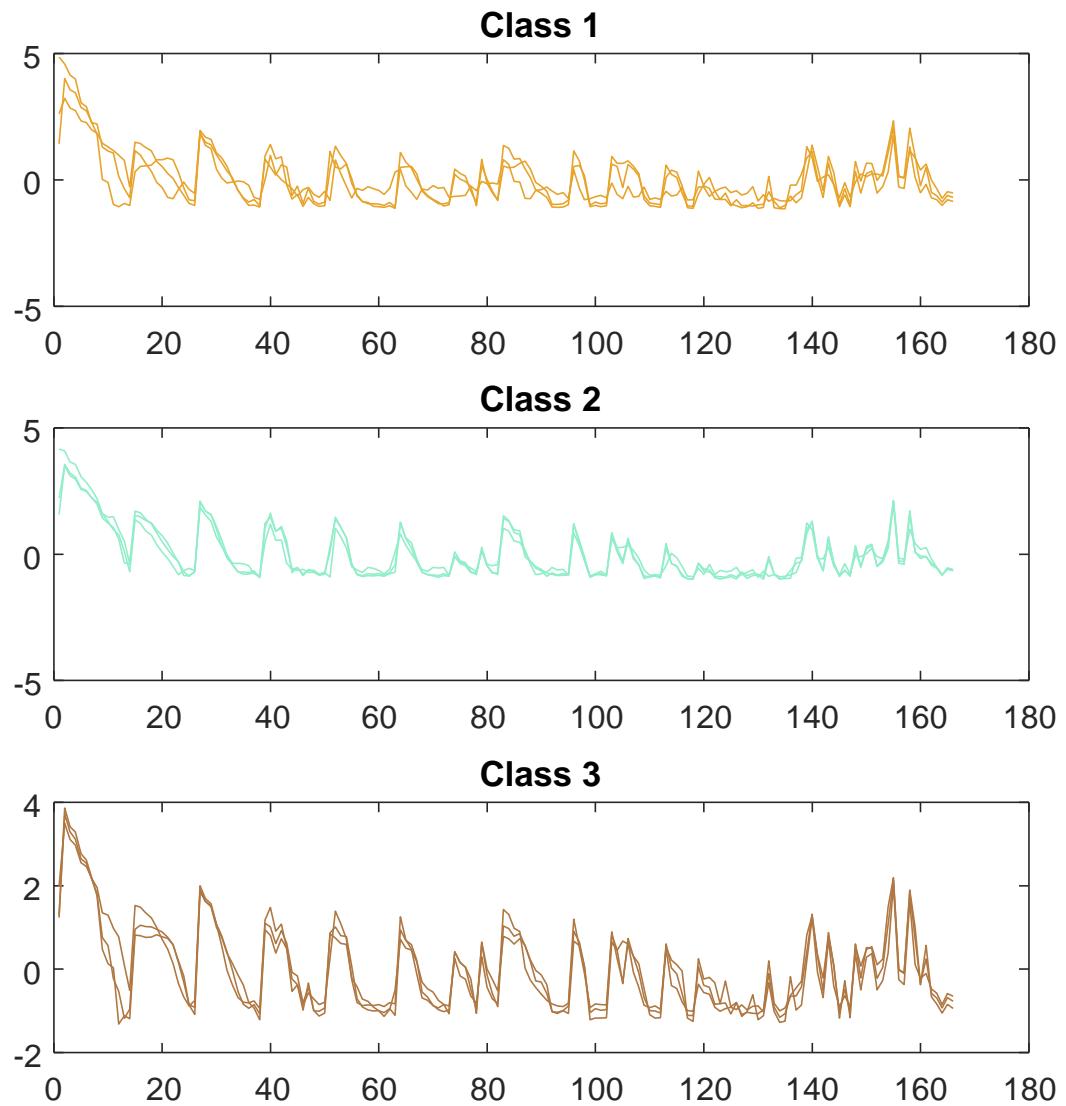
CBF

Three exemplars per class,
with z-normalization



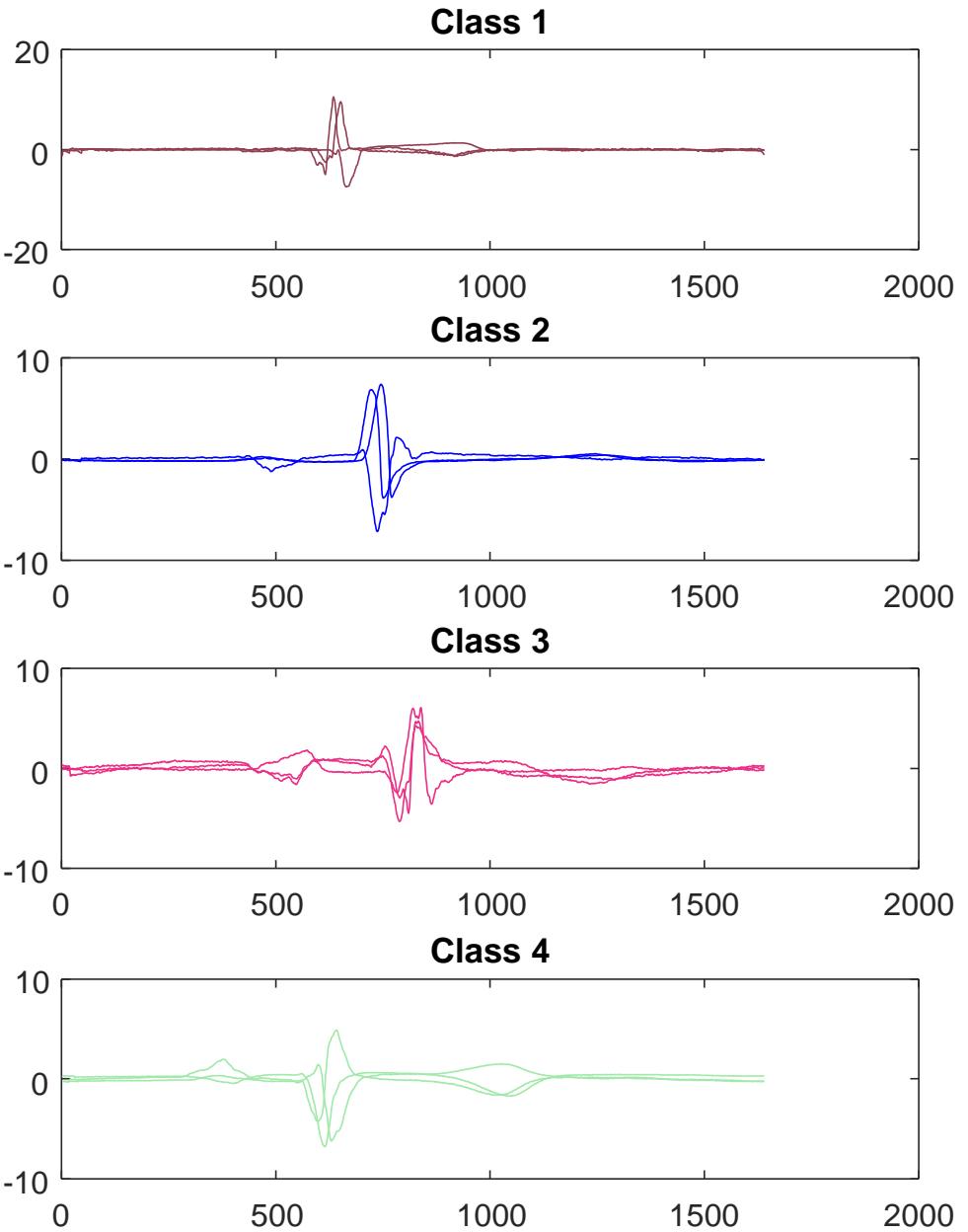
ChlorineConcentration

Three exemplars per class,
with z-normalization



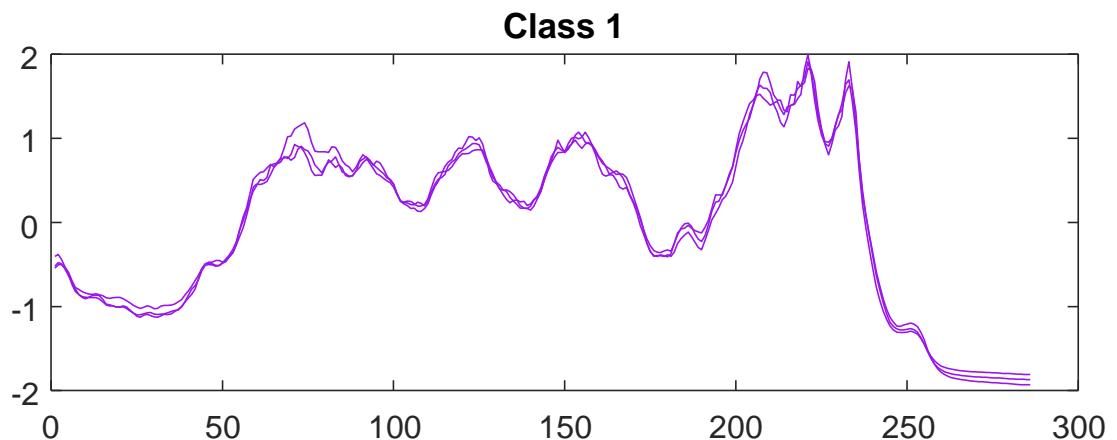
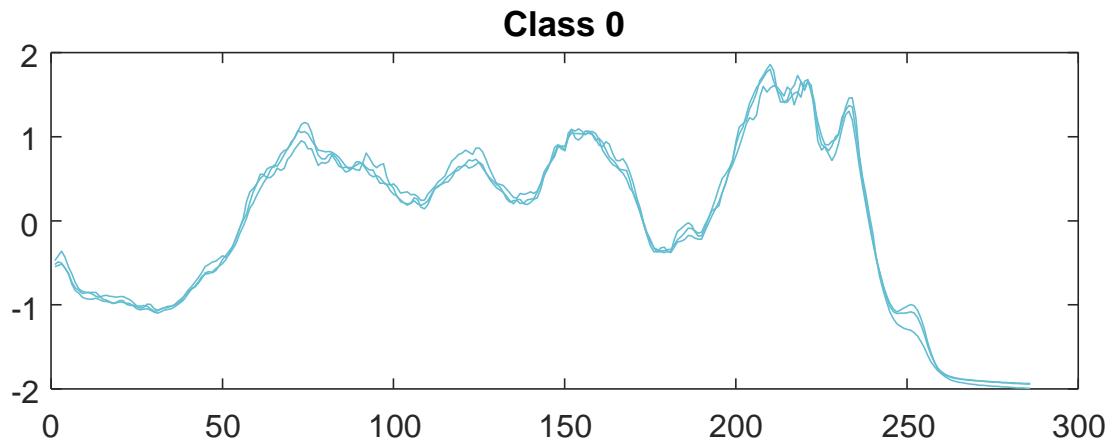
CinCECGTorso

Three exemplars per class,
with z-normalization



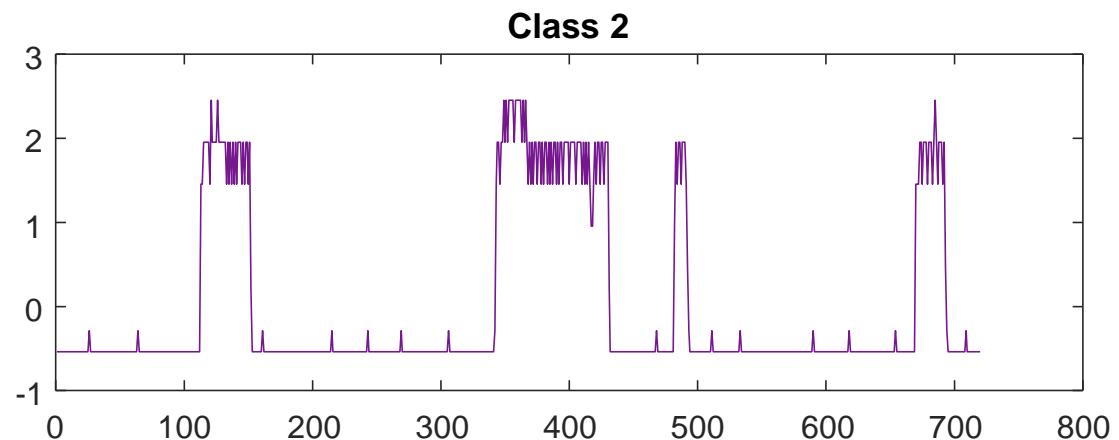
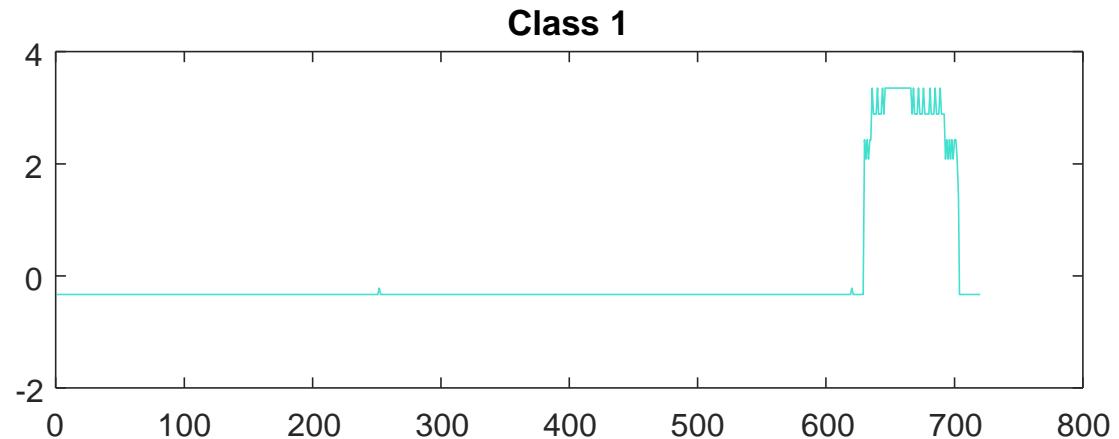
Coffee

Three exemplars per class,
with z-normalization



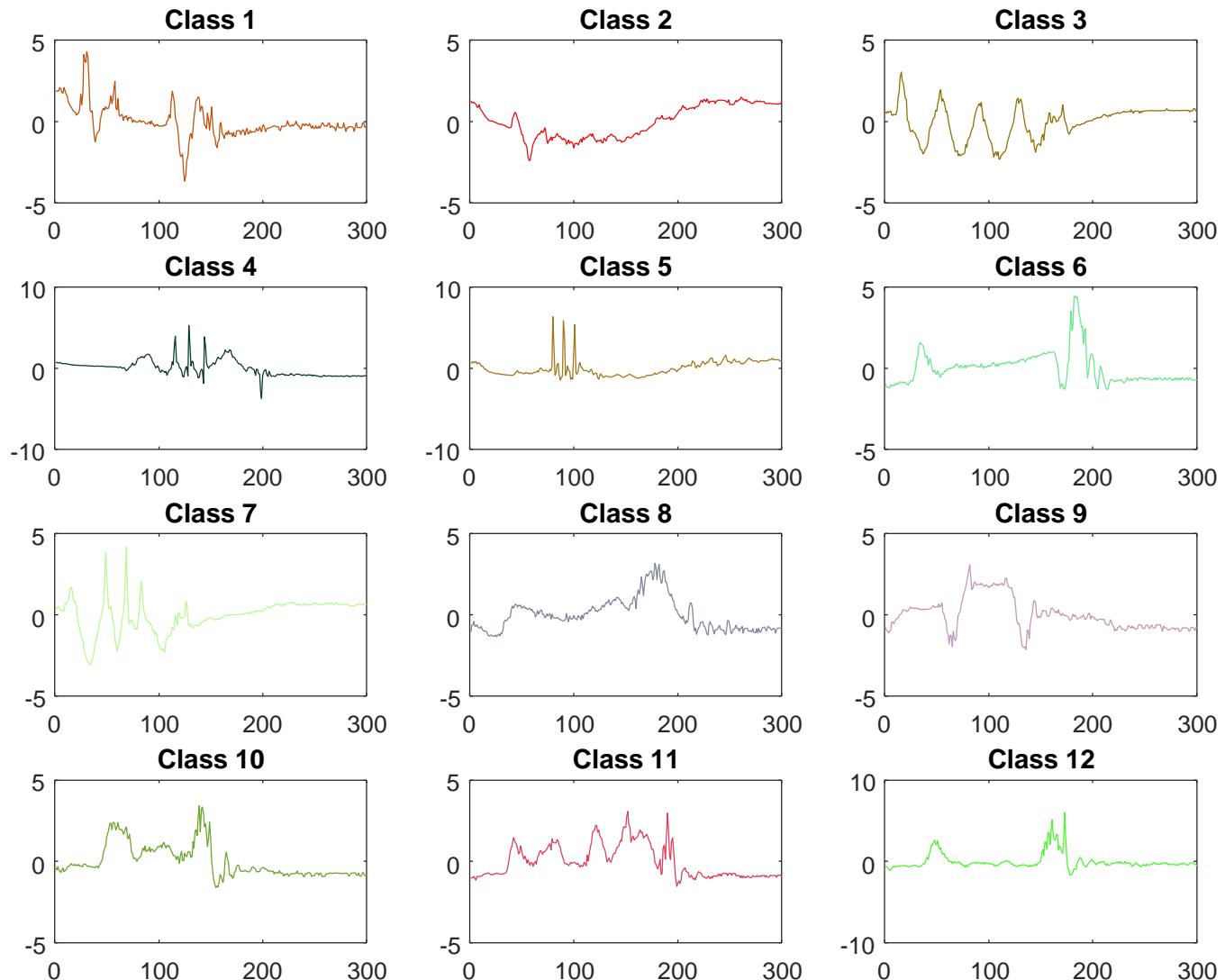
Computers

One exemplar per class,
with z-normalization



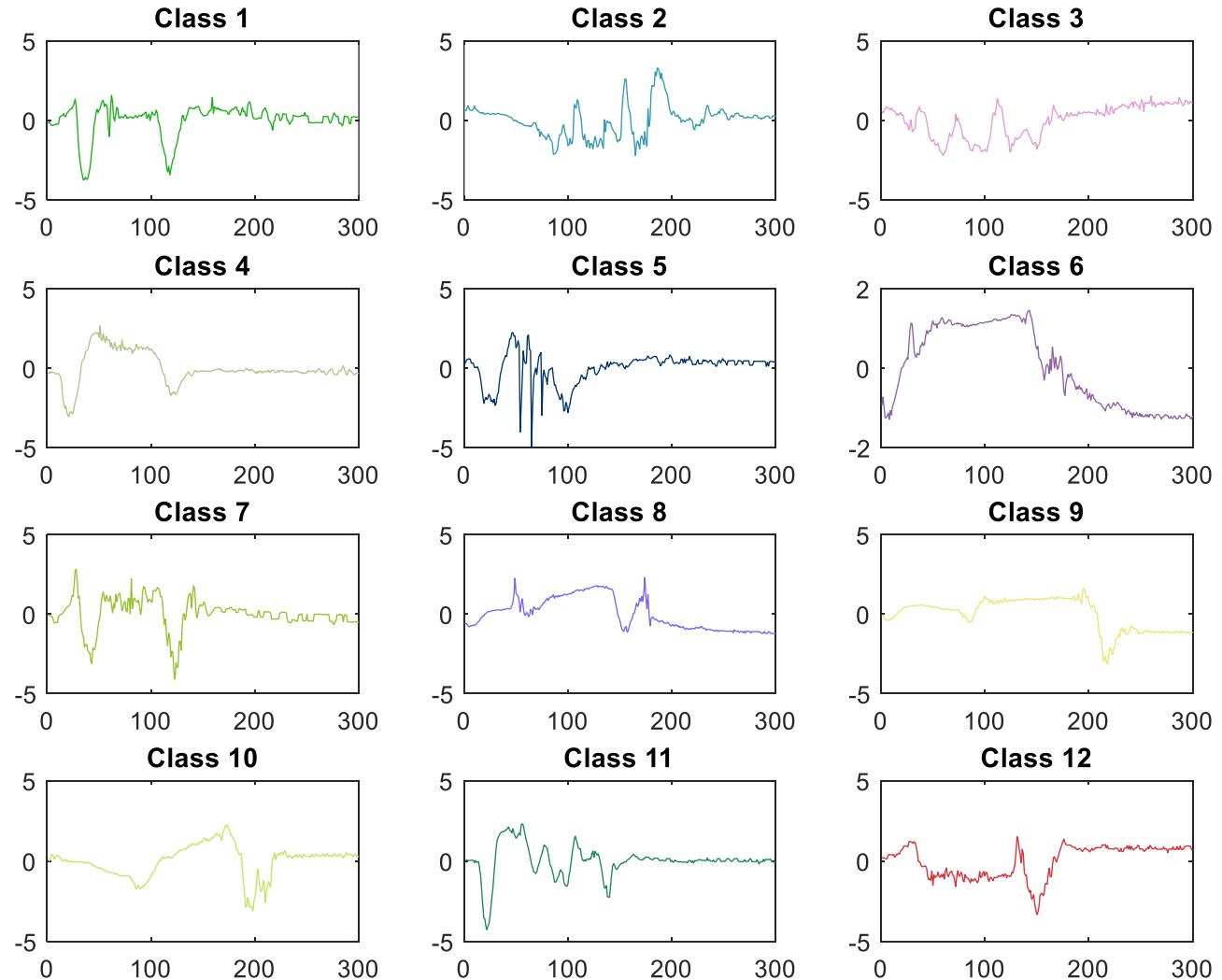
CricketX

One exemplar per class,
with z-normalization



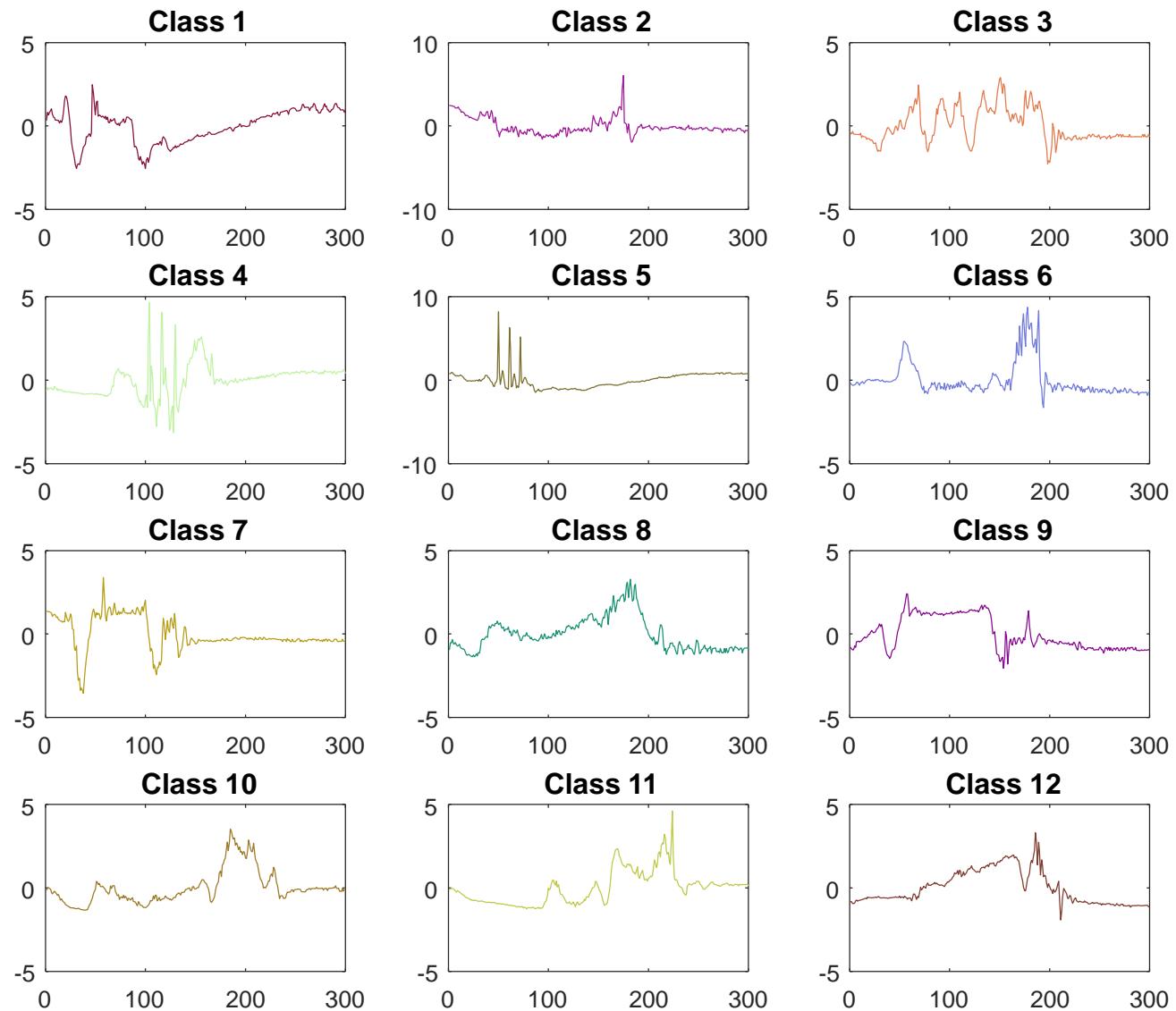
CricketY

One exemplar per class,
with z-normalization



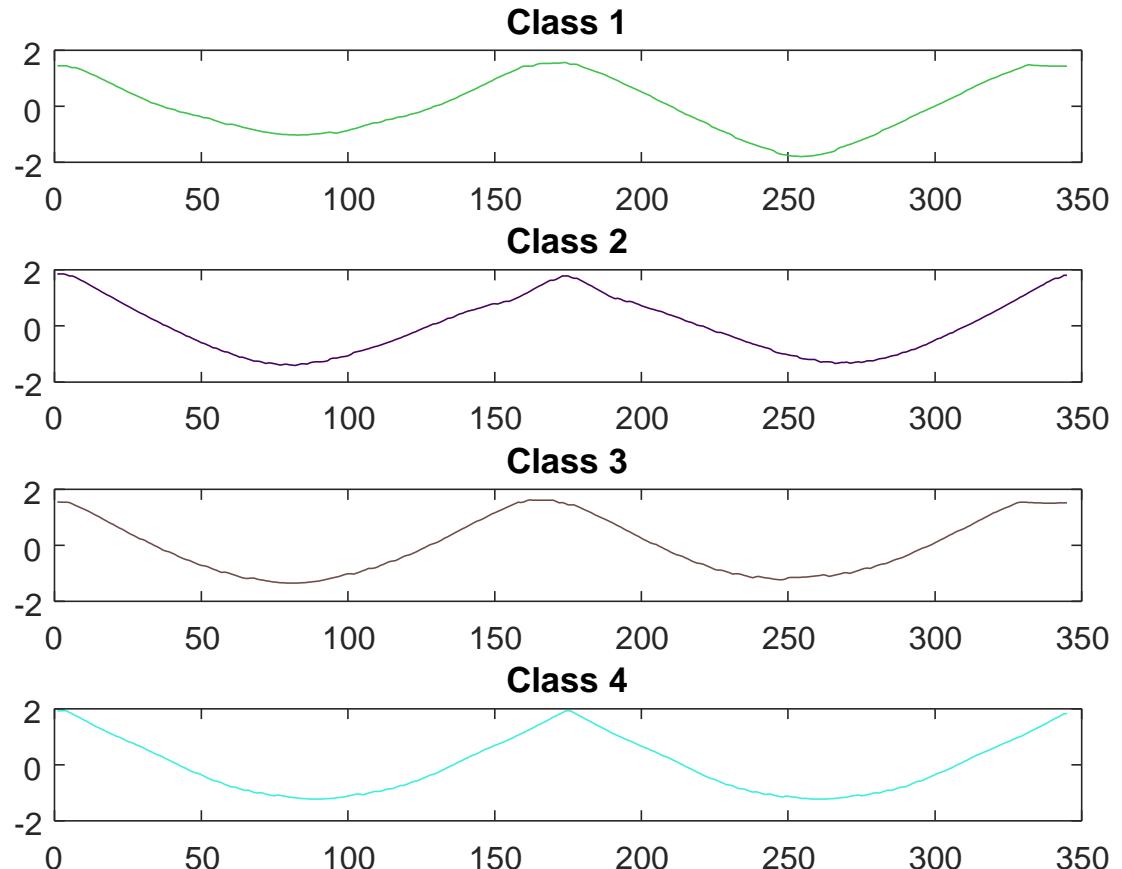
CricketZ

One exemplar per class,
with z-normalization



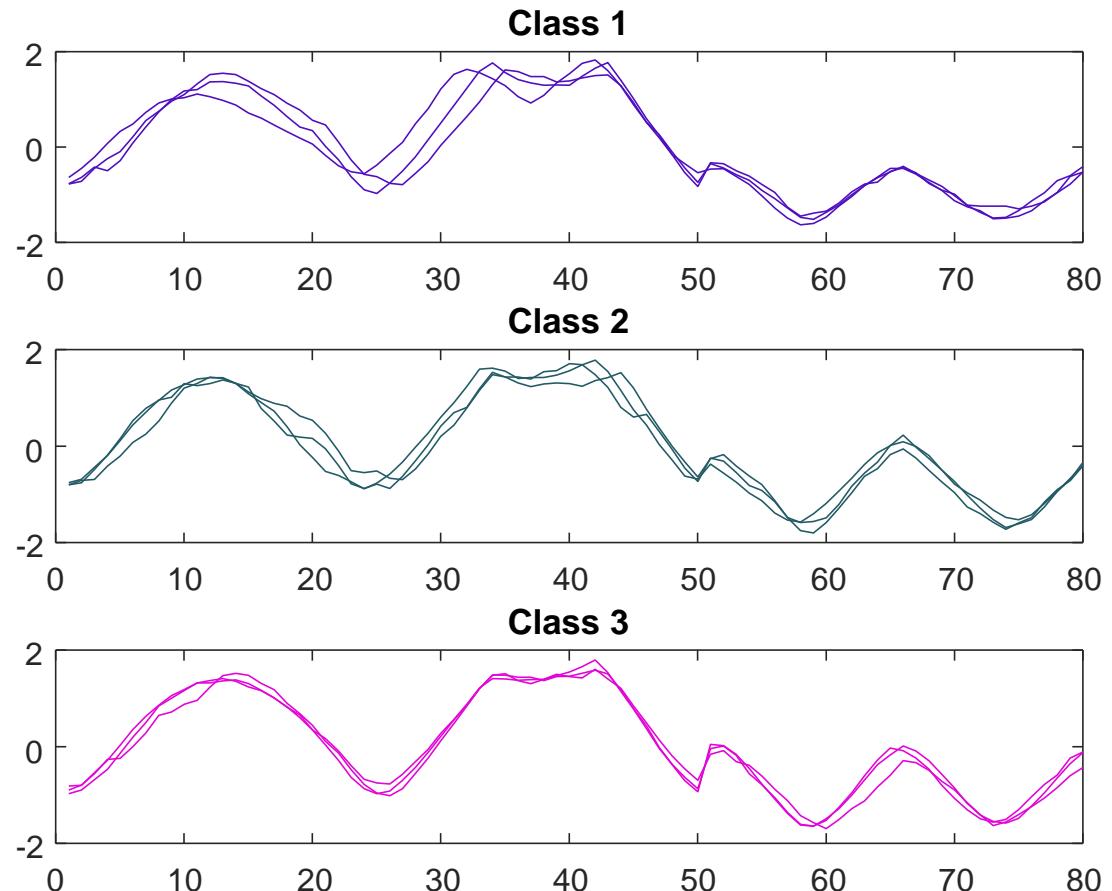
DiatomSizeReduction

One exemplar per class,
with z-normalization



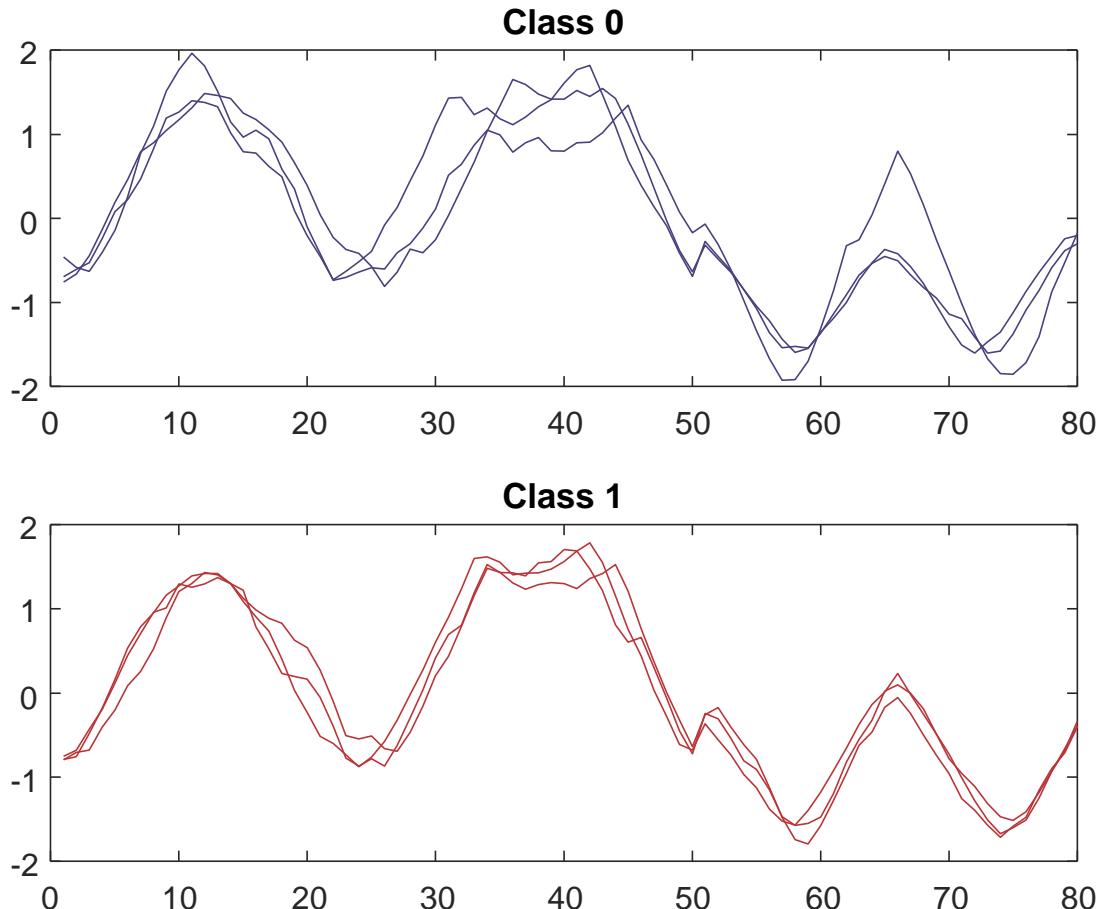
DistalPhalanxOutlineAgeGroup

Three exemplars per class,
with z-normalization



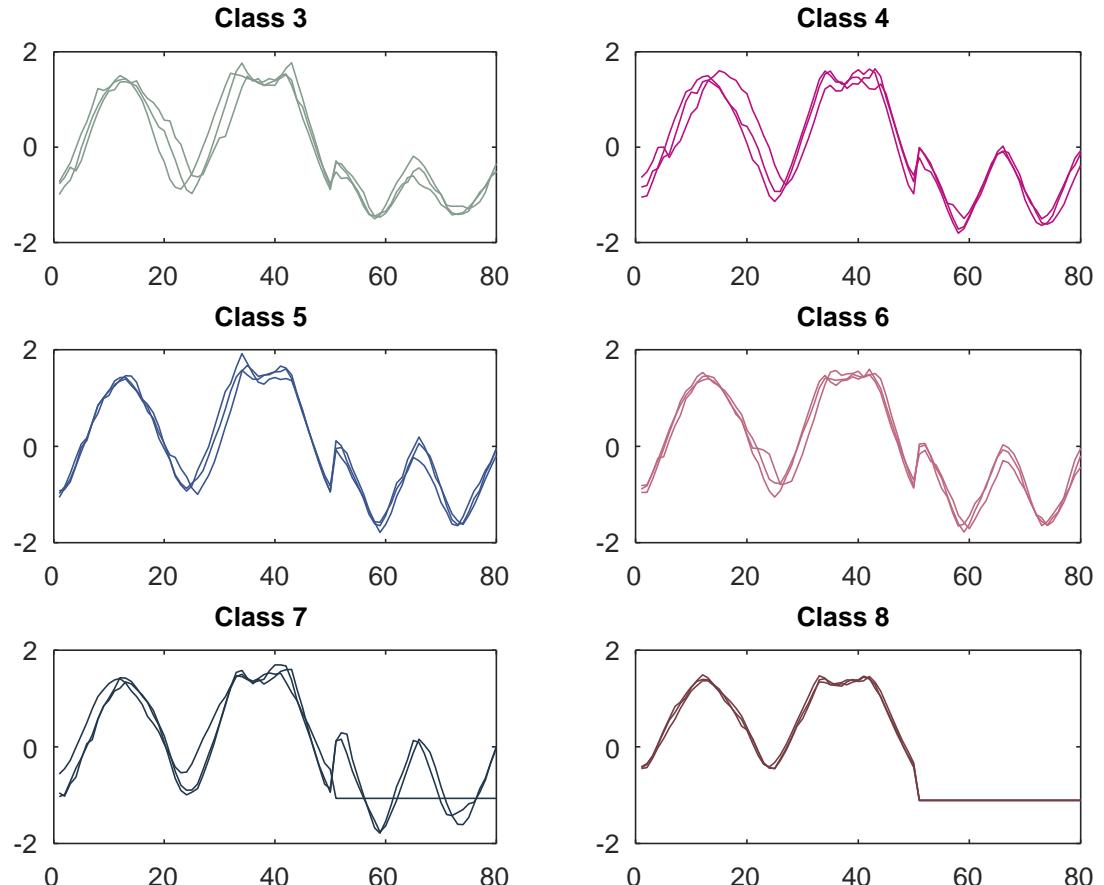
DistalPhalanxOutlineCorrect

Three exemplars per class,
with z-normalization



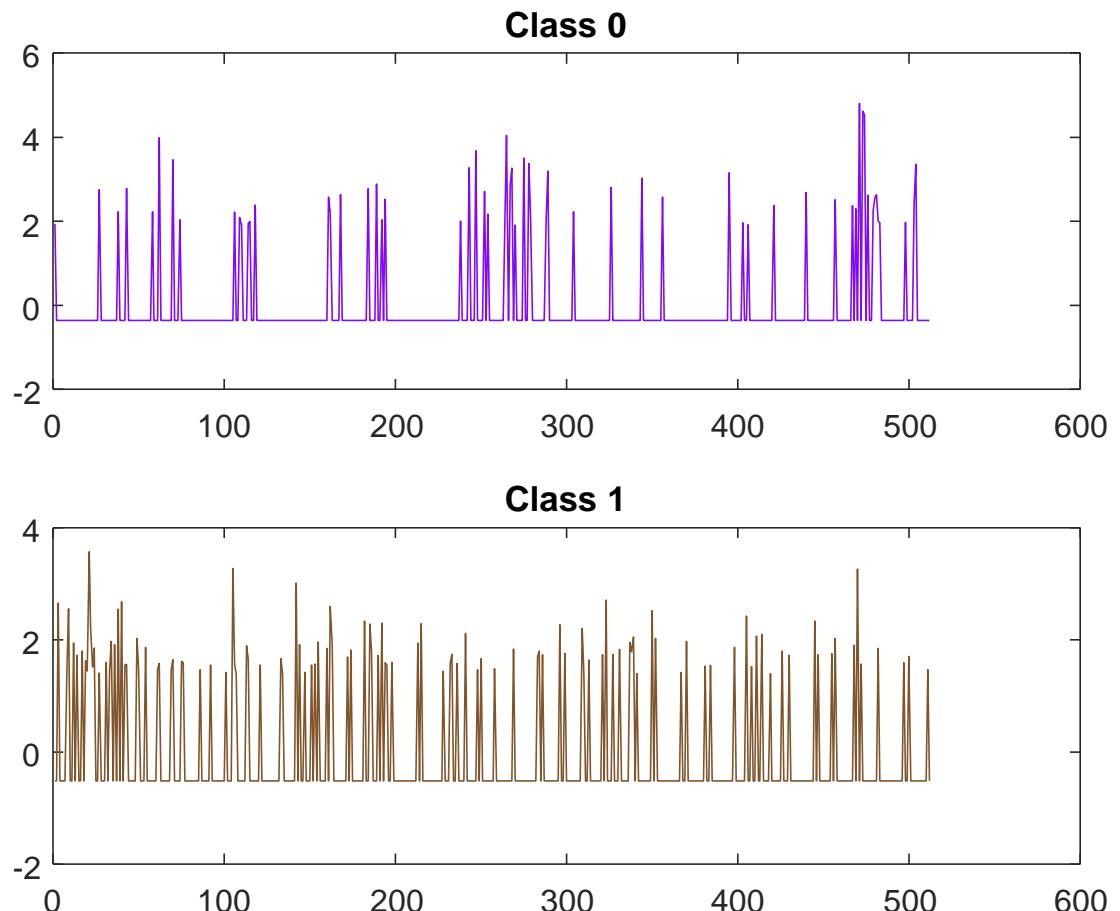
DistalPhalanxTW

Three exemplars per class,
with z-normalization



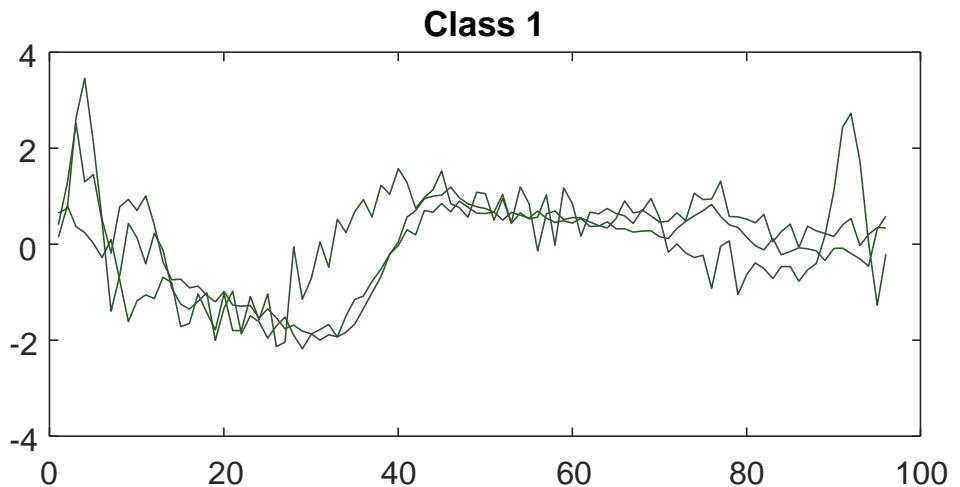
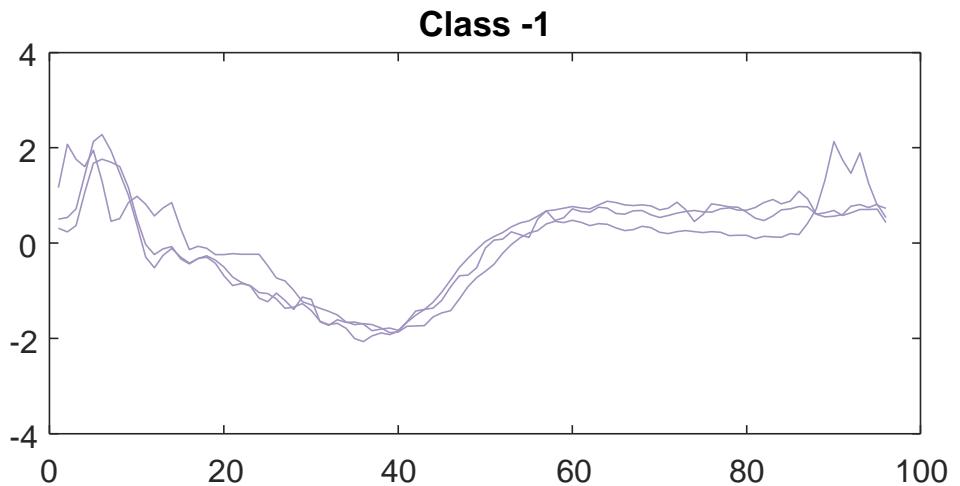
Earthquakes

One exemplar per class,
with z-normalization



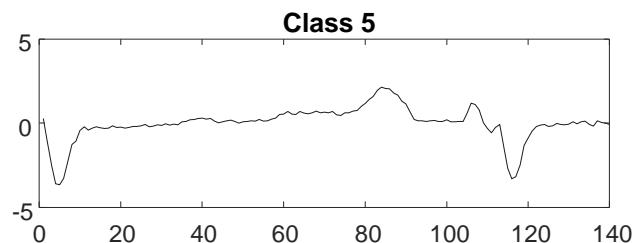
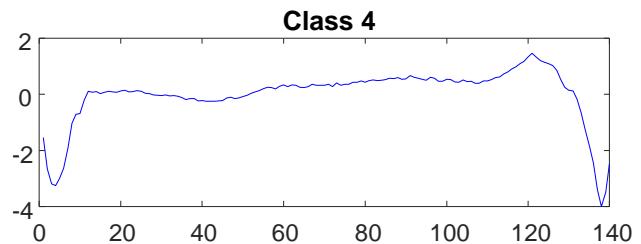
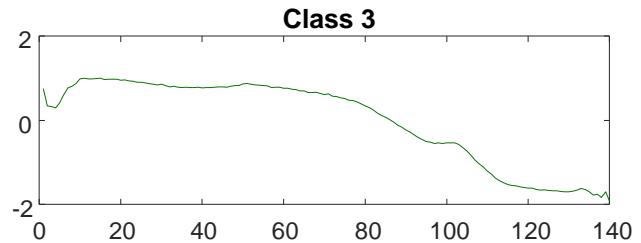
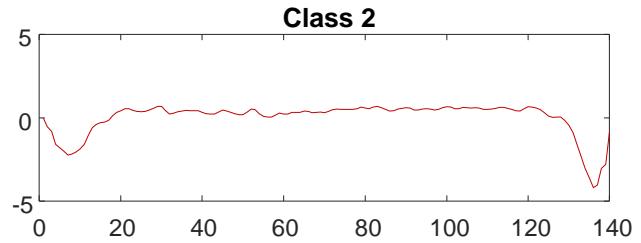
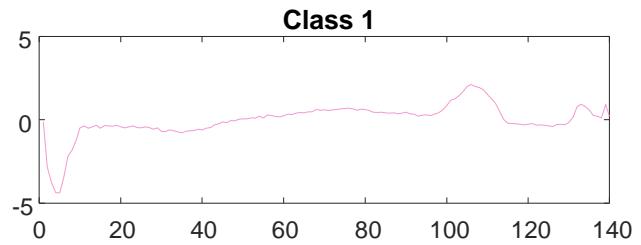
ECG200

Three exemplars per class,
with z-normalization



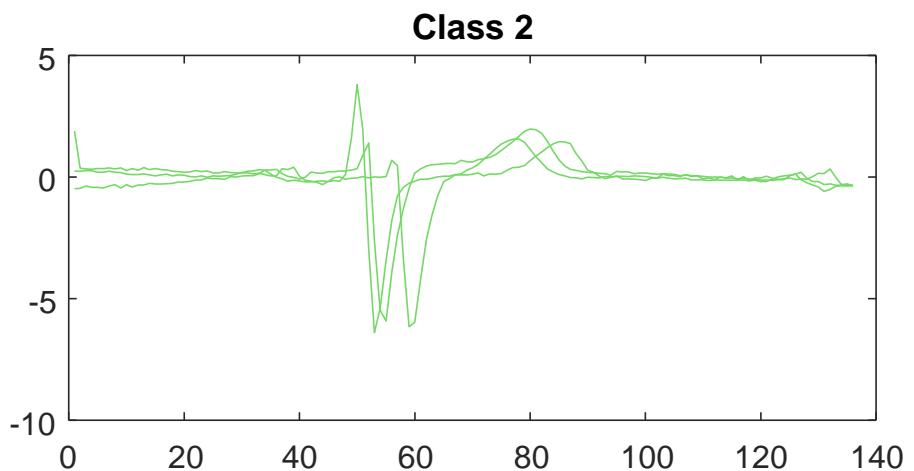
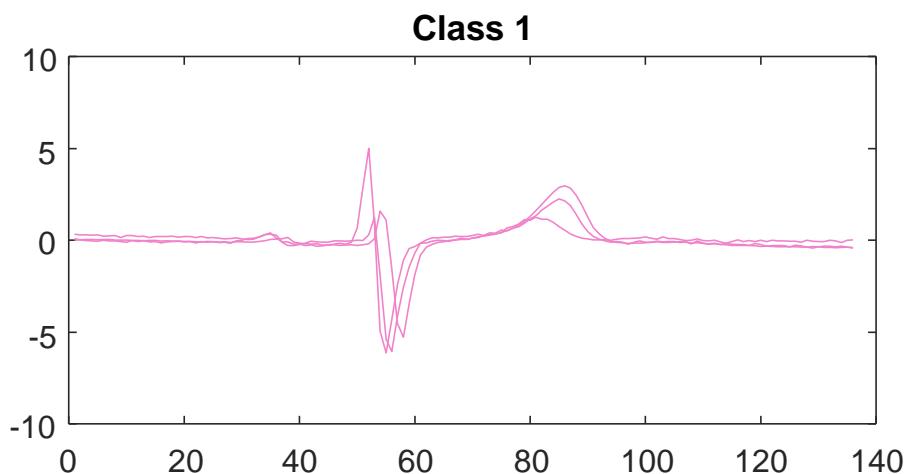
ECG5000

One exemplar per class,
with z-normalization



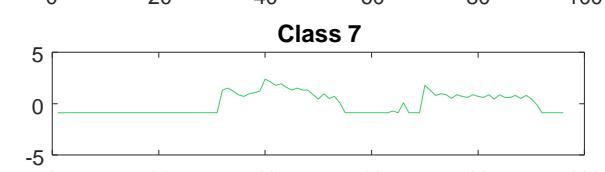
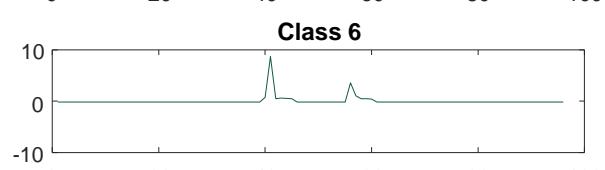
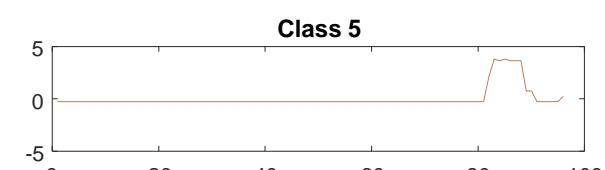
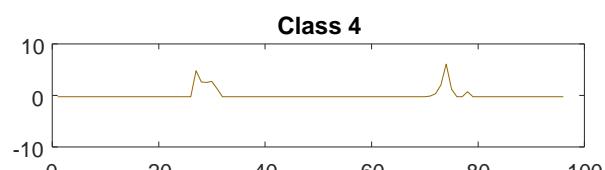
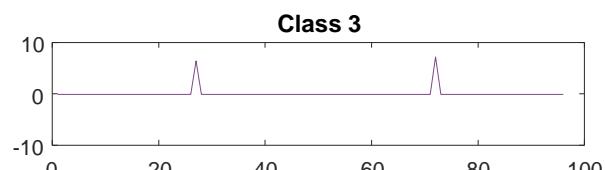
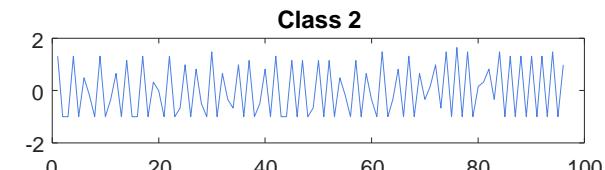
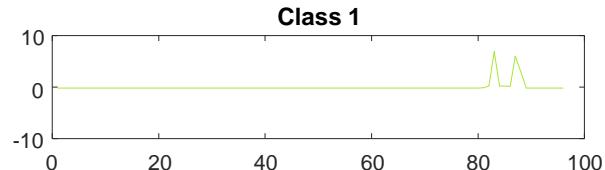
ECGFiveDays

Three exemplars per class,
with z-normalization



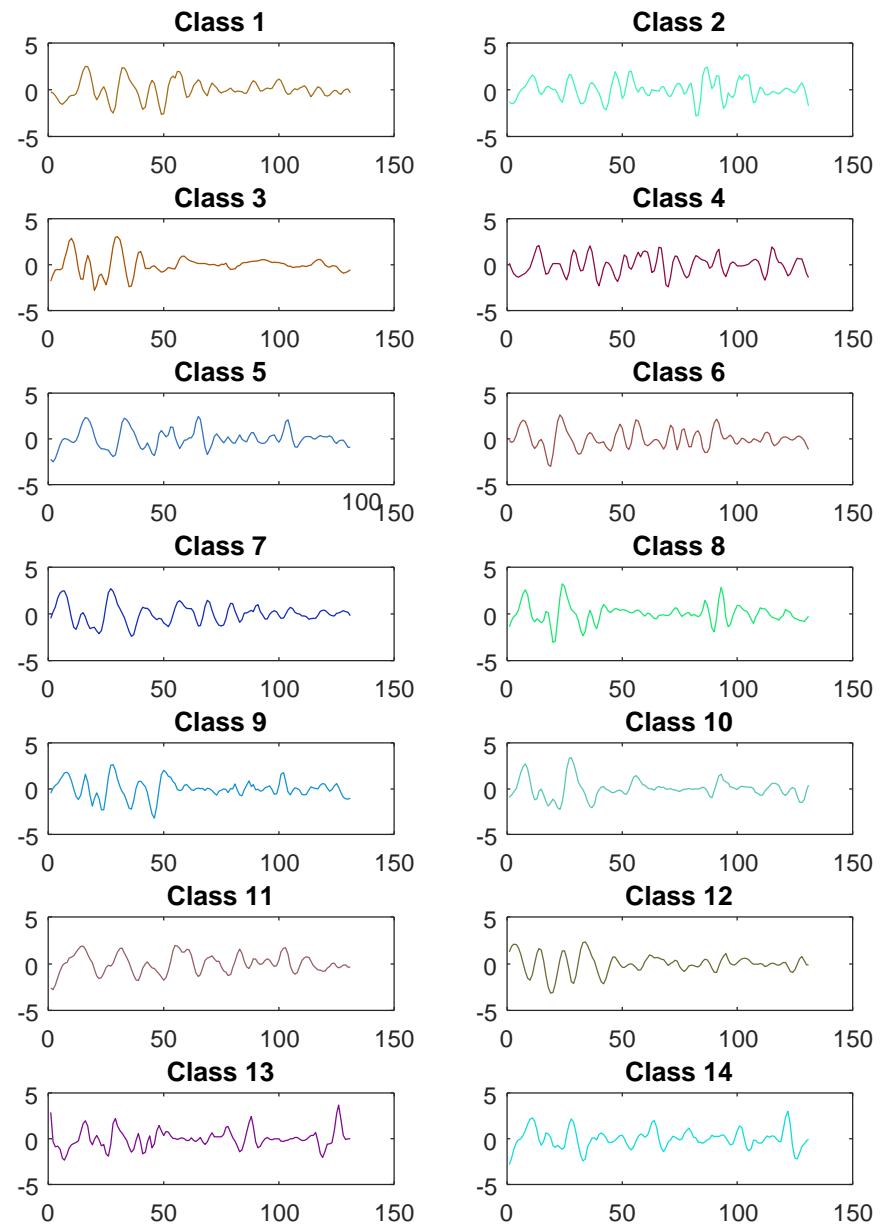
ElectricDevices

One exemplar per class,
with z-normalization



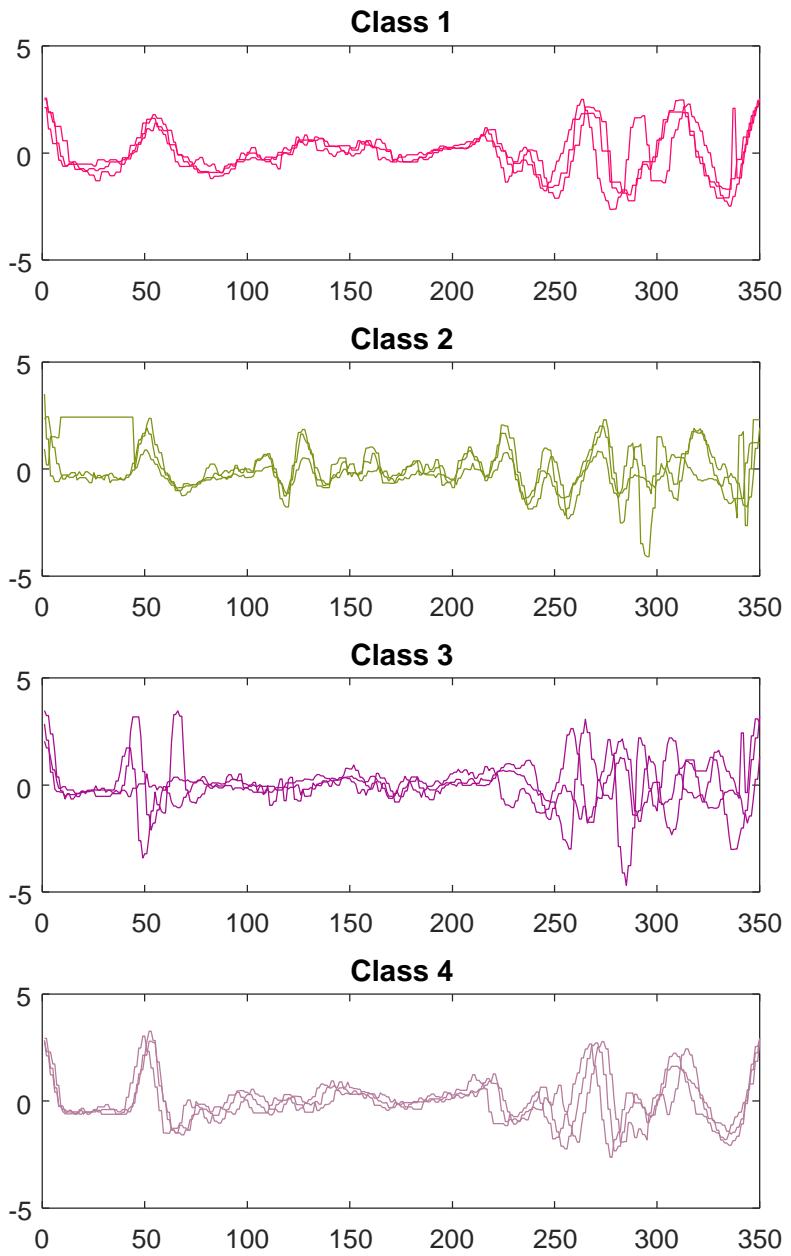
FaceAll

One exemplar per class,
with z-normalization



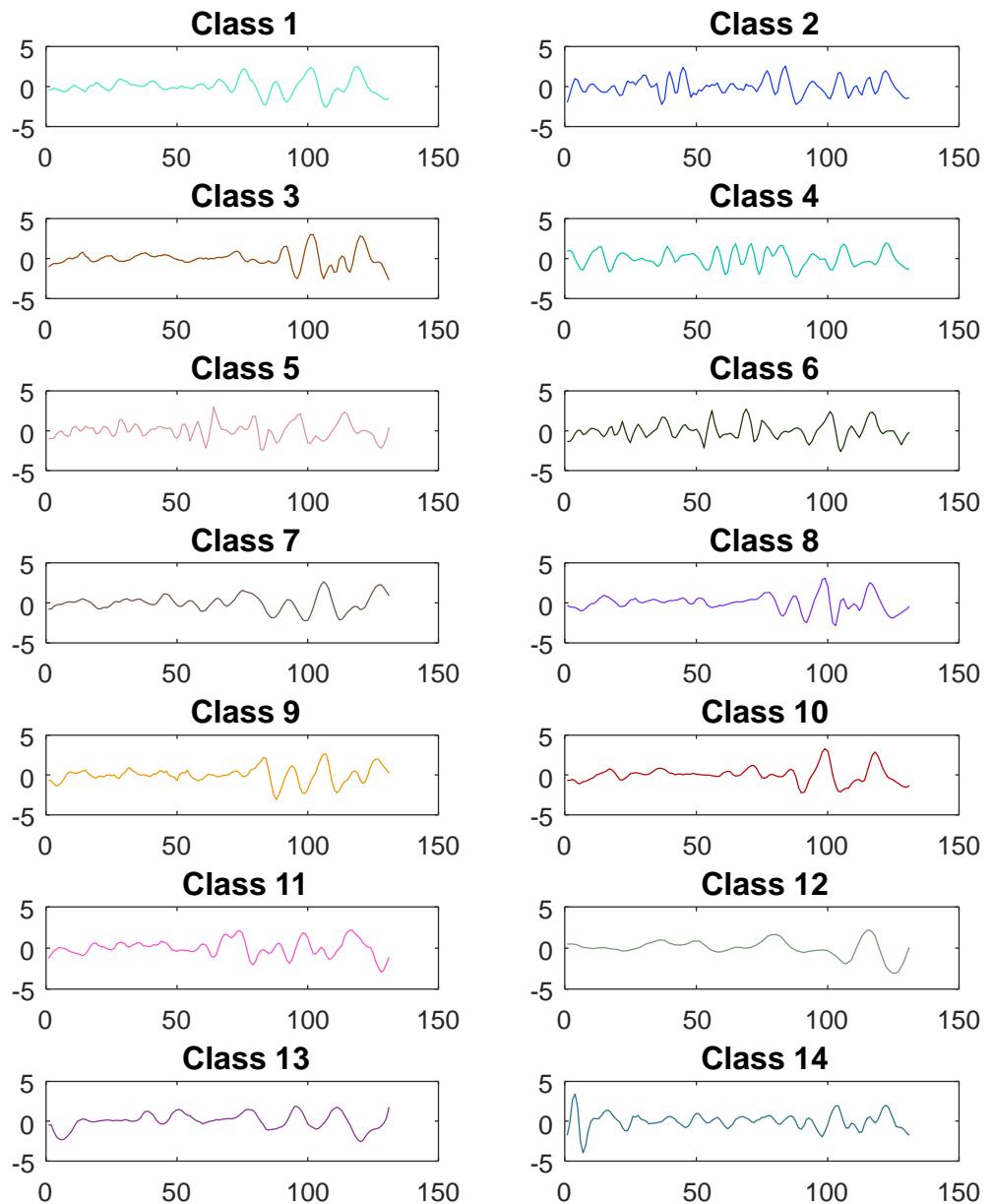
FaceFour

Three exemplars per class,
with z-normalization



FacesUCR

One exemplar per class,
with z-normalization



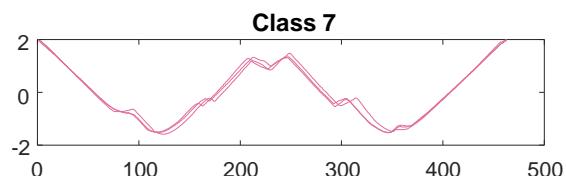
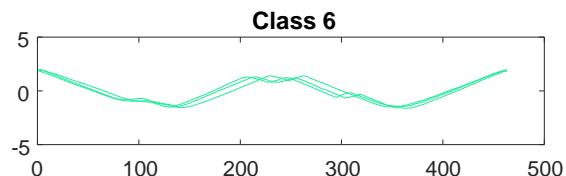
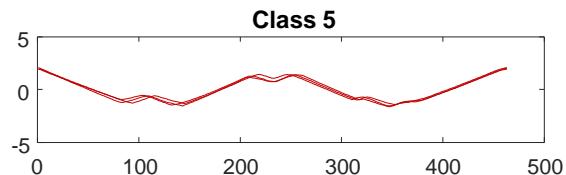
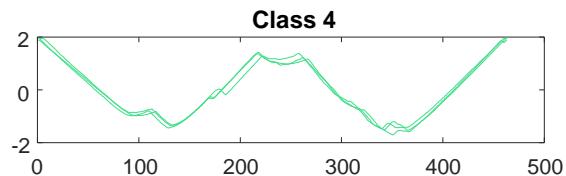
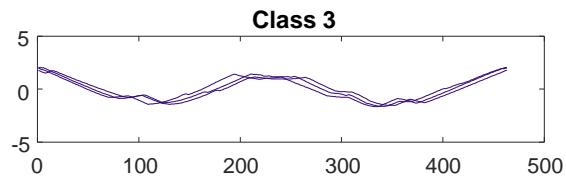
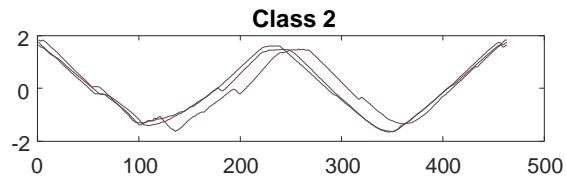
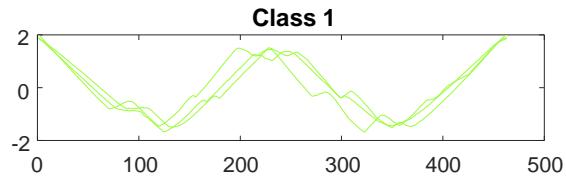
FiftyWords

One exemplar per class,
with z-normalization



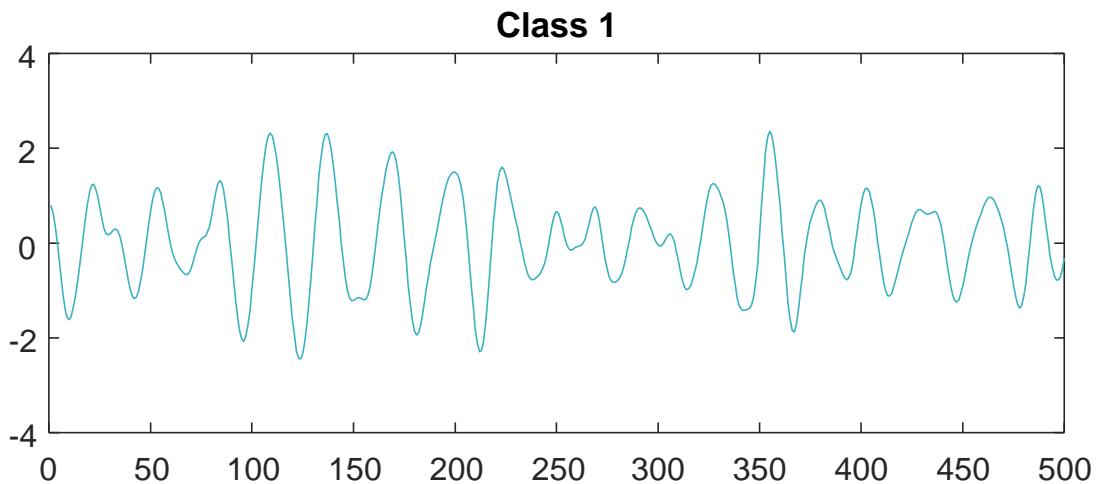
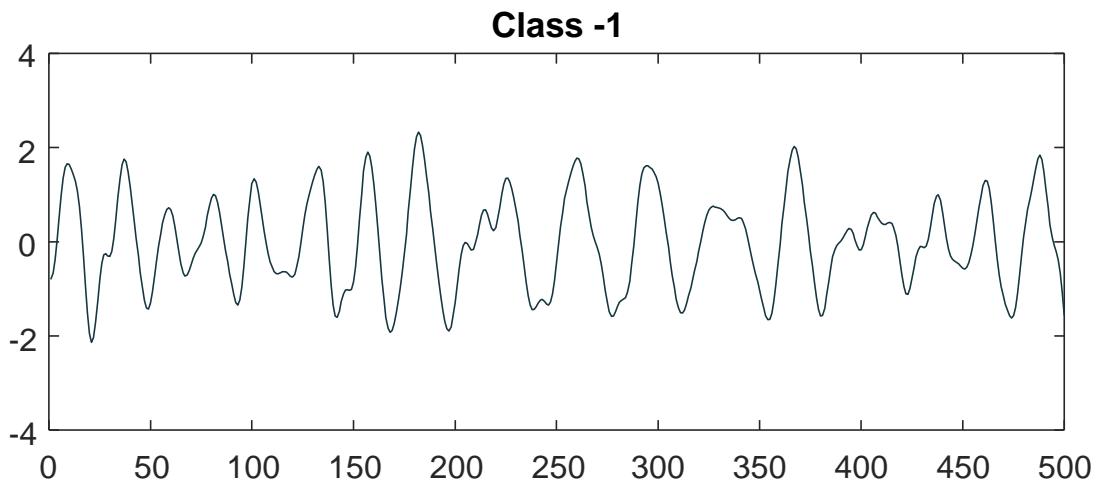
Fish

Three exemplars per class,
with z-normalization



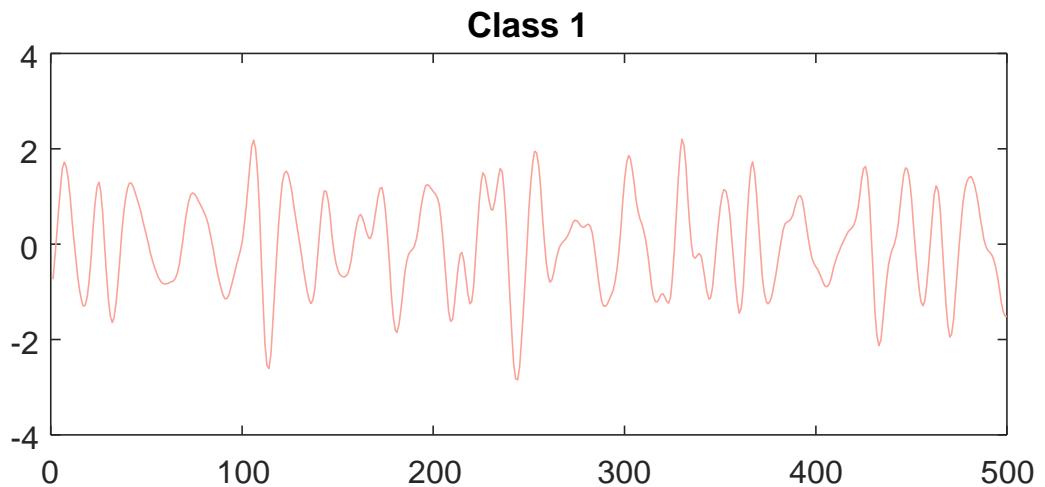
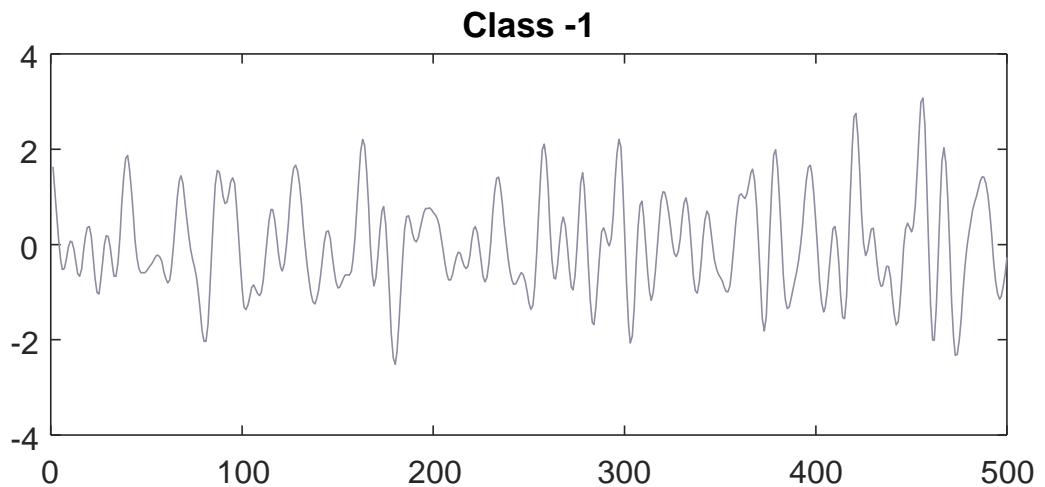
FordA

One exemplar per class,
with z-normalization



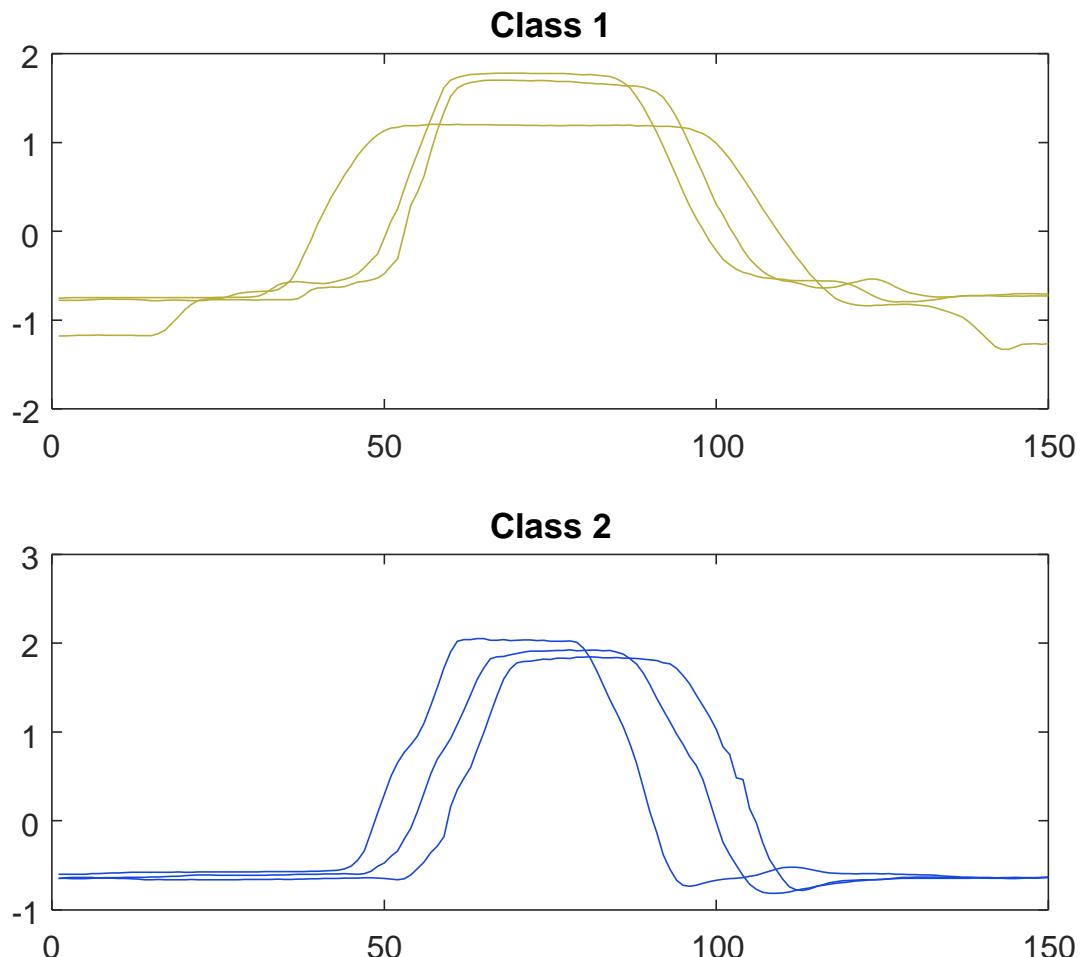
FordB

One exemplar per class,
with z-normalization



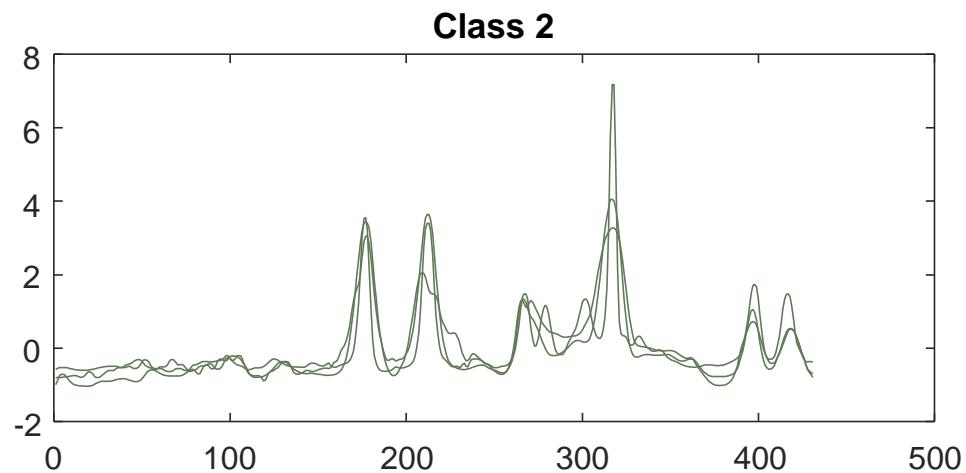
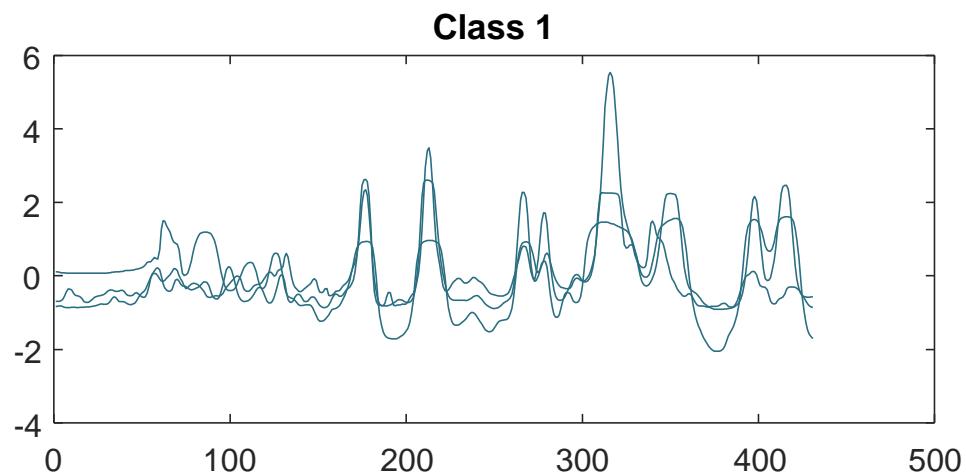
GunPoint

Three exemplars per class,
with z-normalization



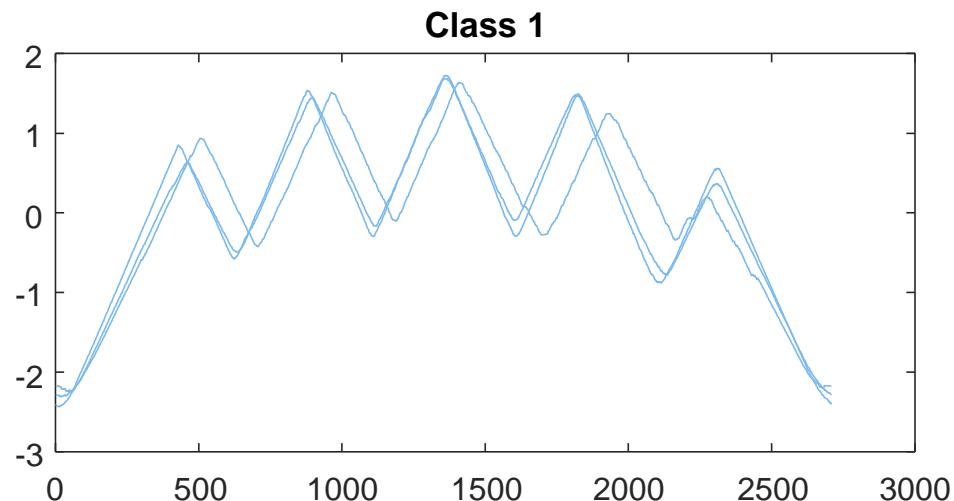
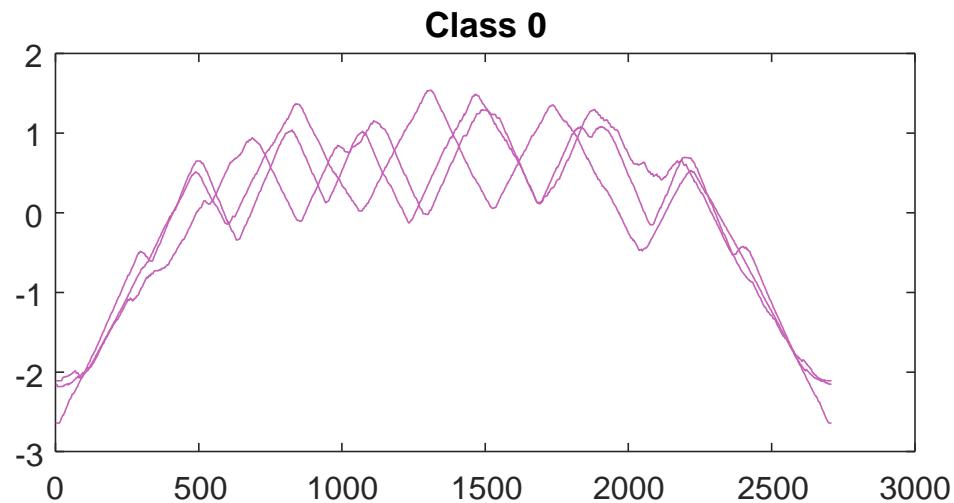
Ham

Three exemplars per class,
with z-normalization



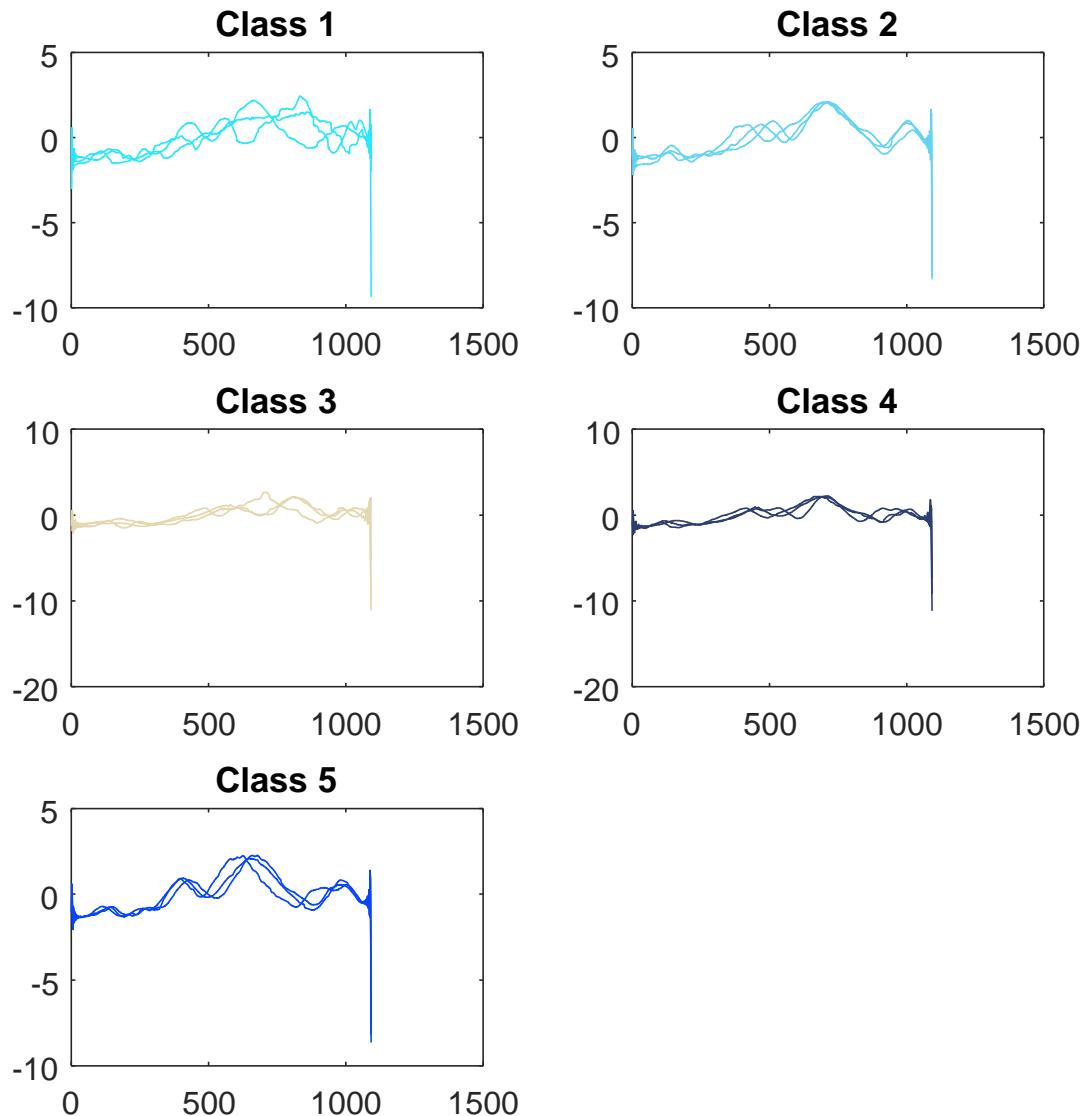
HandOutlines

Three exemplars per class,
with z-normalization



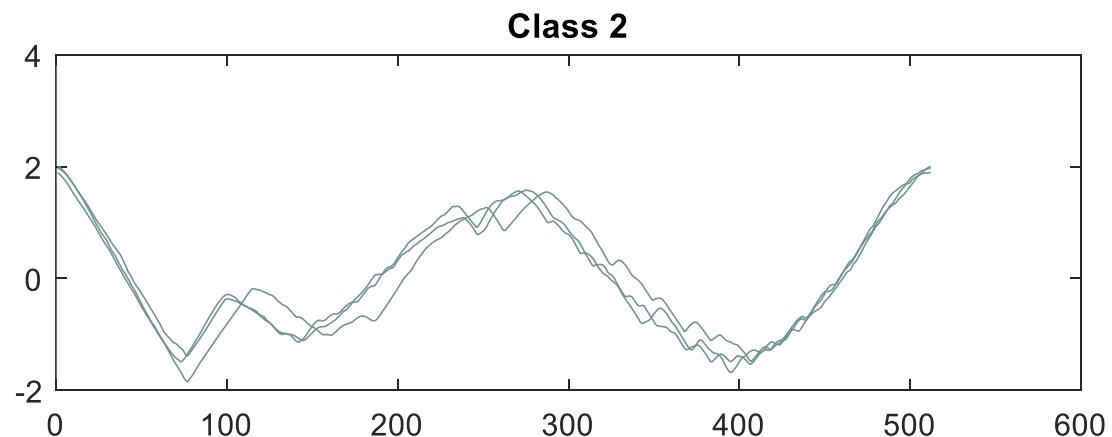
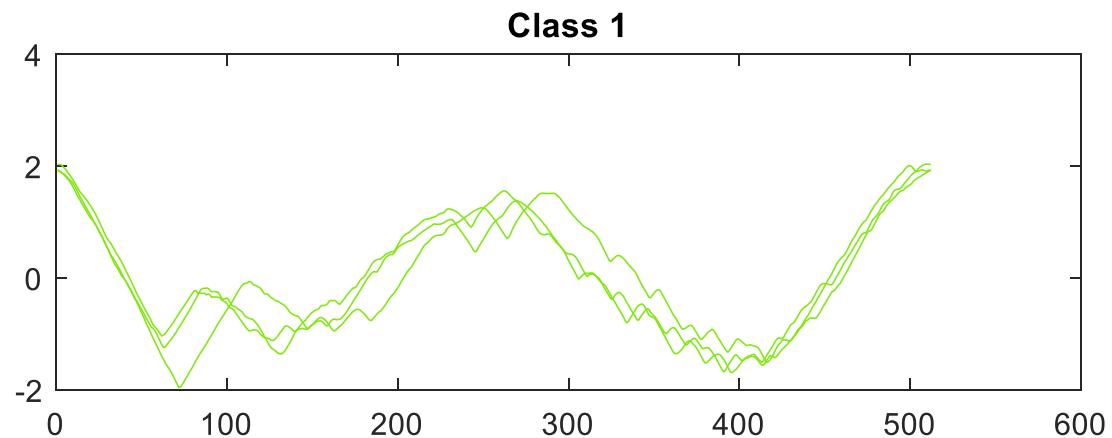
Haptics

Three exemplars per class,
with z-normalization



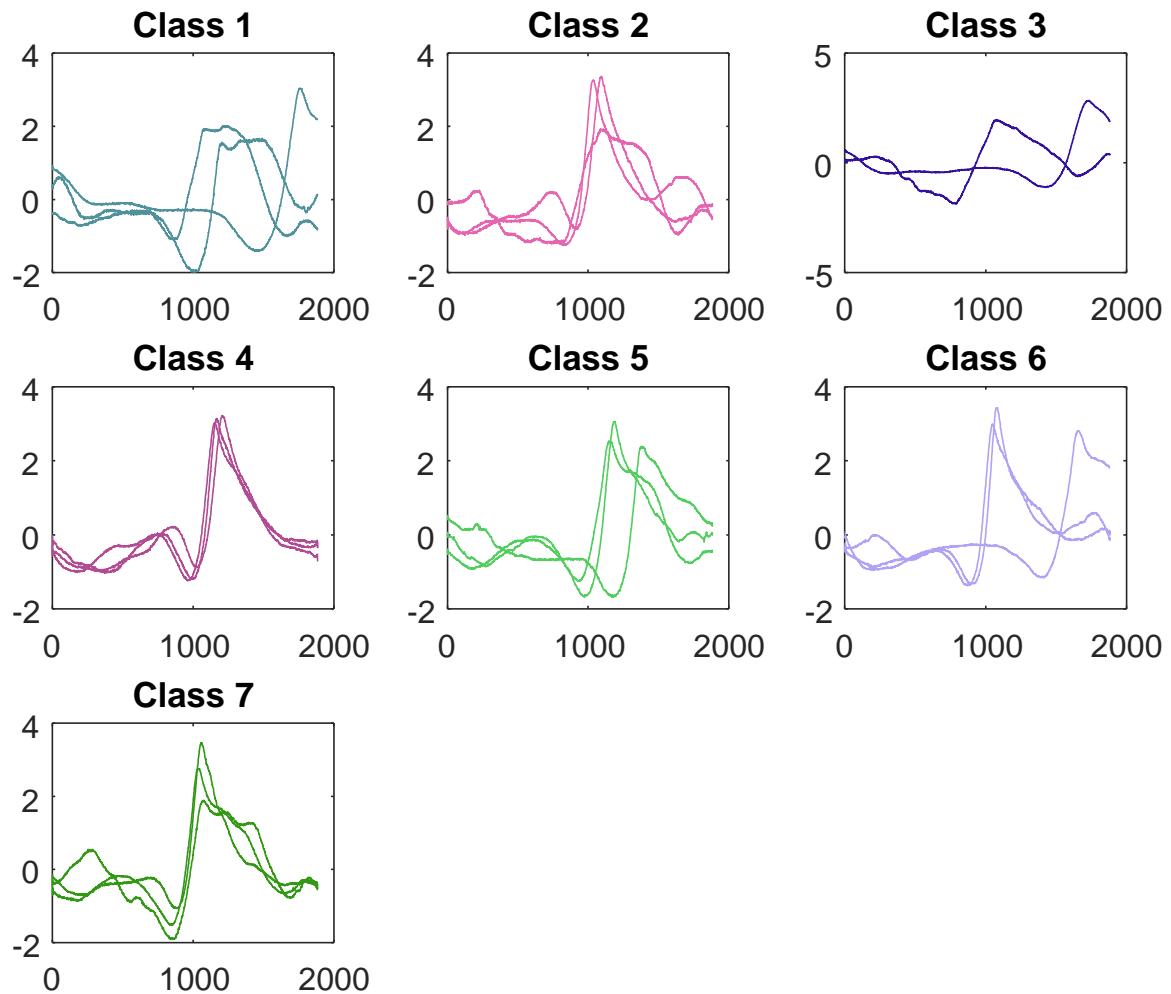
Herring

Three exemplars per class,
with z-normalization



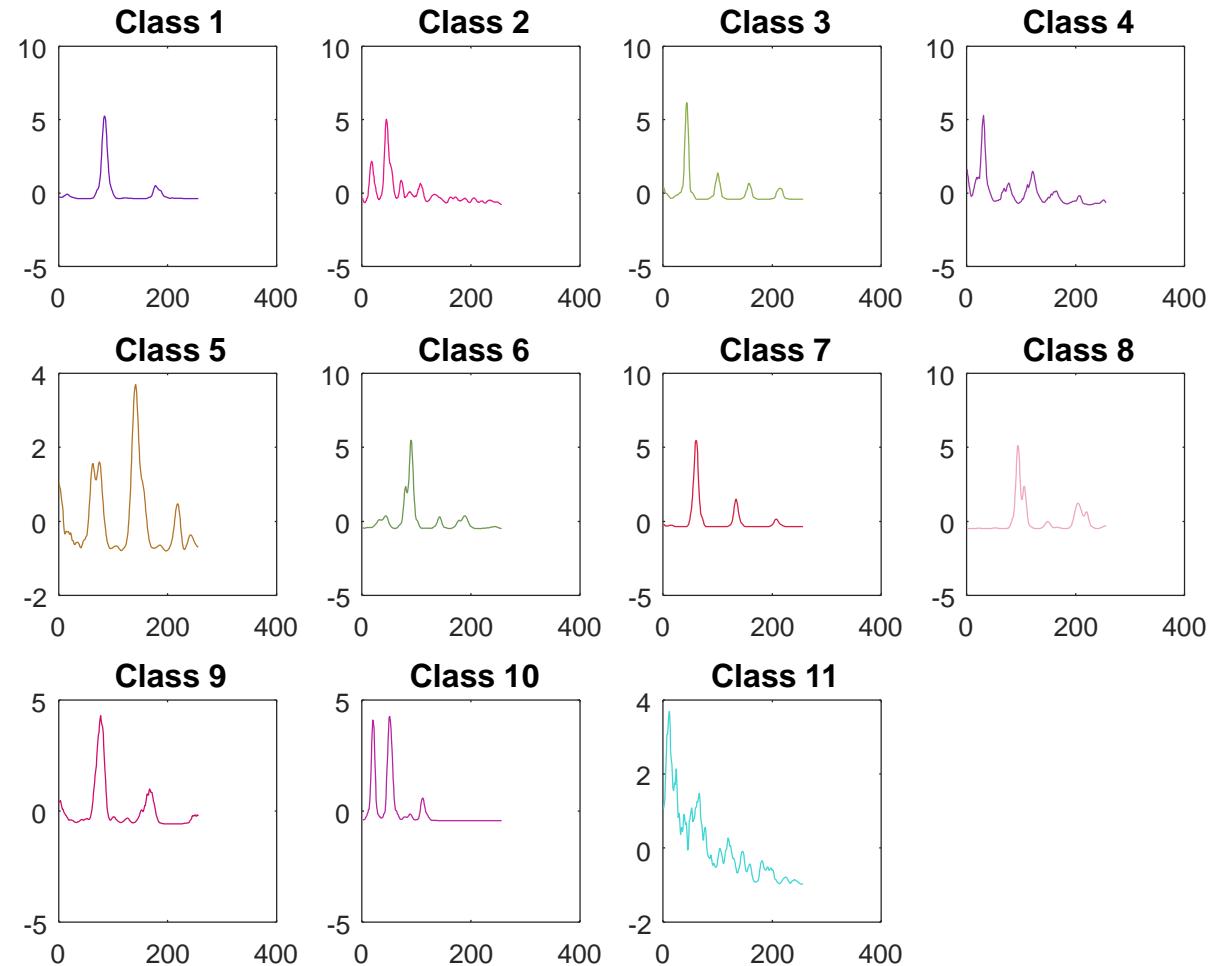
InlineSkate

Three exemplars per class,
with z-normalization



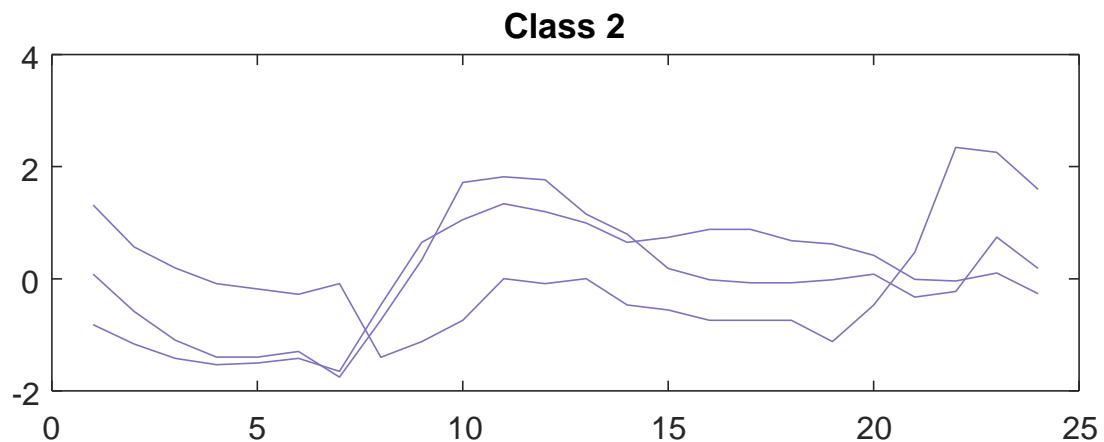
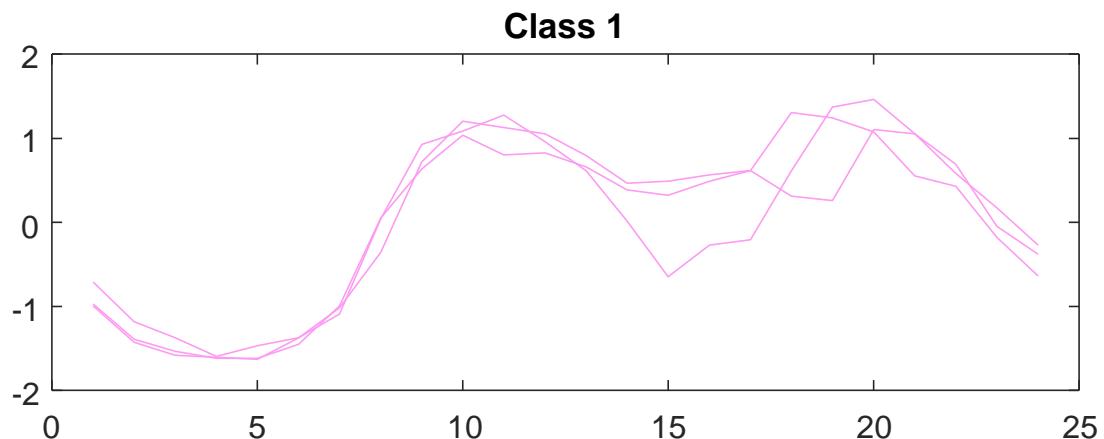
InsectWingbeatSound

One exemplar per class,
with z-normalization



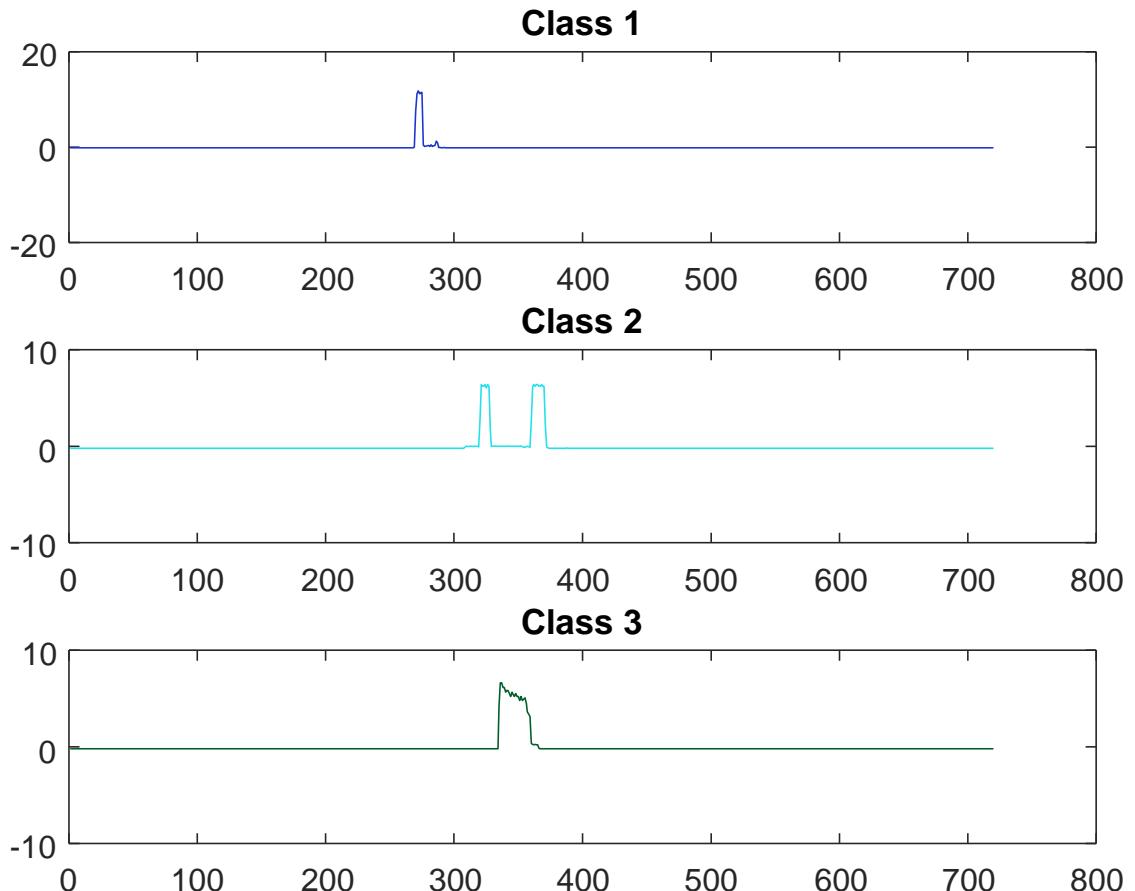
ItalyPowerDemand

Three exemplars per class,
with z-normalization



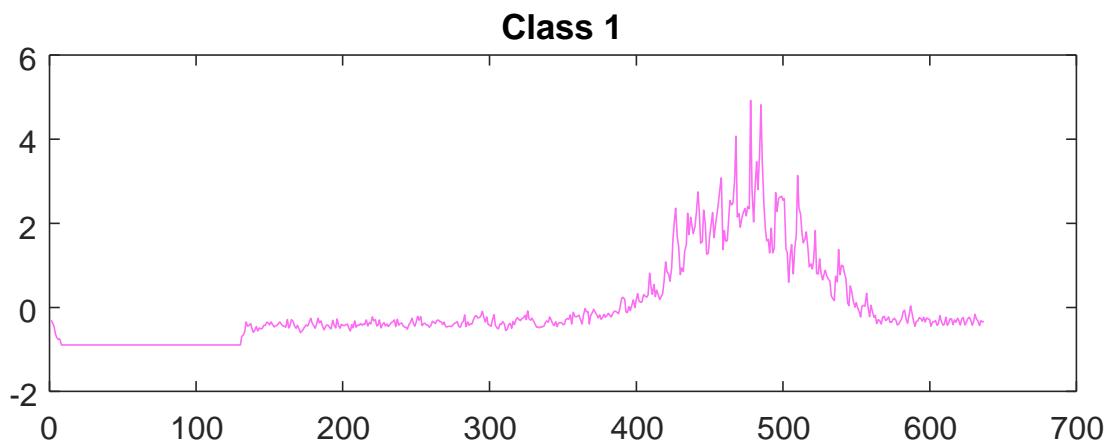
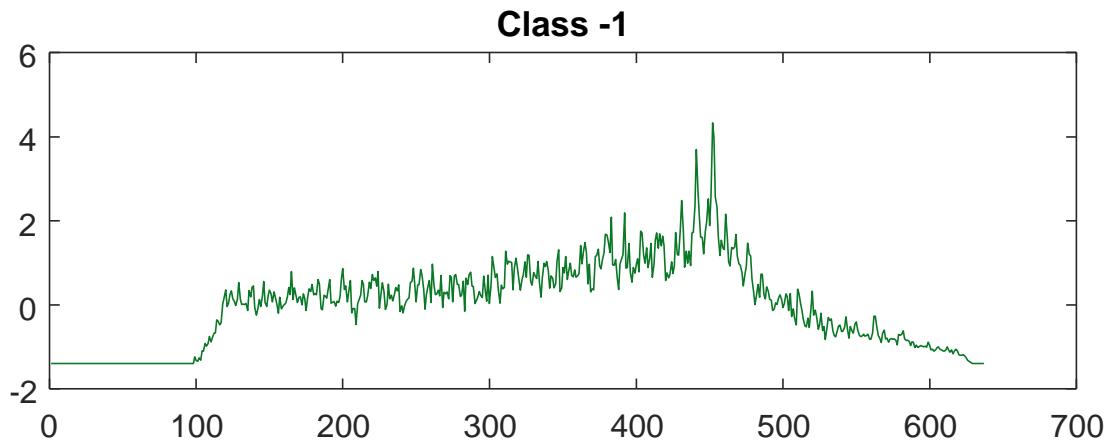
LargeKitchenAppliances

One exemplar per class,
with z-normalization



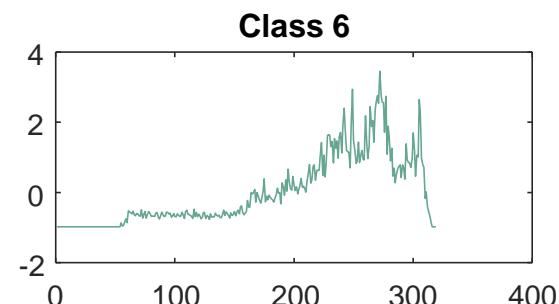
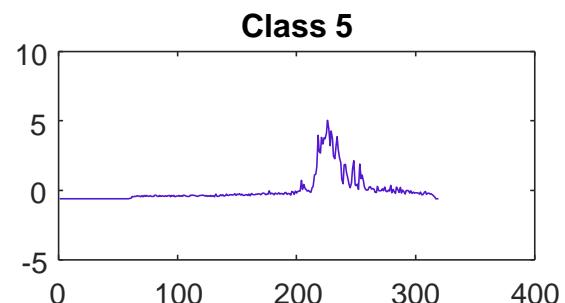
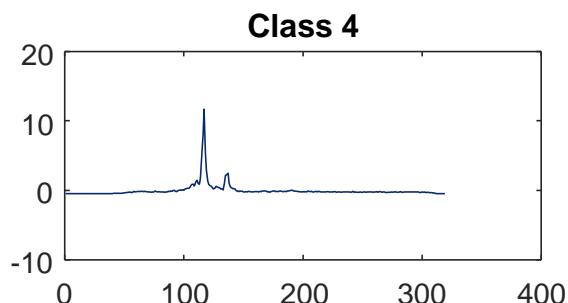
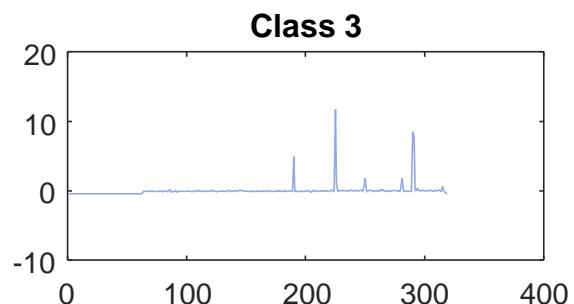
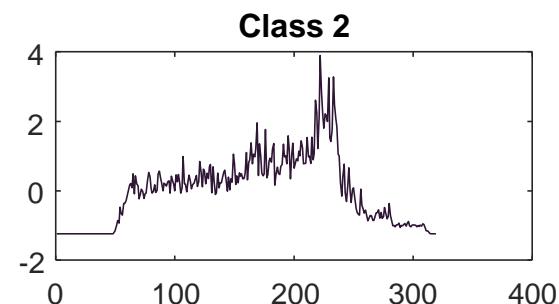
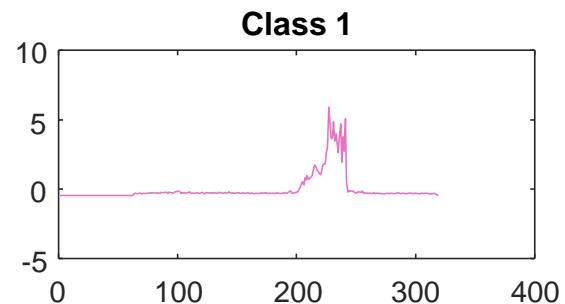
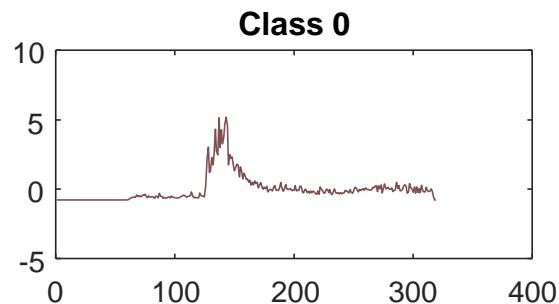
Lightning2

One exemplar per class,
with z-normalization



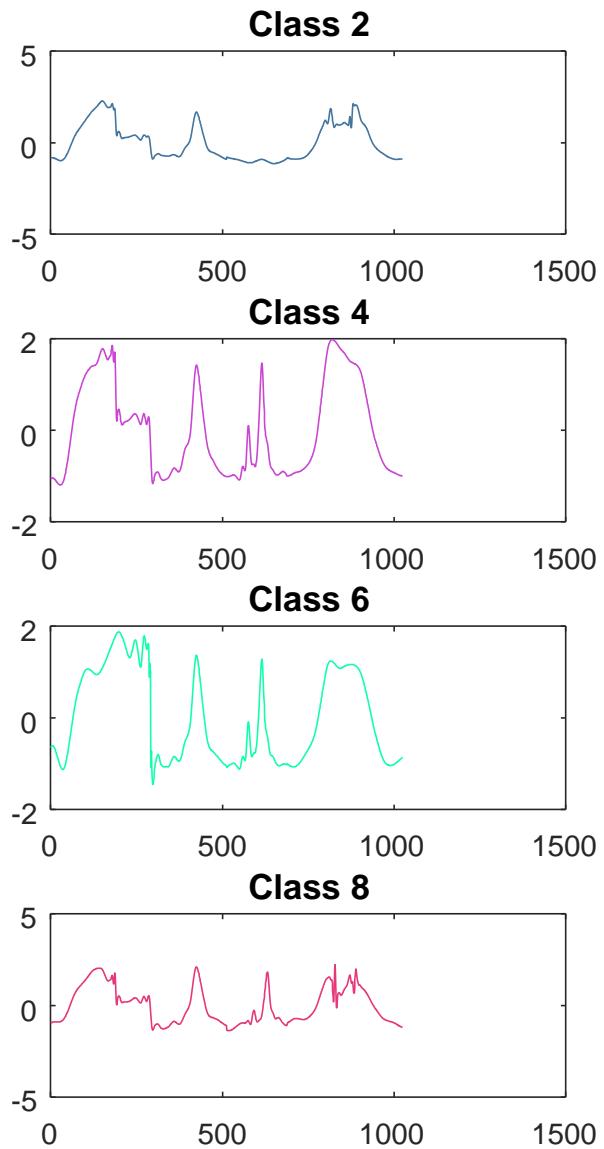
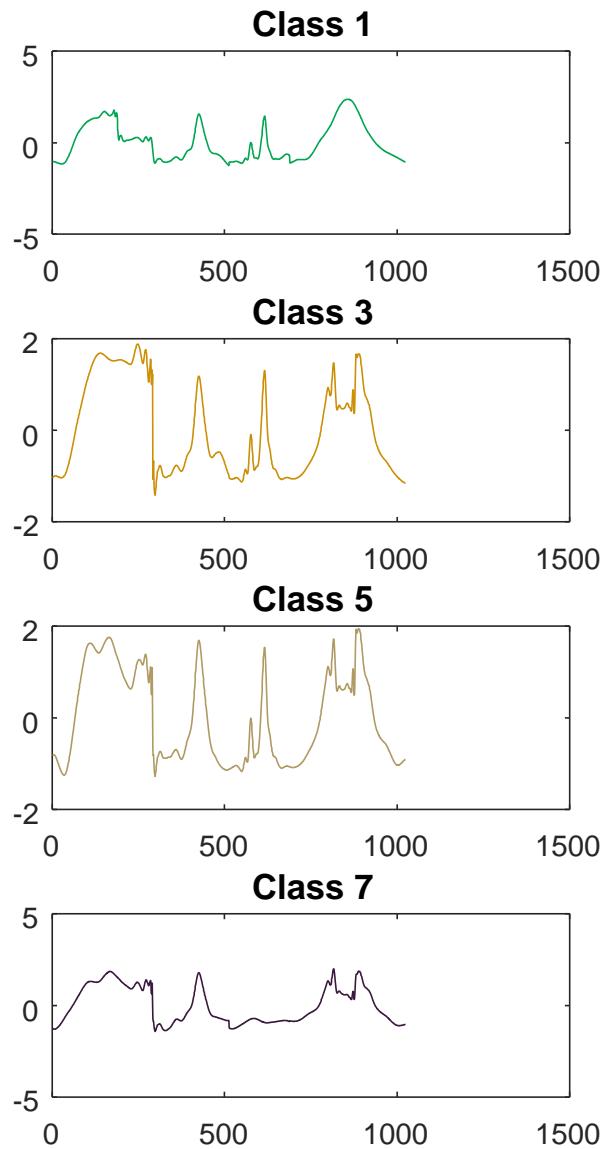
Lightning7

One exemplar per class,
with z-normalization



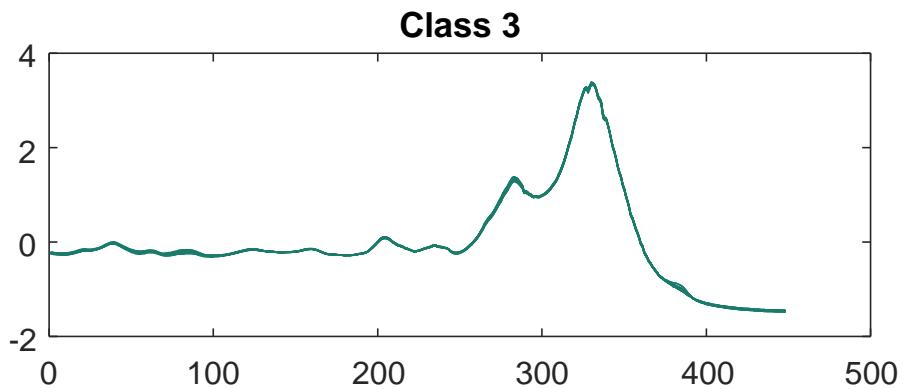
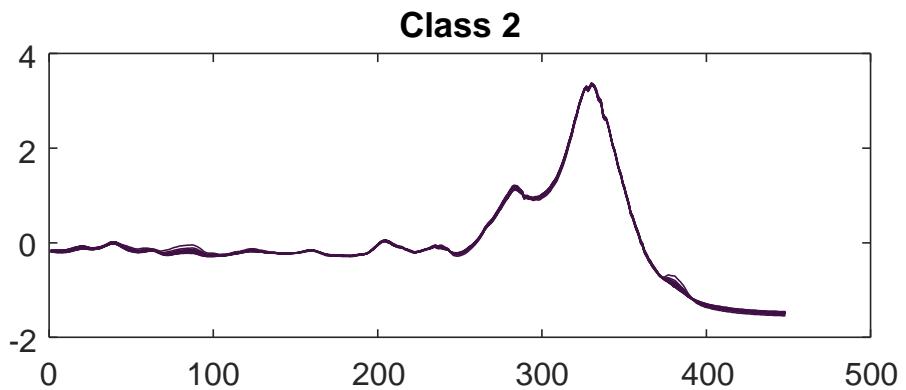
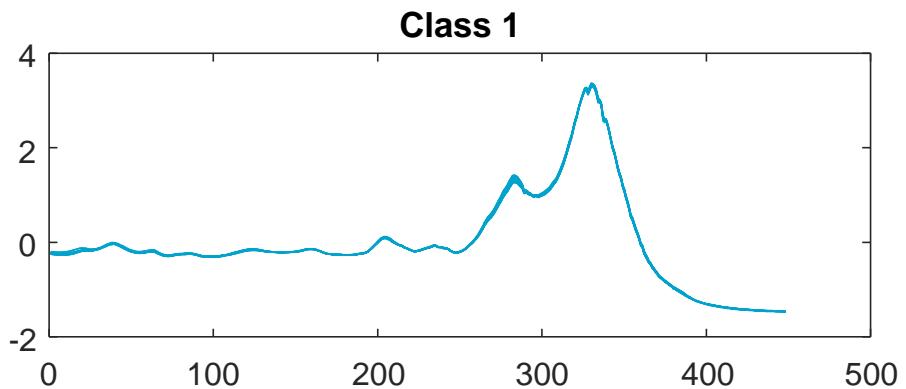
Mallat

One exemplar per class,
with z-normalization



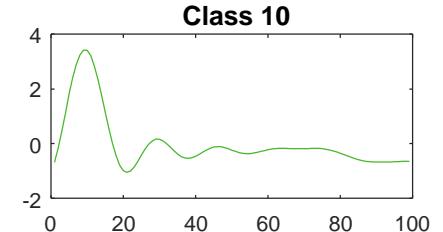
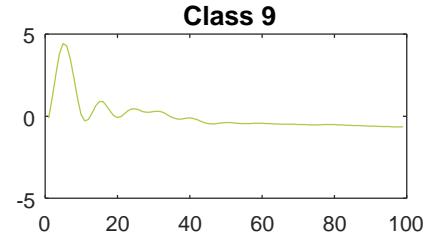
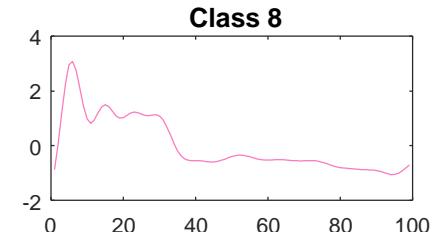
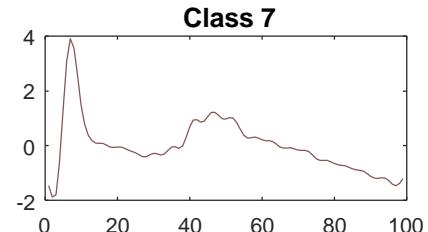
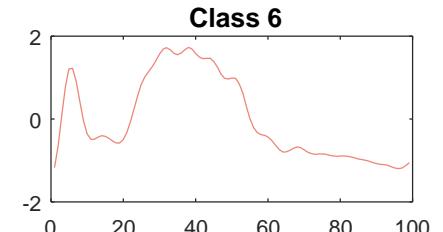
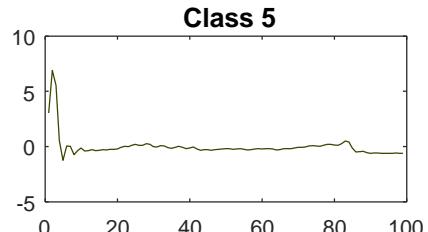
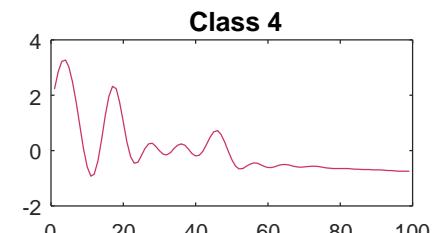
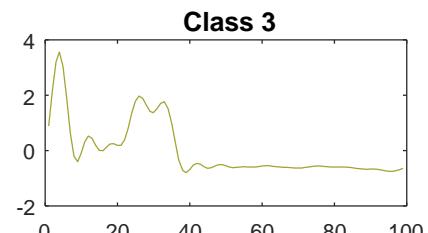
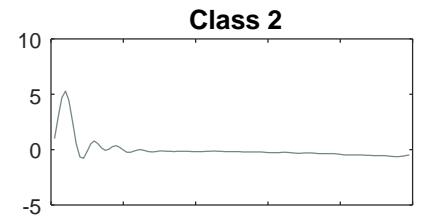
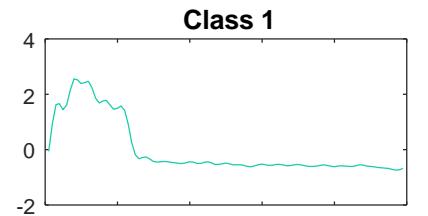
Meat

Twenty exemplars per class, with z-normalization



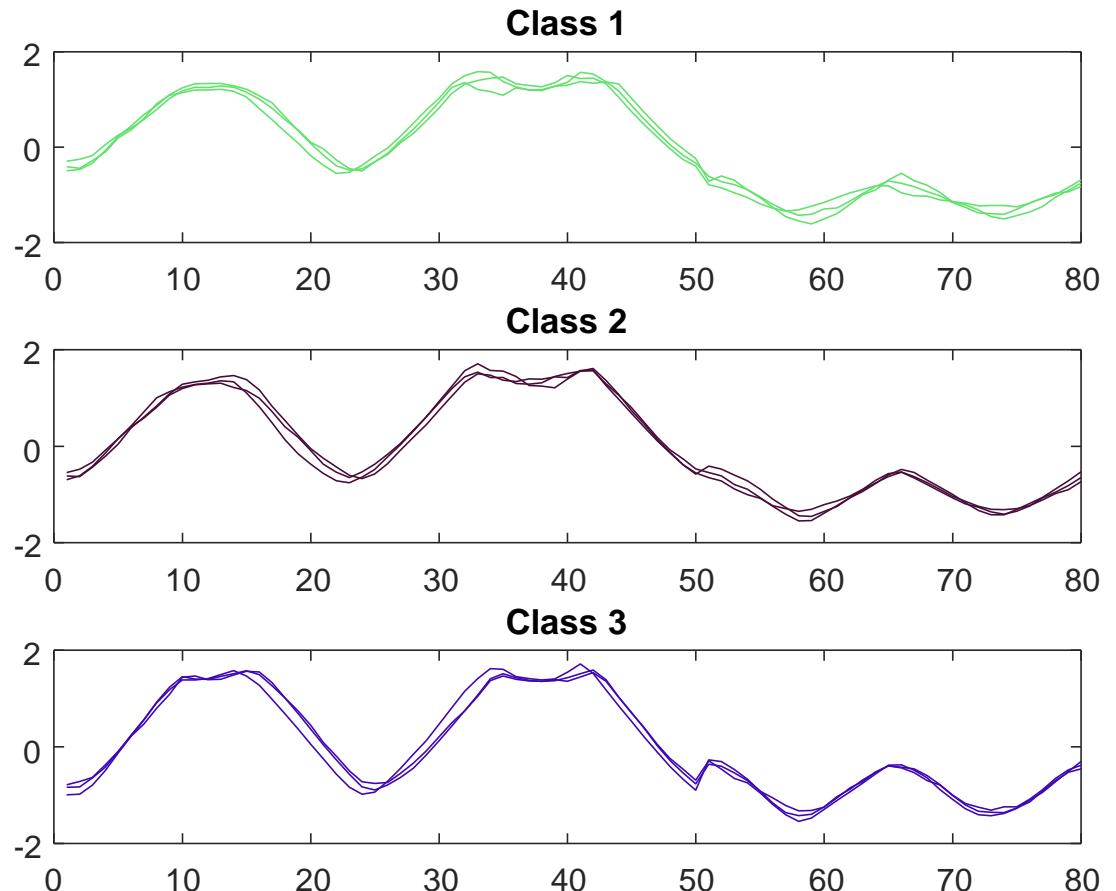
MedicallImages

One exemplar per class,
with z-normalization



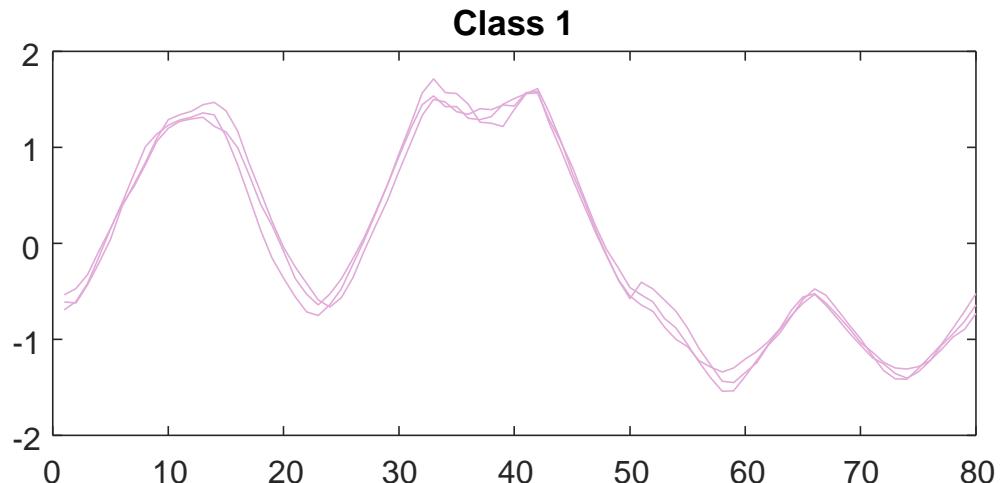
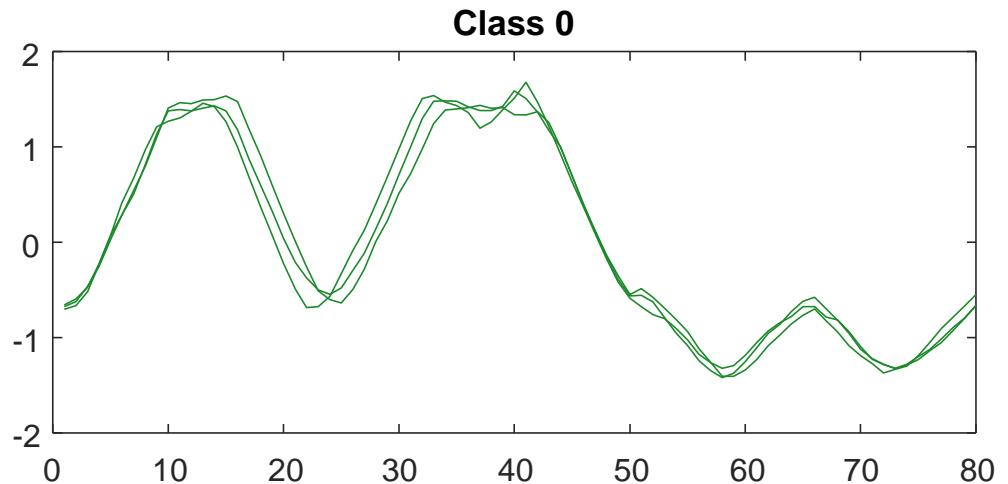
MiddlePhalanxOutlineAgeGroup

Three exemplars per class,
with z-normalization



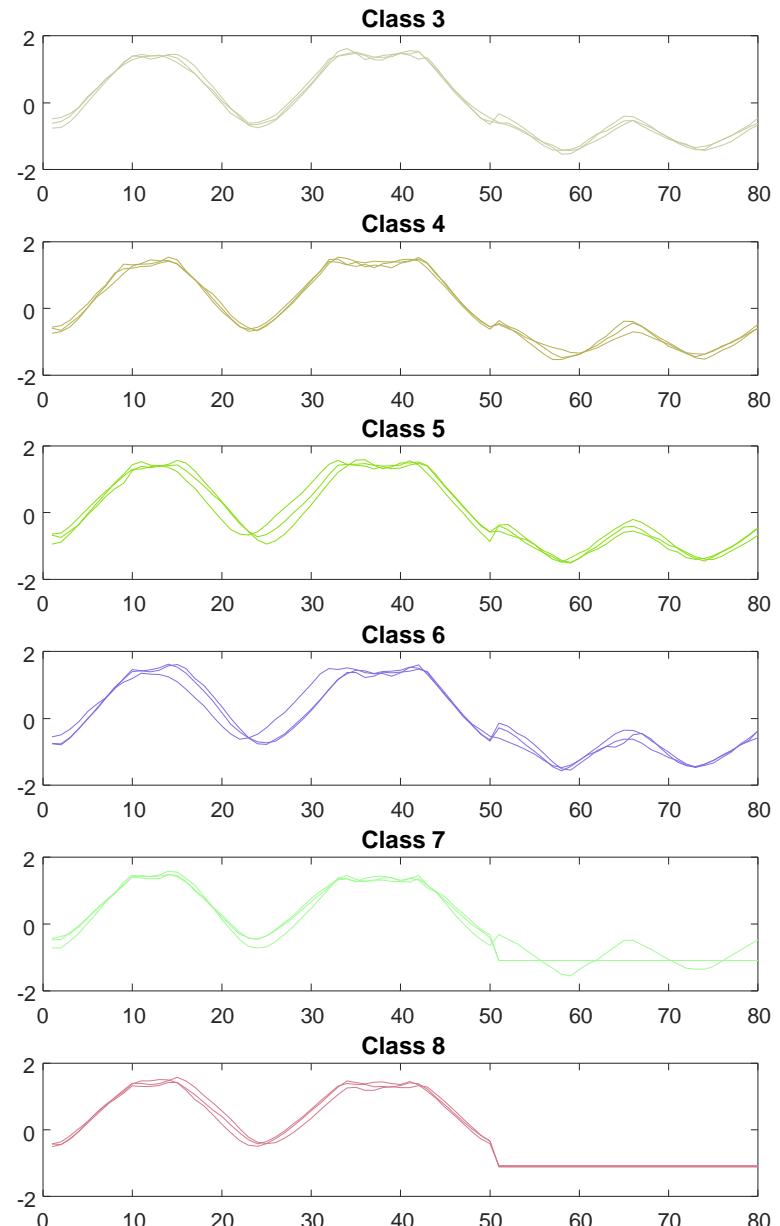
MiddlePhalanxOutlineCorrect

Three exemplars per class,
with z-normalization



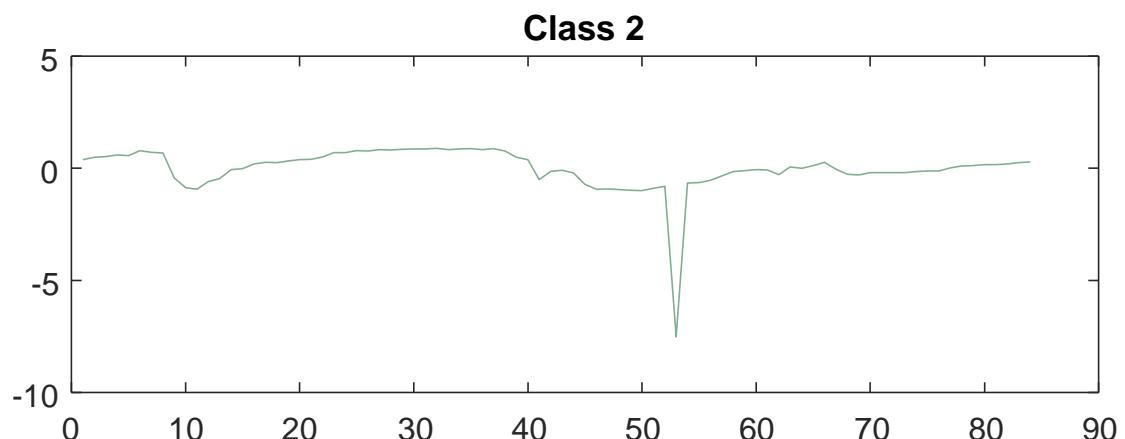
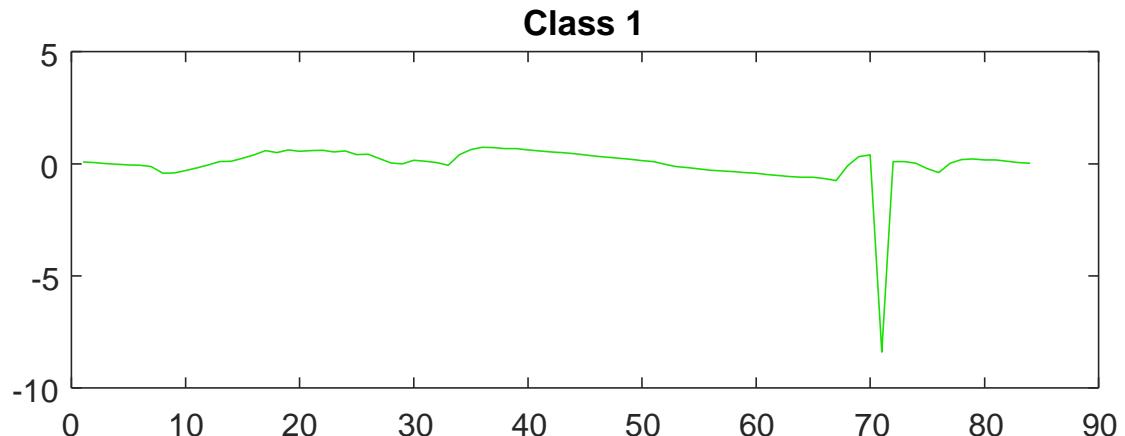
MiddlePhalanxTW

Three exemplars per class,
with z-normalization



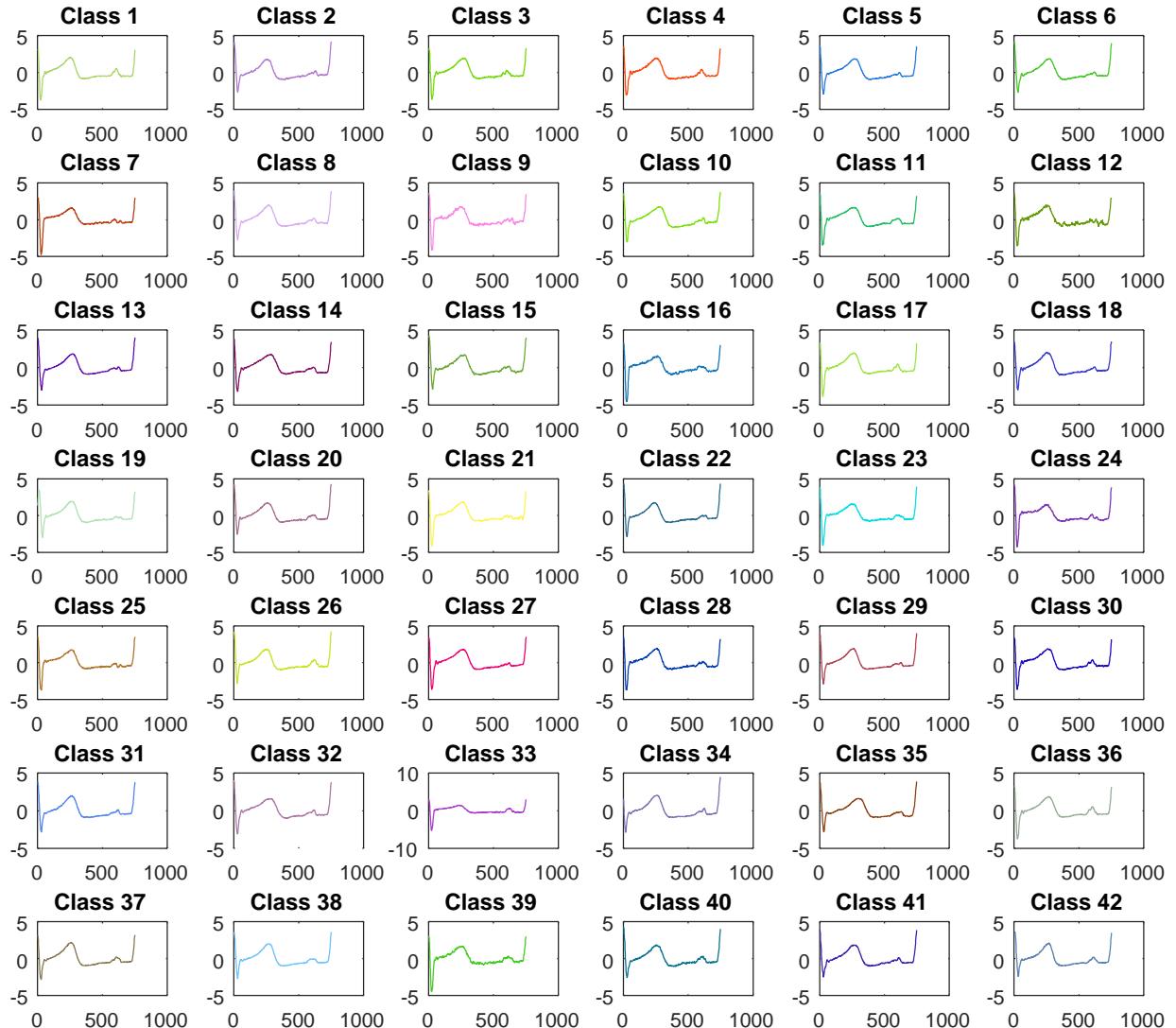
MoteStrain

One exemplar per class,
with z-normalization



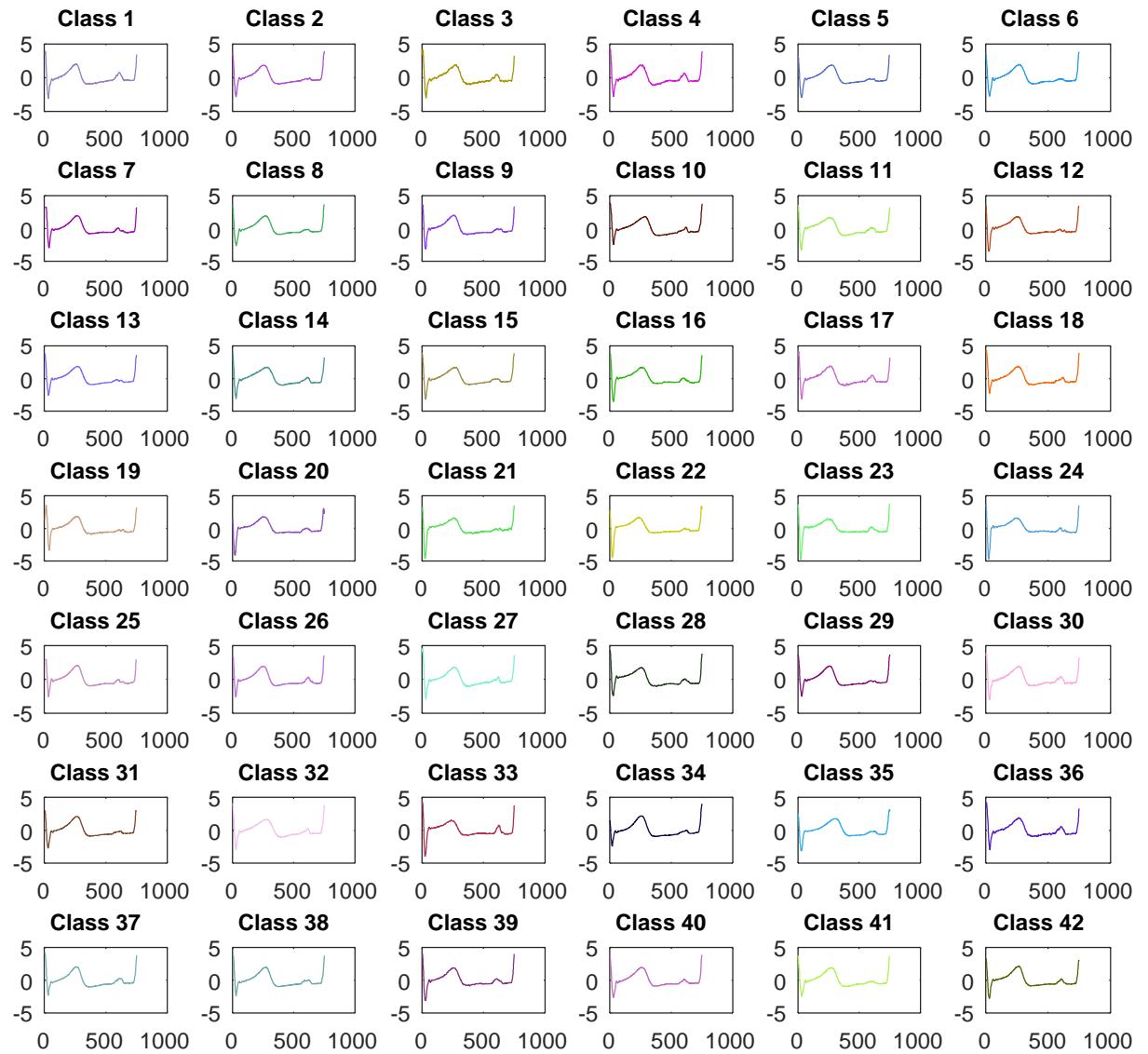
NonInvasiveFetalECGThorax1

One exemplar per class,
with z-normalization



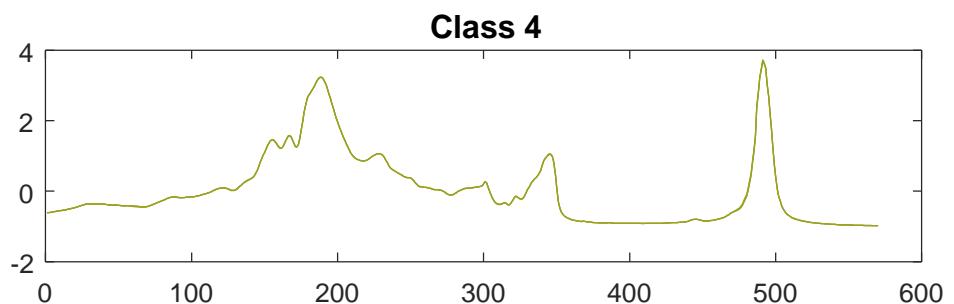
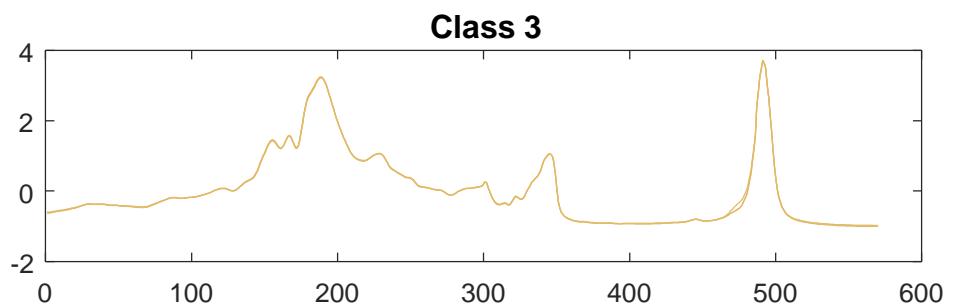
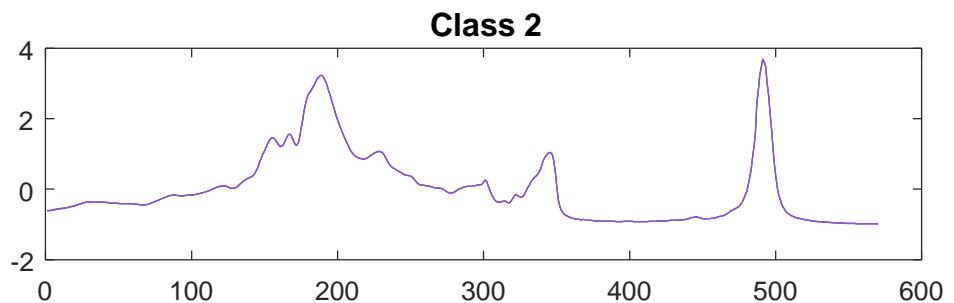
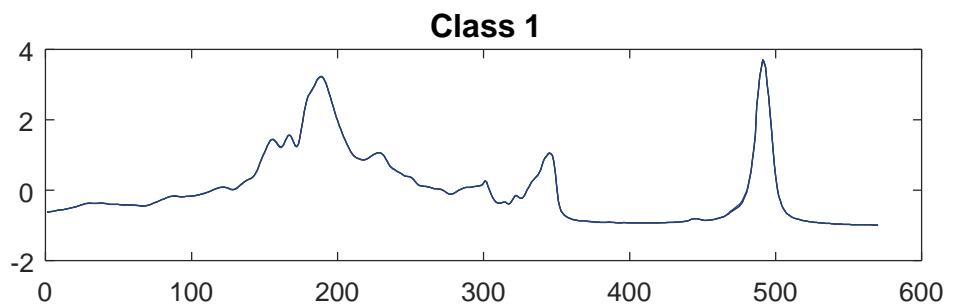
NonInvasiveFetalECGThorax2

One exemplar per class,
with z-normalization



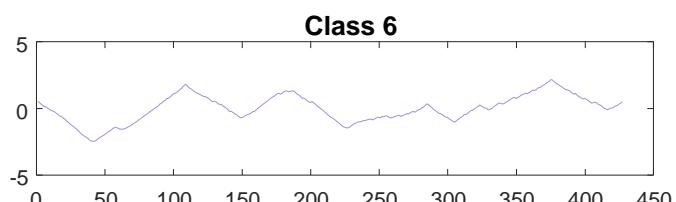
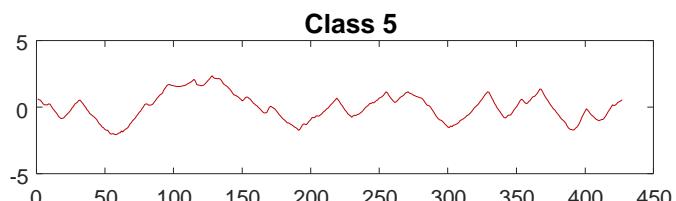
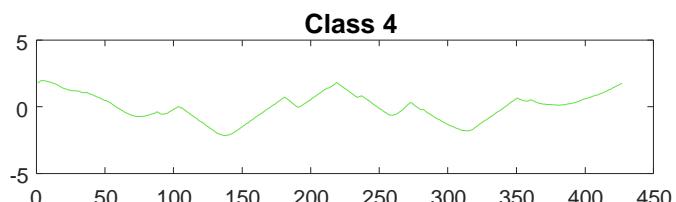
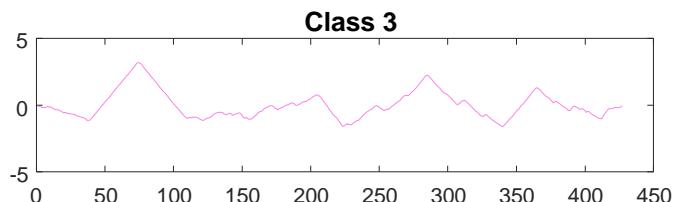
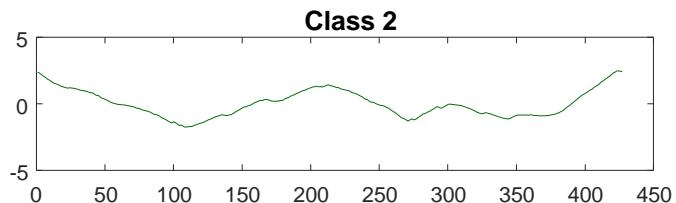
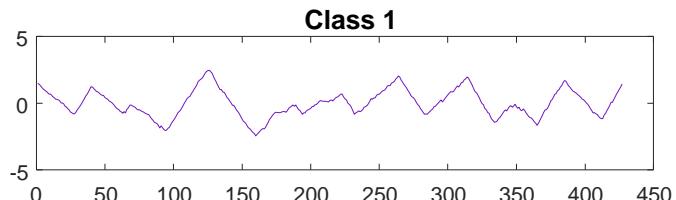
OliveOil

Three exemplars per class,
with z-normalization



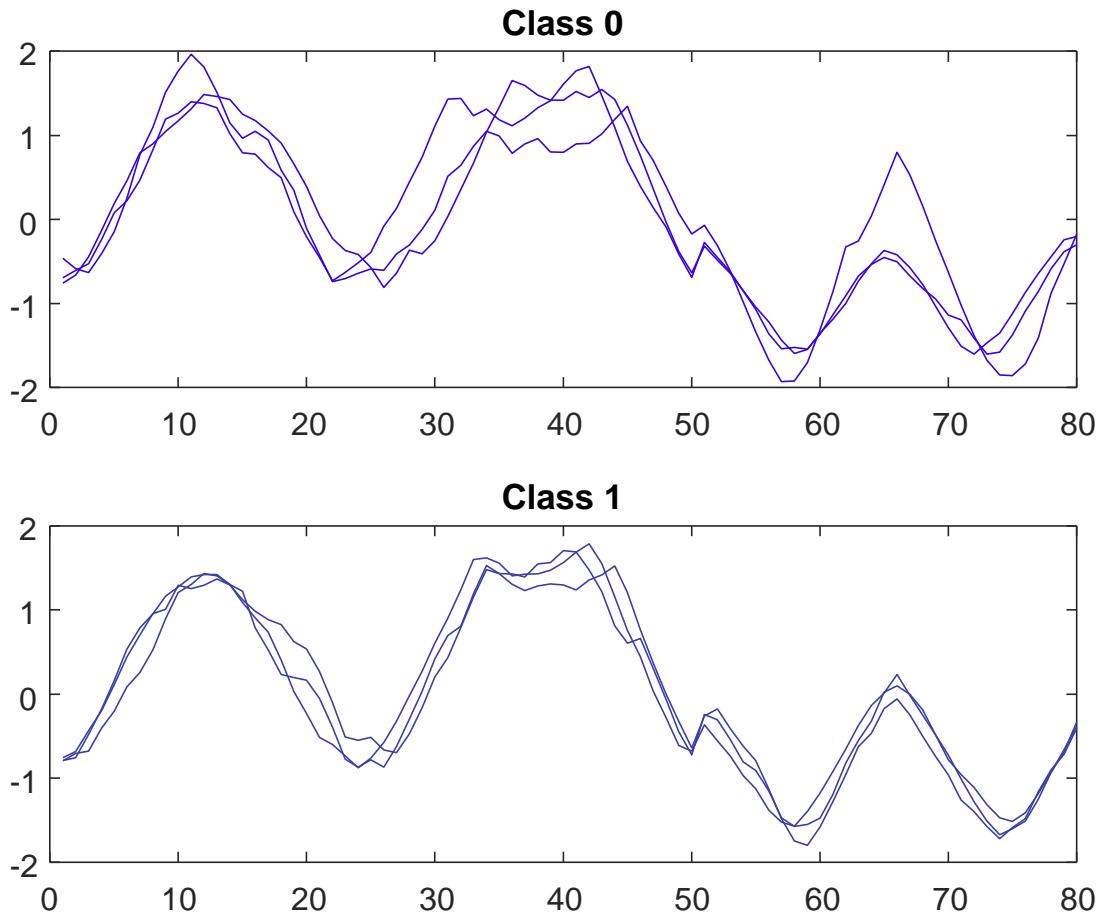
OSULeaf

One exemplar per class,
with z-normalization



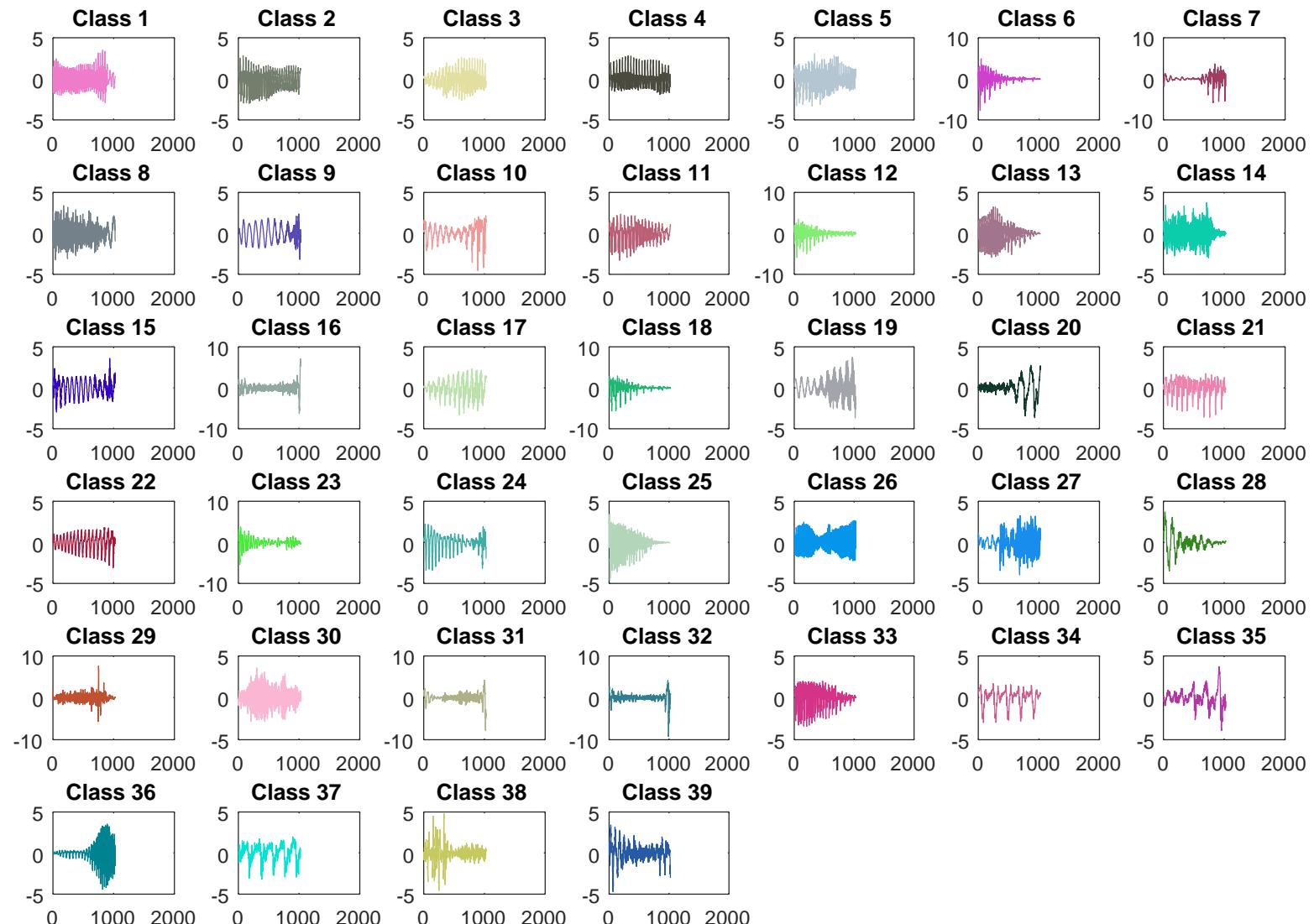
PhalangesOutlinesCorrect

Three exemplars per class,
with z-normalization



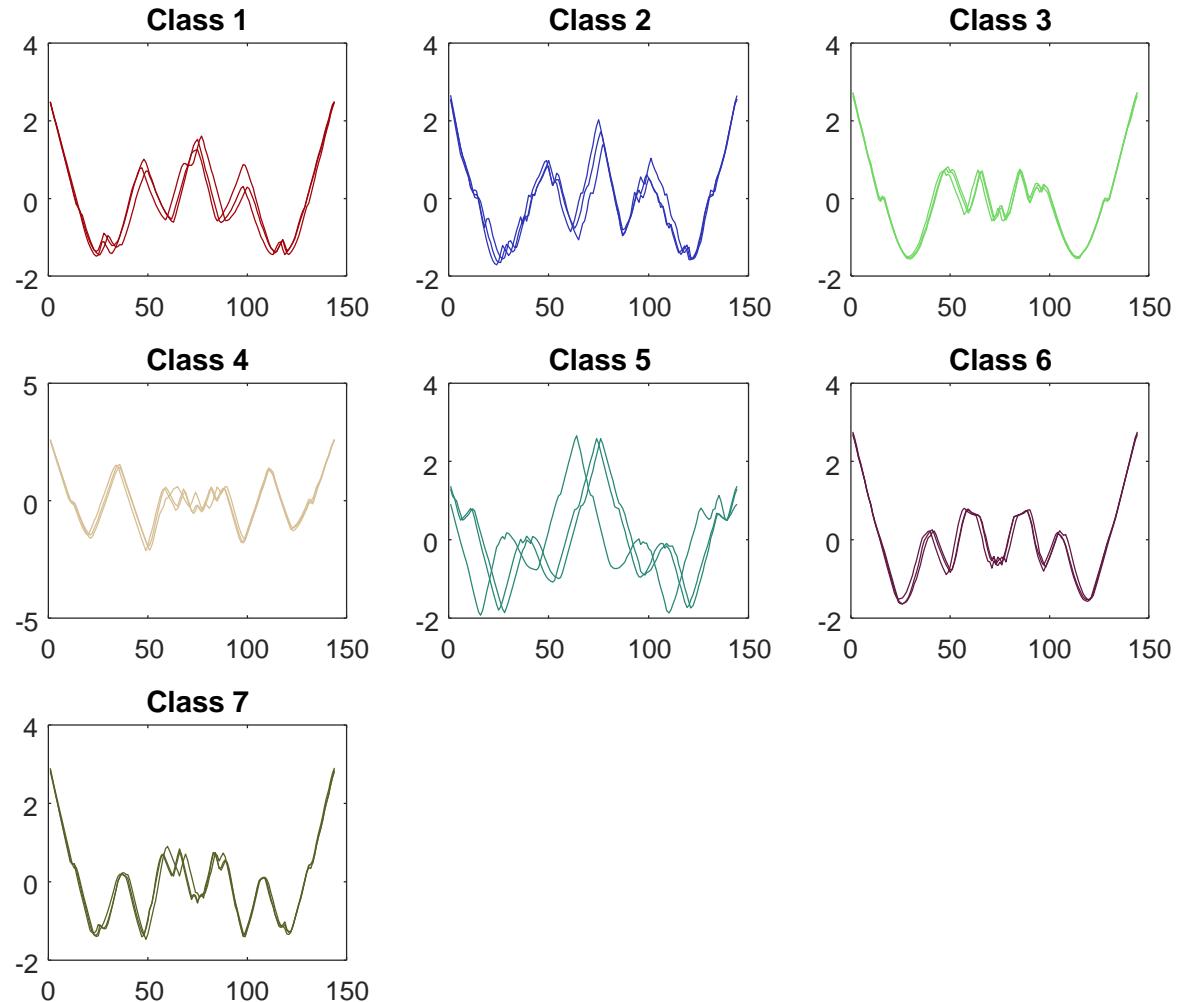
Phoneme

One exemplar per class,
with z-normalization



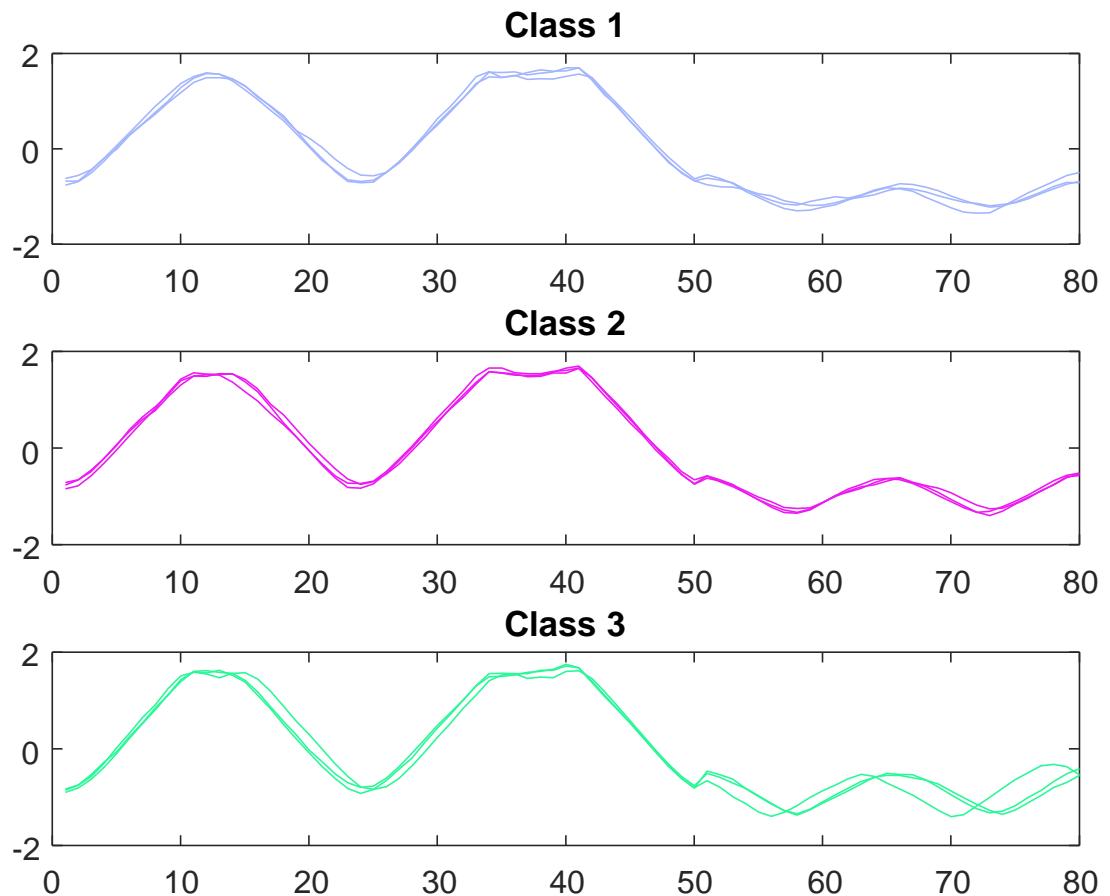
Plane

Three exemplars per class,
with z-normalization



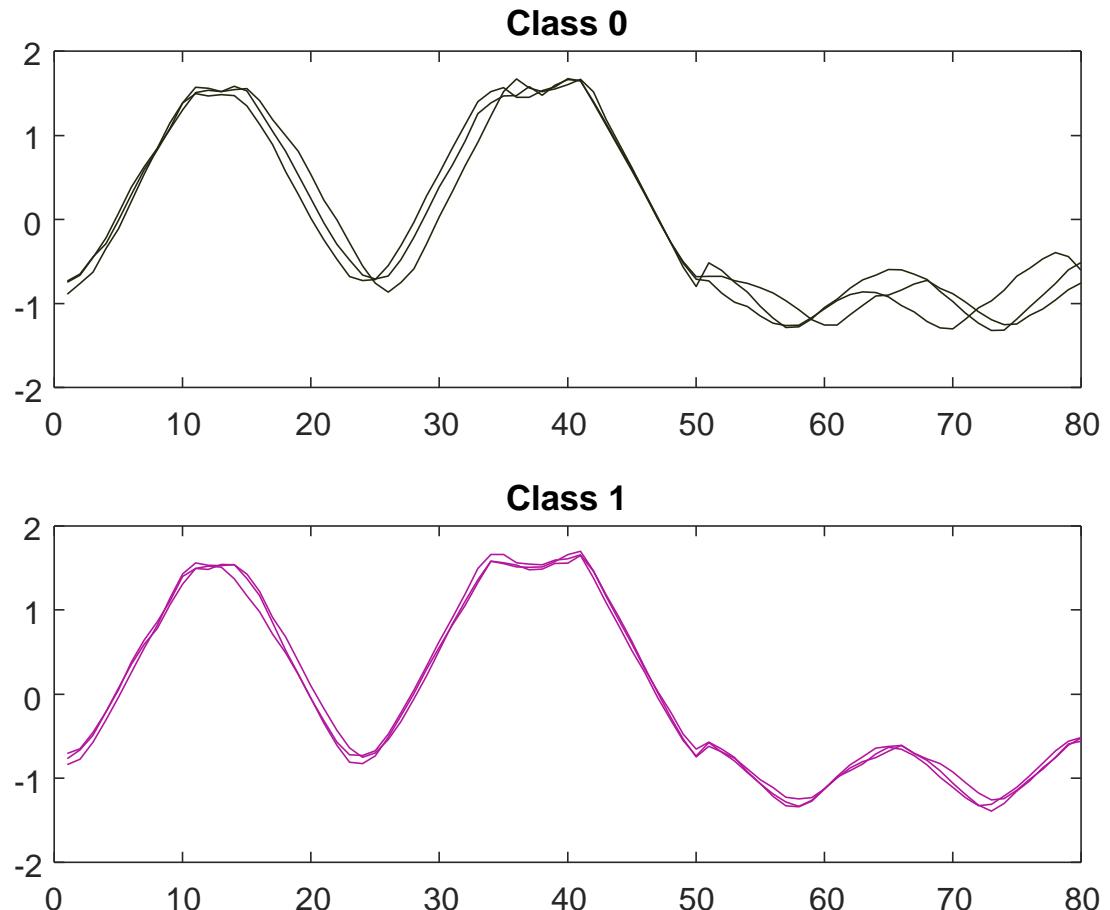
ProximalPhalanxOutlineAgeGroup

Three exemplars per class,
with z-normalization



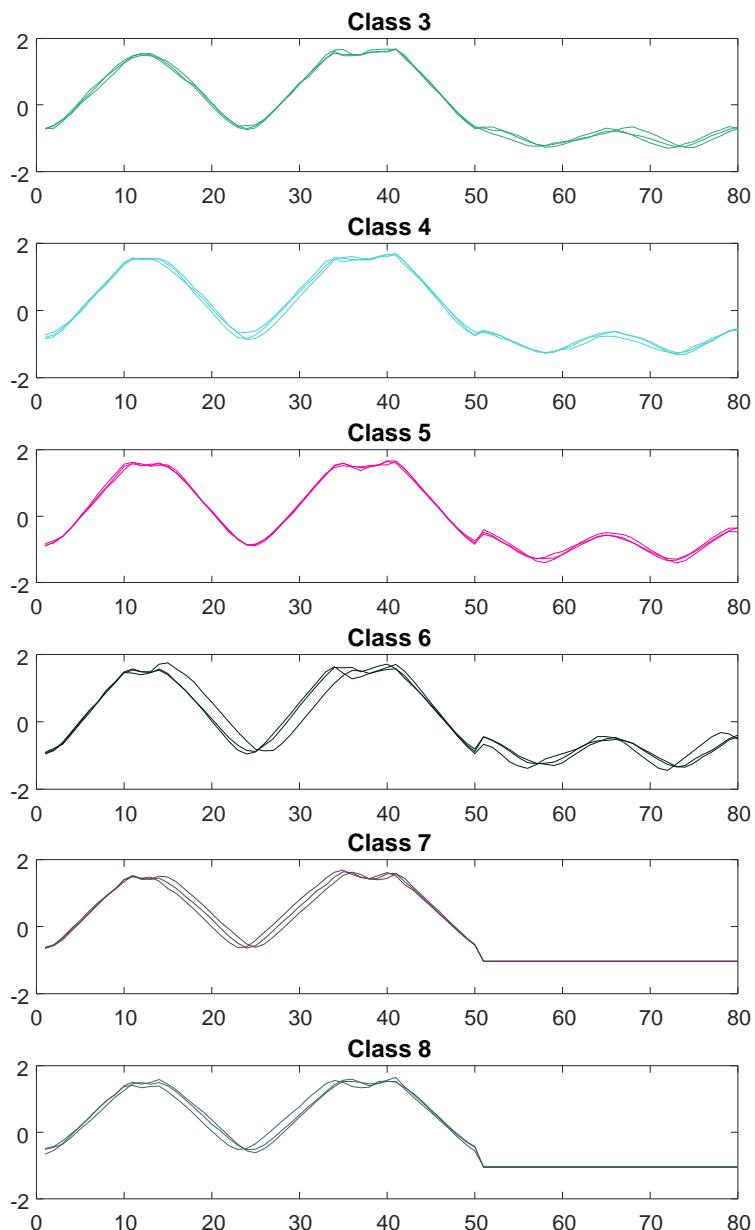
ProximalPhalanxOutlineCorrect

Three exemplars per class,
with z-normalization



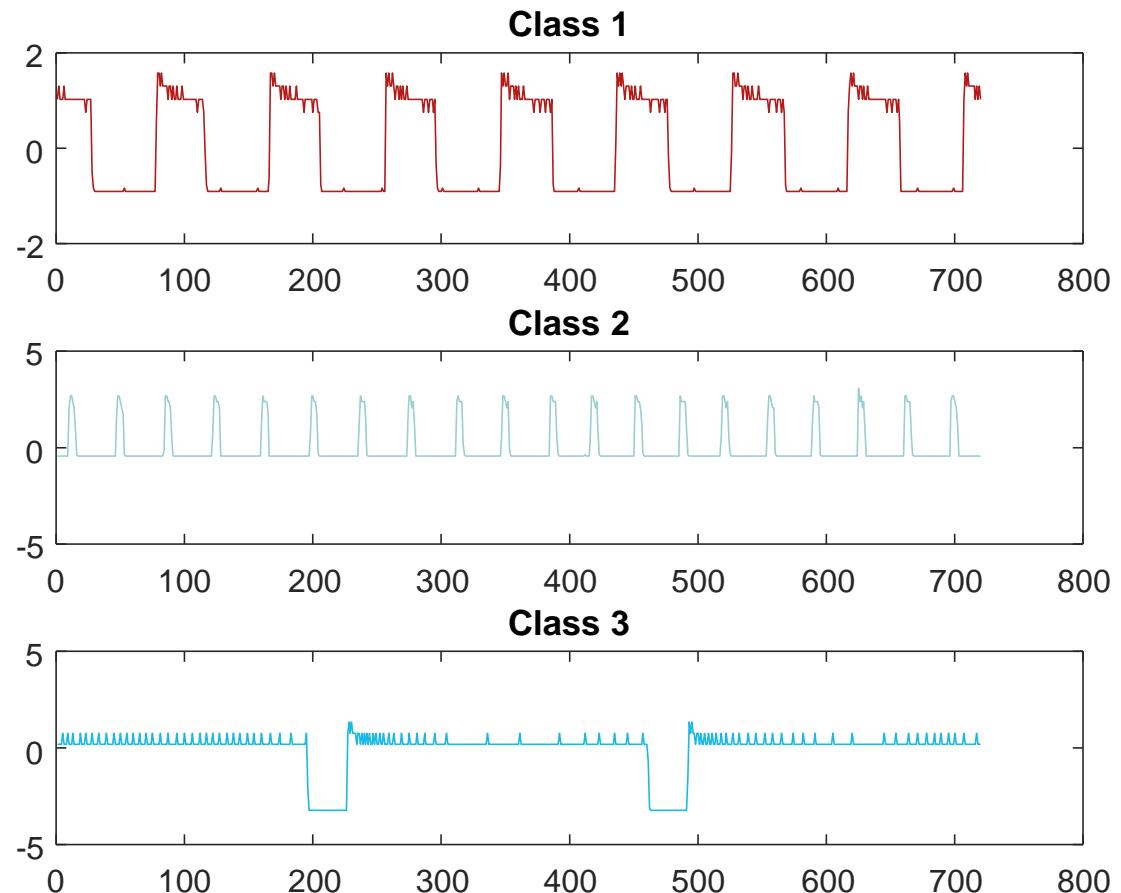
ProximalPhalanxTW

Three exemplars per class,
with z-normalization



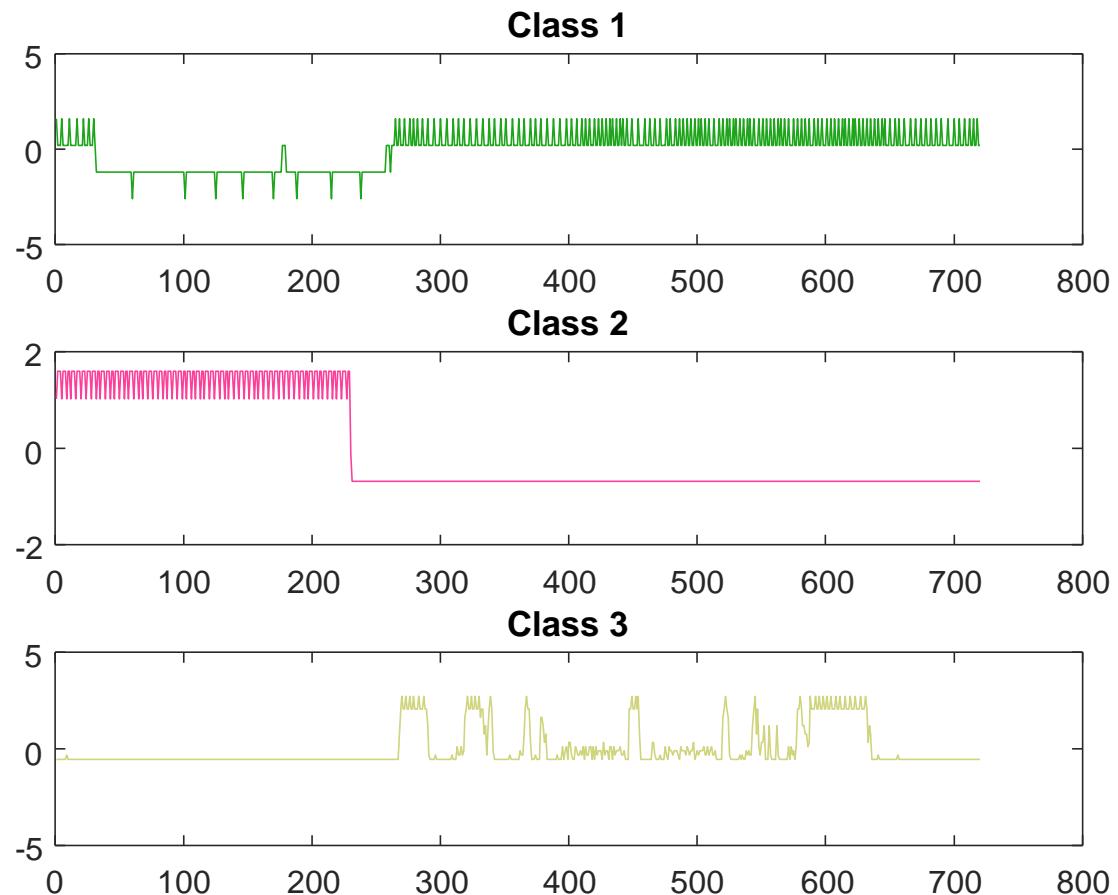
RefrigerationsDevices

One exemplar per class,
with z-normalization



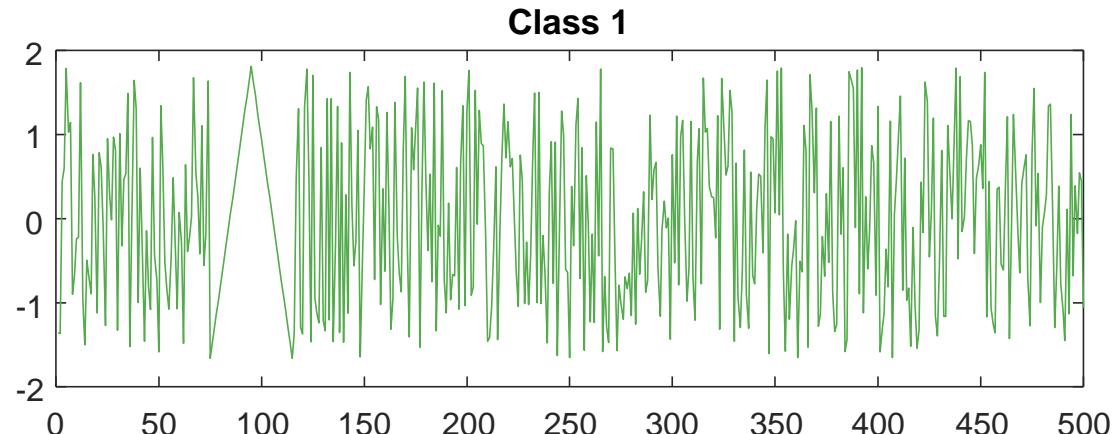
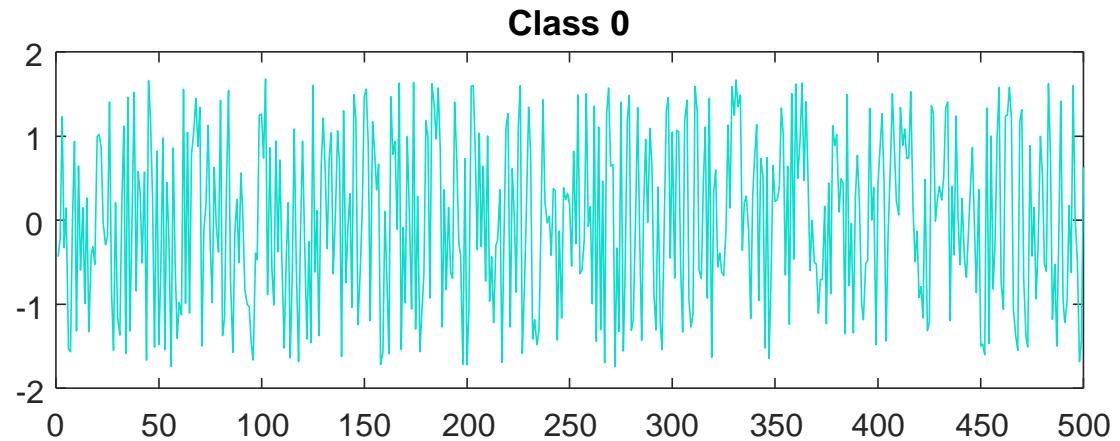
ScreenType

One exemplar per class,
with z-normalization



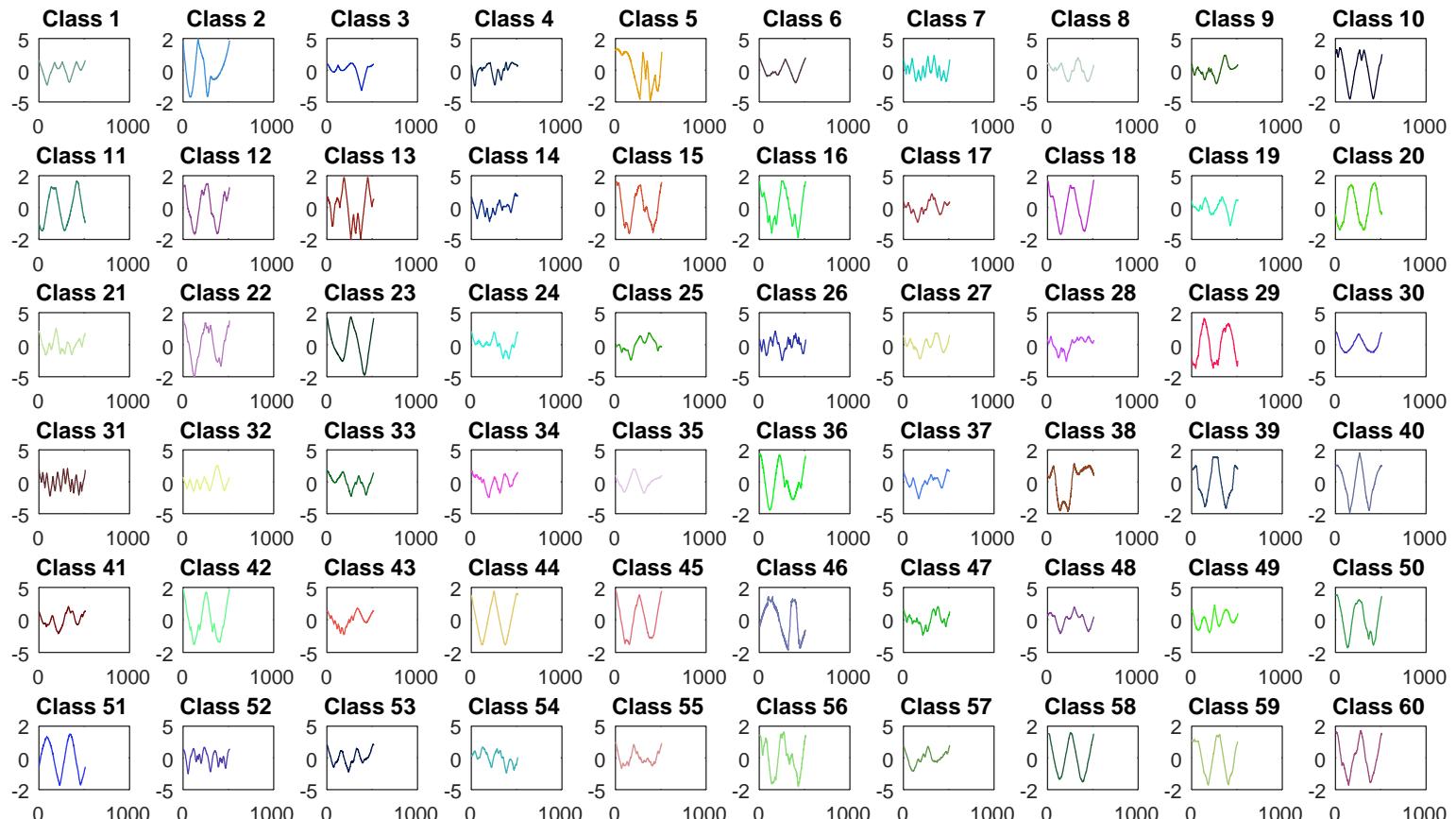
ShapeletSim

One exemplar per class,
with z-normalization



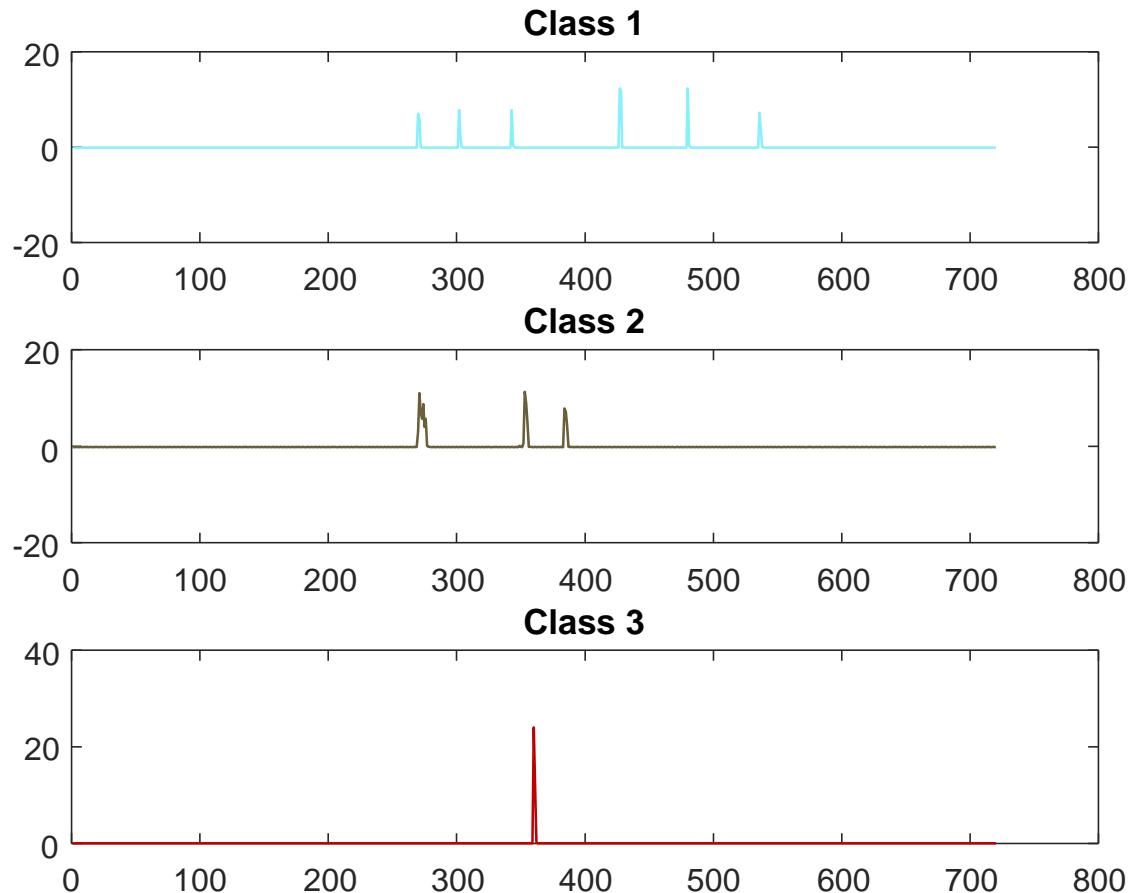
ShapesAll

One exemplar per class,
with z-normalization



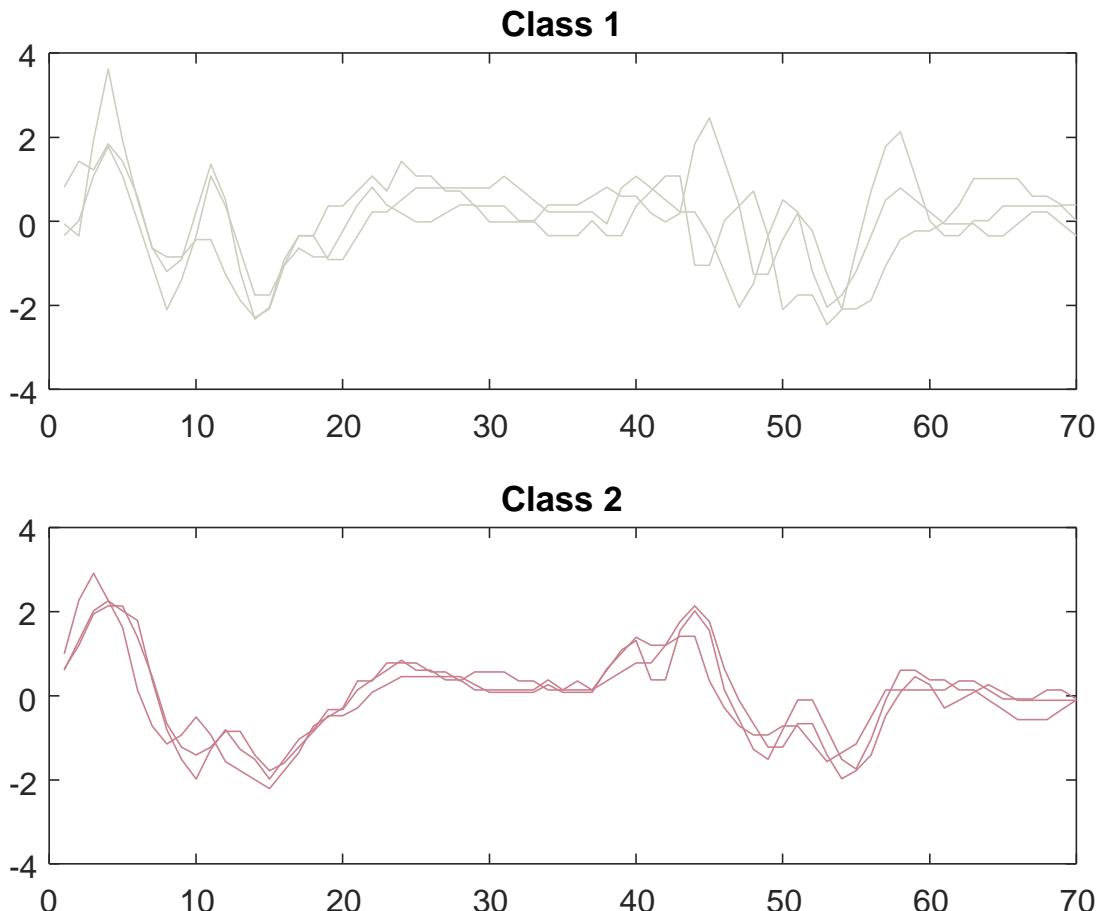
SmallKitchenAppliances

One exemplar per class,
with z-normalization



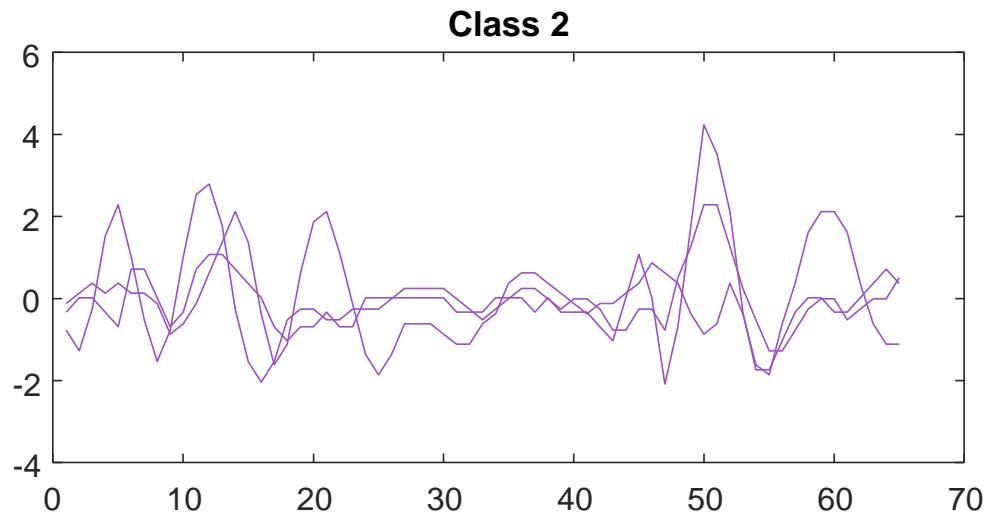
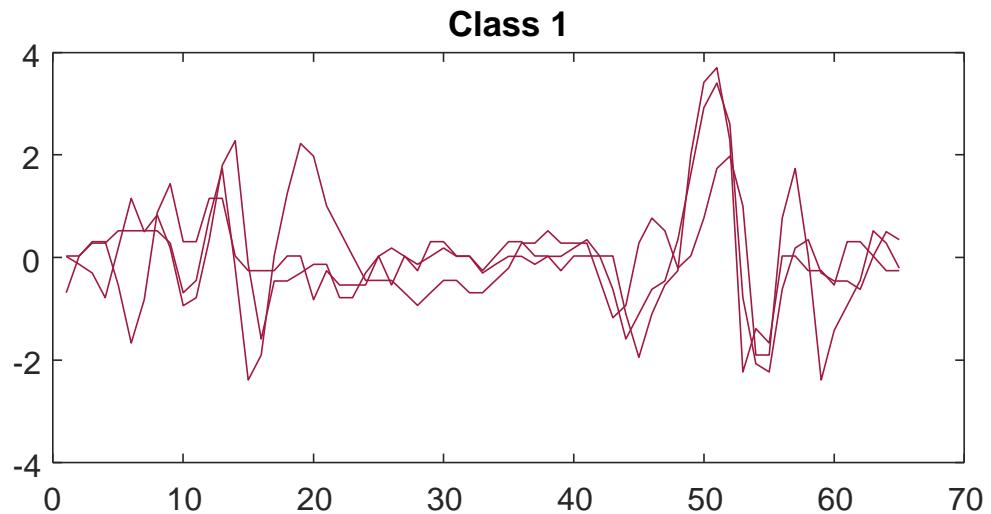
SonyAIBORobotSurface1

Three exemplars per class,
with z-normalization



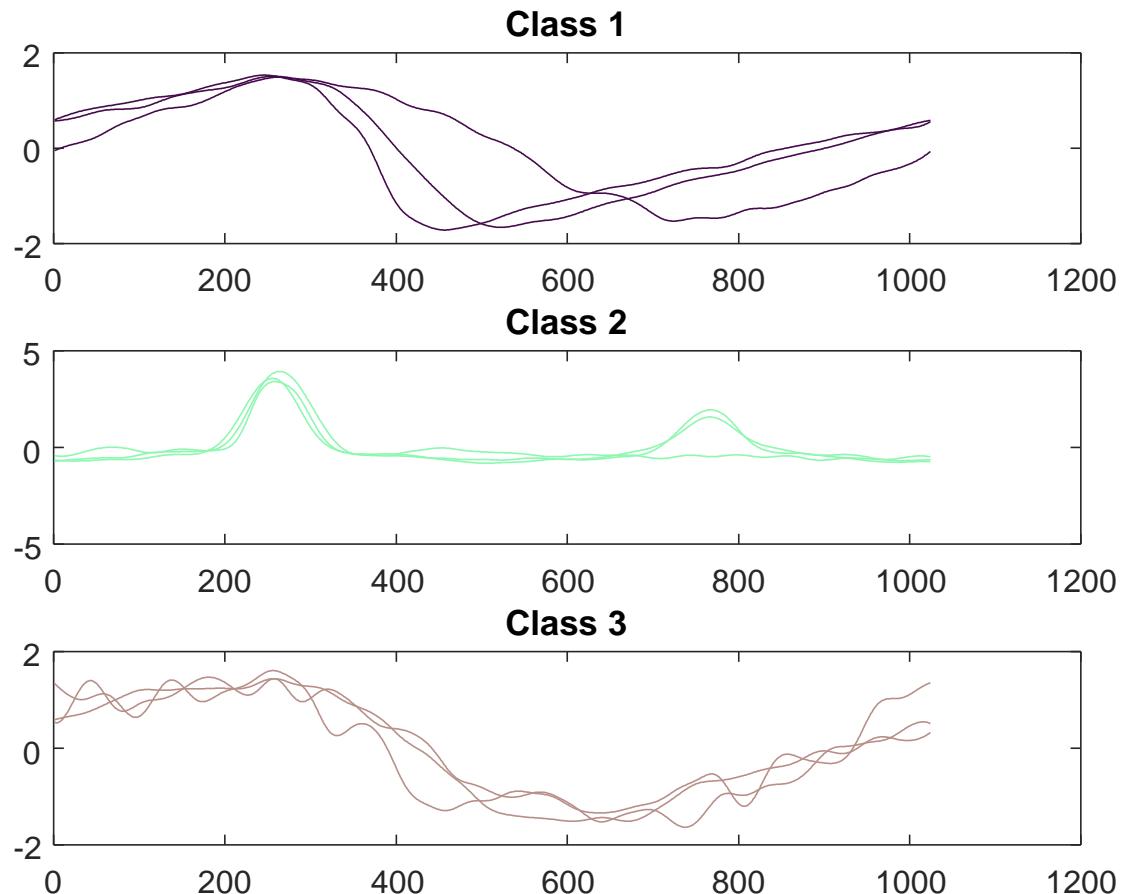
SonyAIBORobotSurface2

Three exemplars per class,
with z-normalization



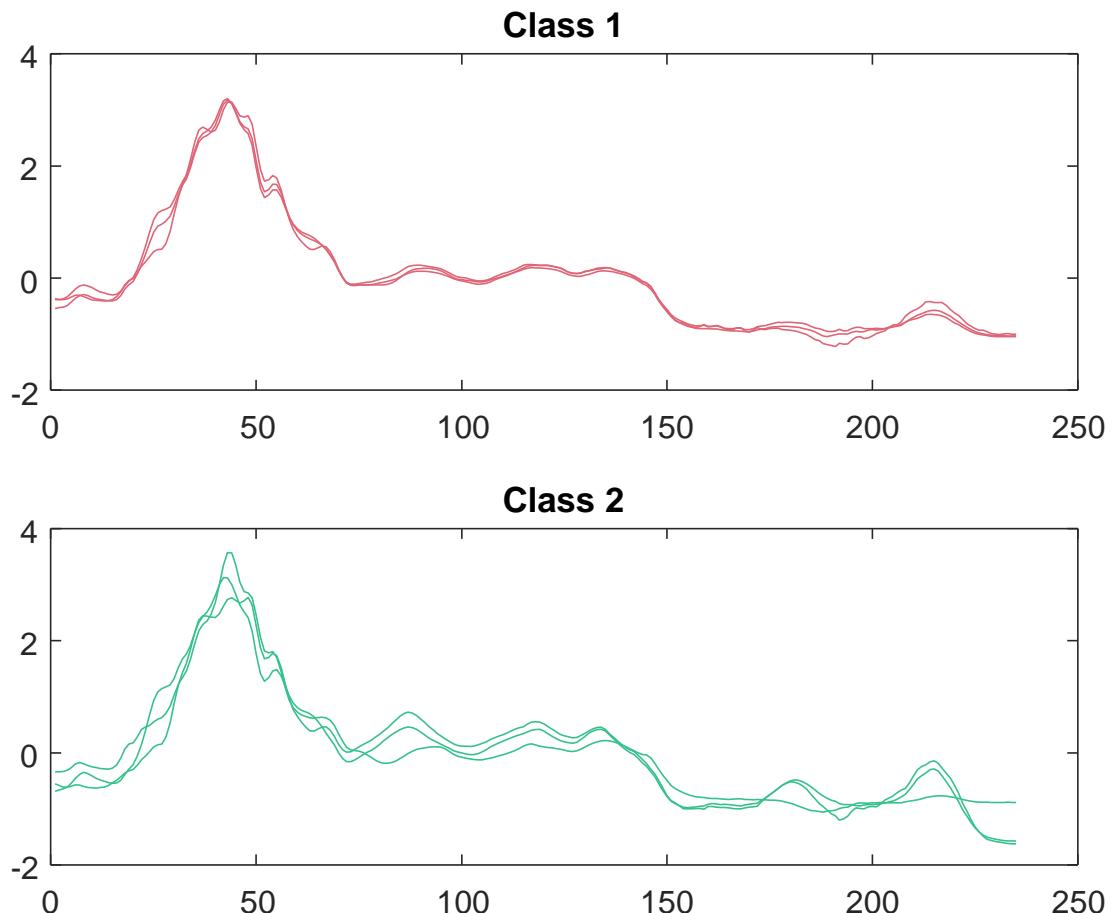
StarLightCurves

Three exemplars per class,
with z-normalization



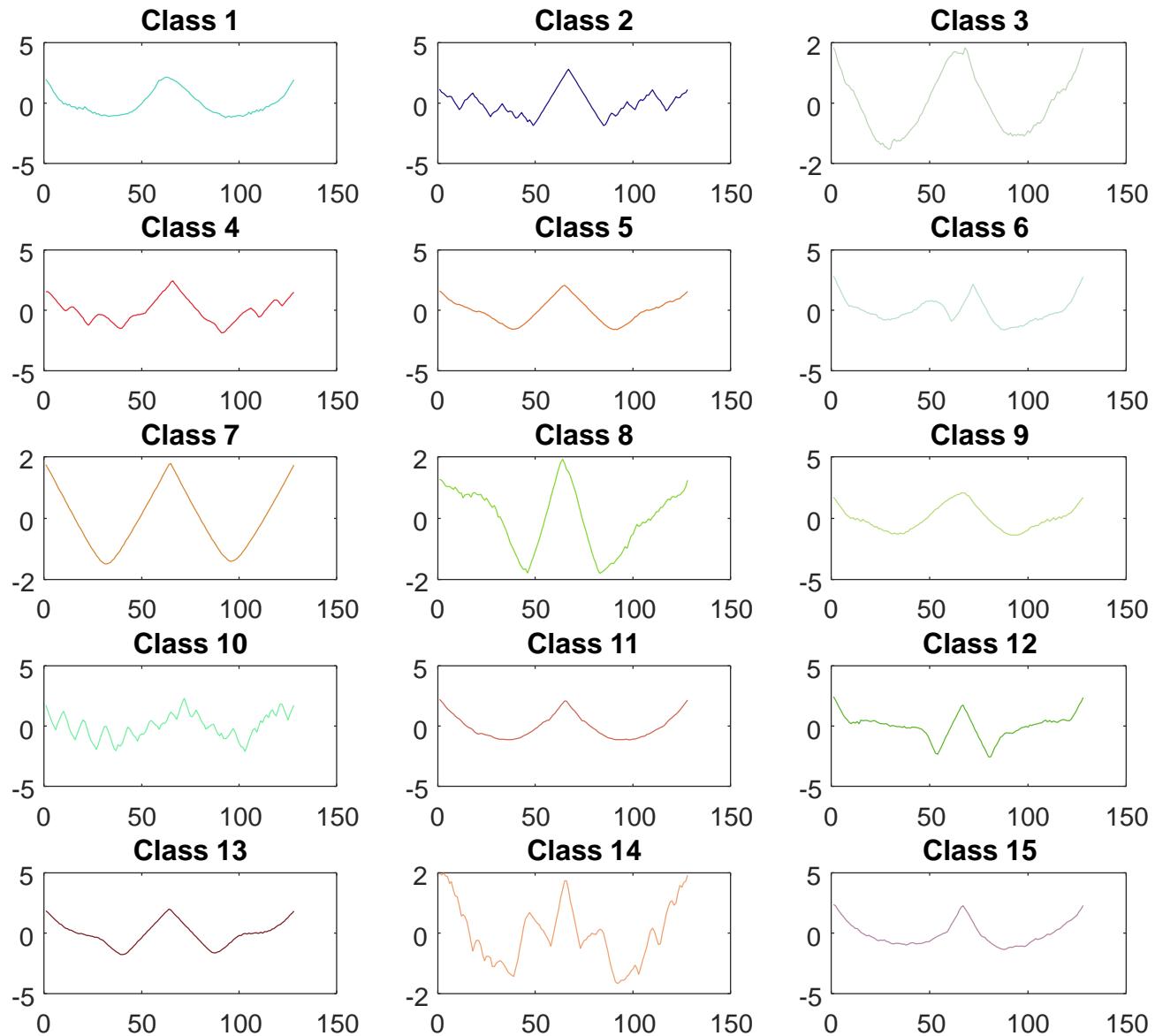
Strawberry

Three exemplars per class,
with z-normalization



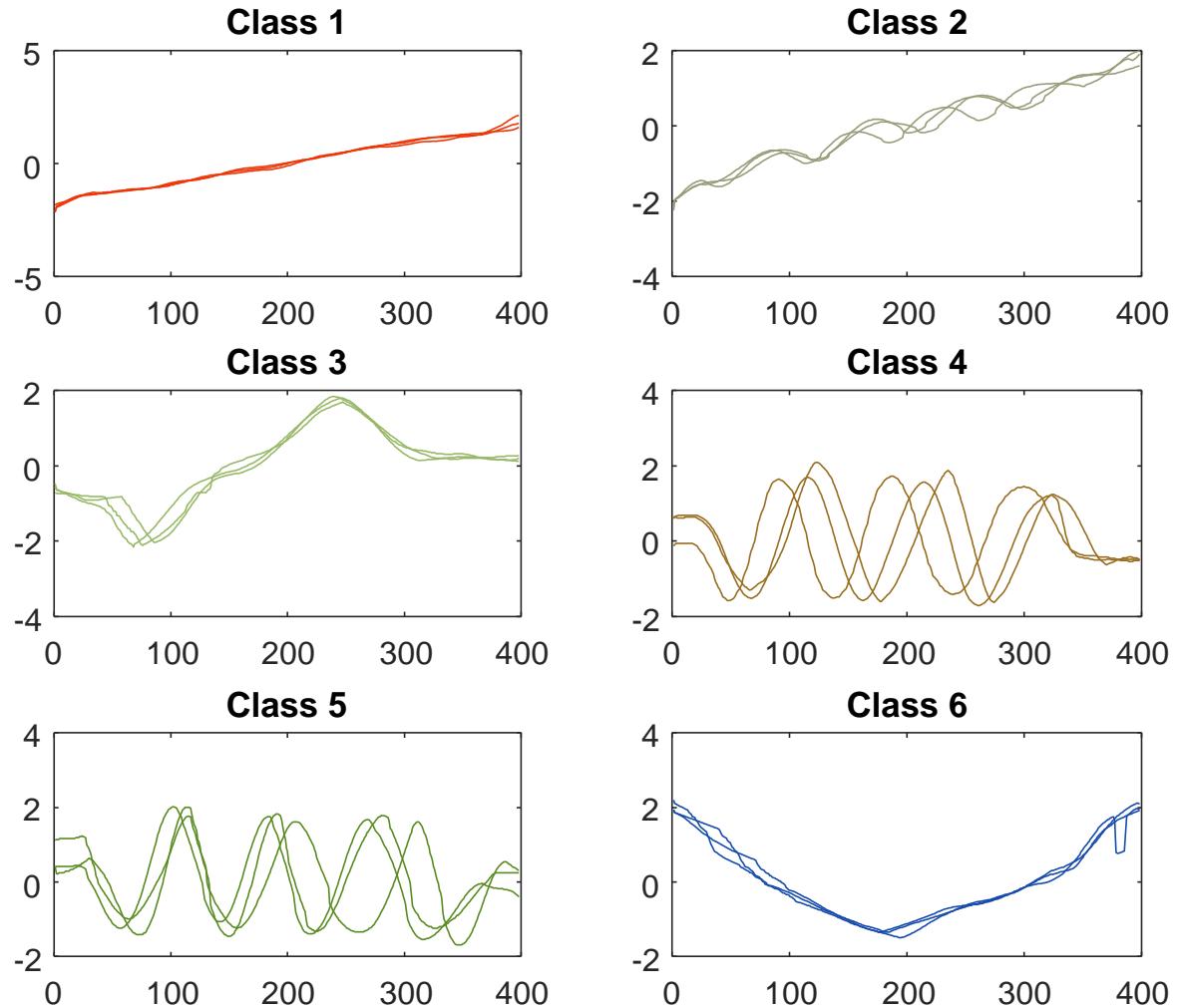
SwedishLeaf

One exemplar per class,
with z-normalization



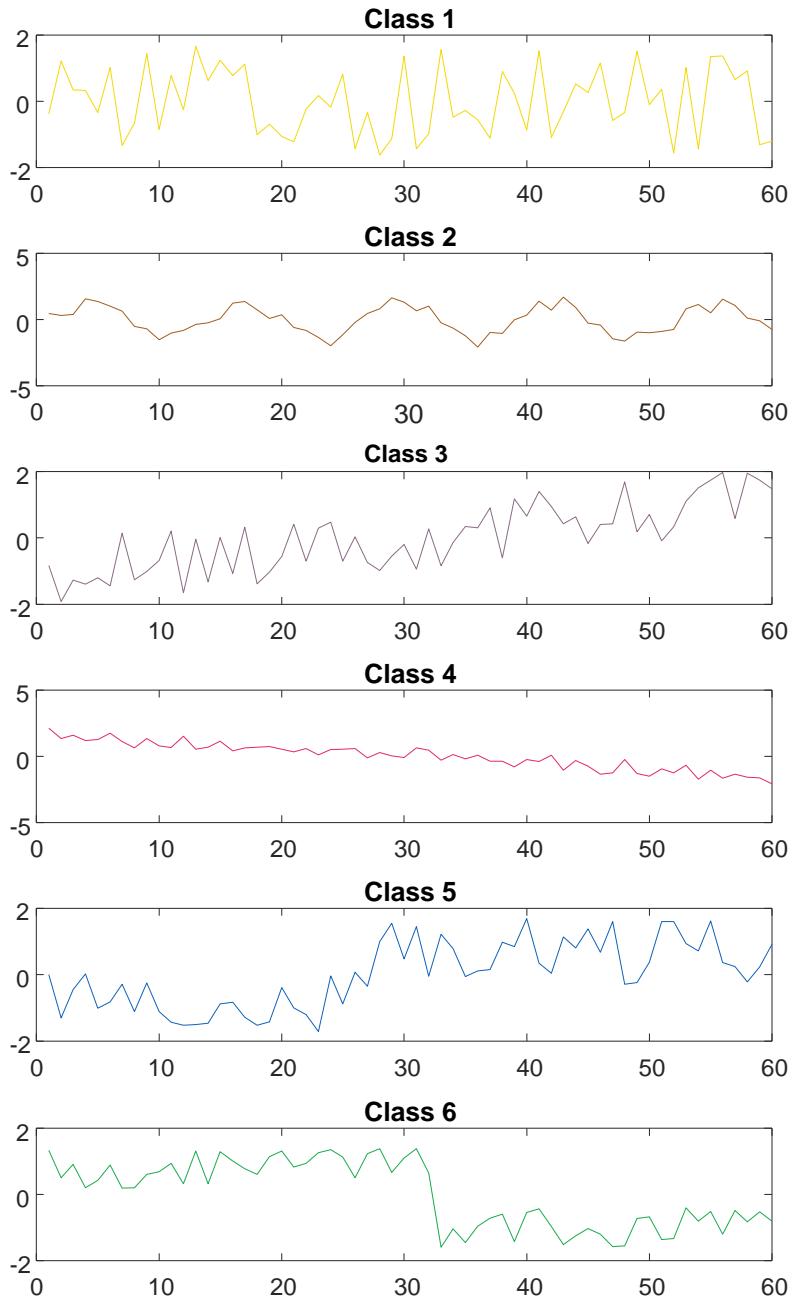
Symbols

Three exemplars per class,
with z-normalization



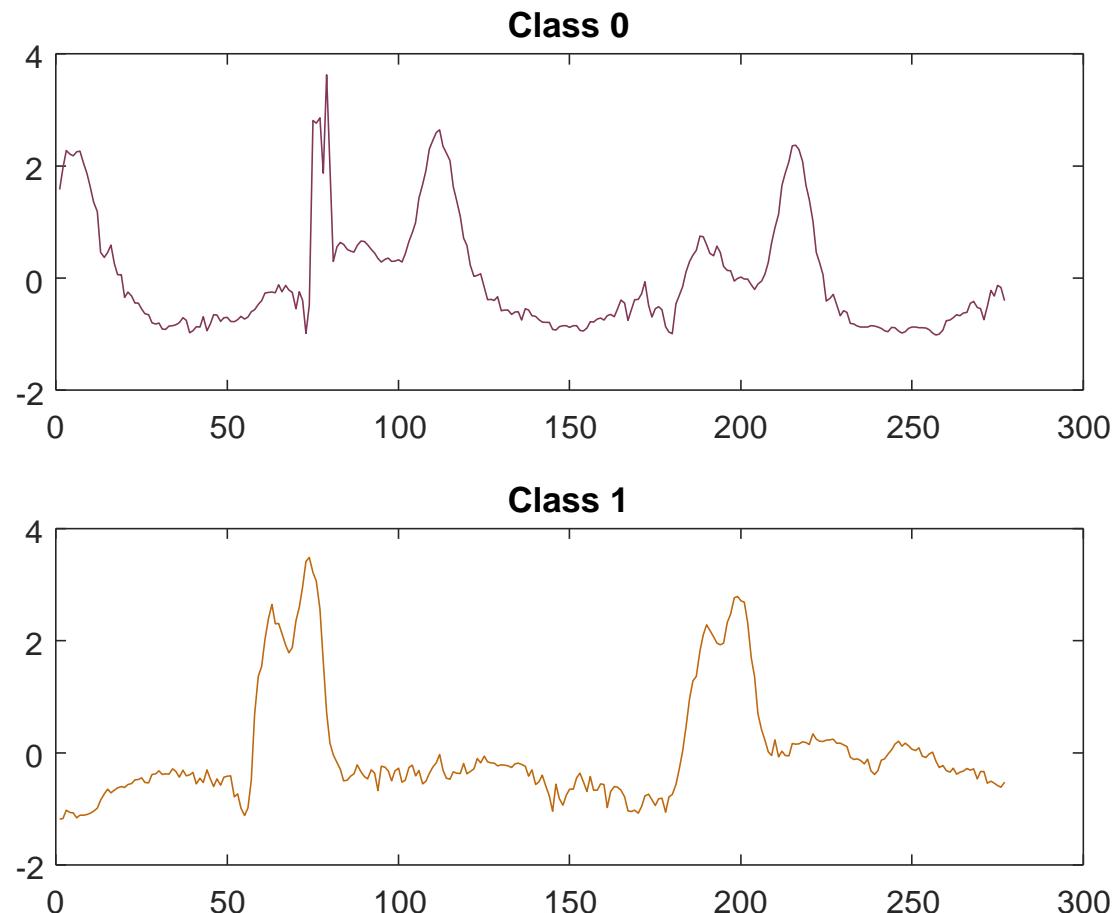
SyntheticControl

One exemplar per class,
with z-normalization



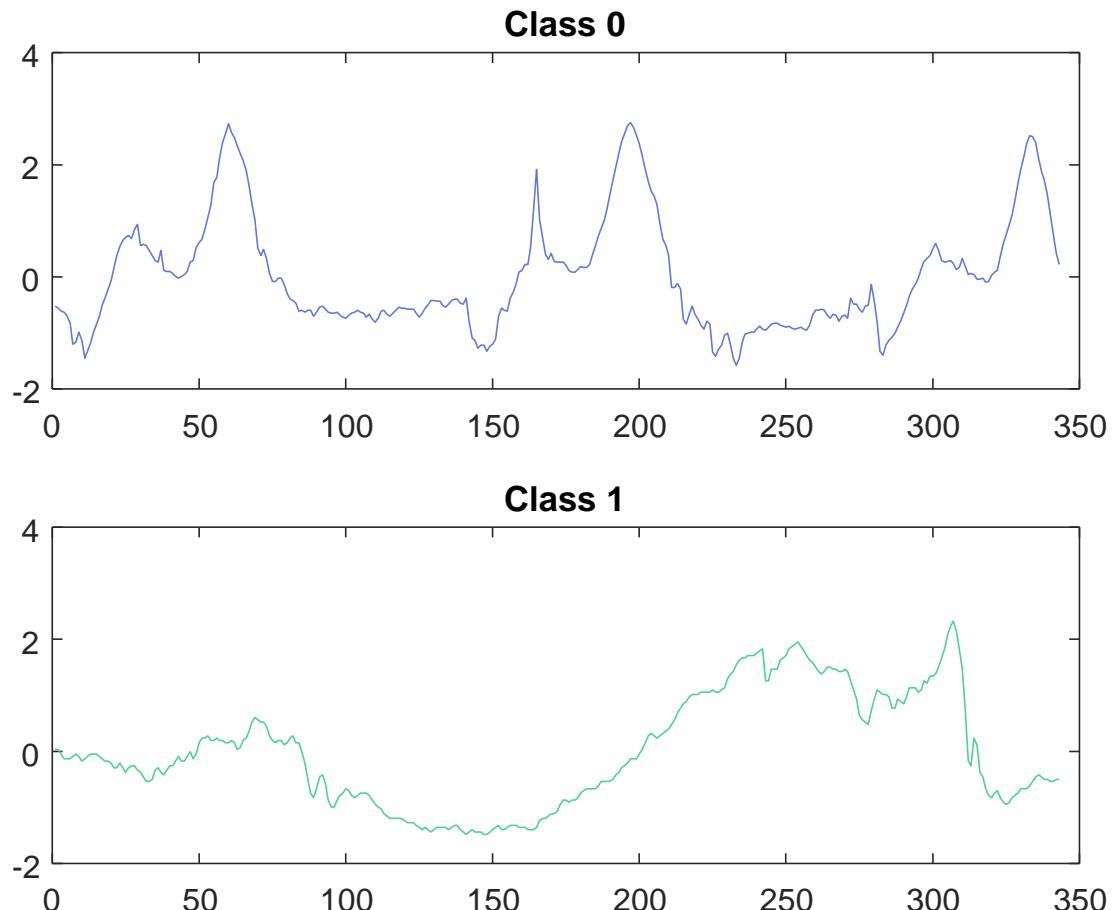
ToeSegmentation1

One exemplar per class,
with z-normalization



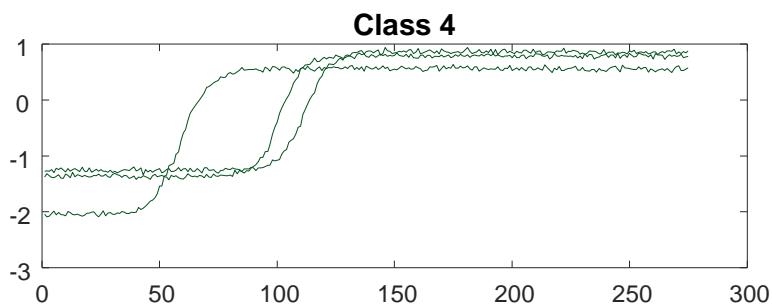
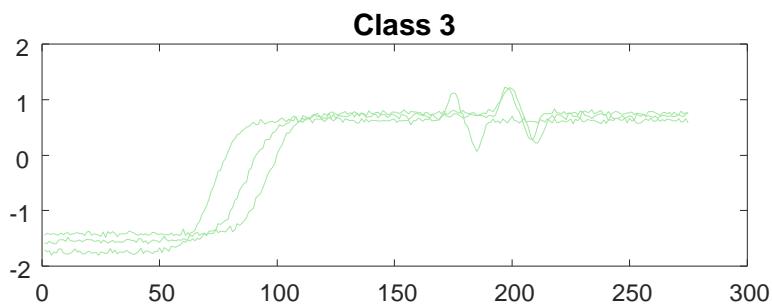
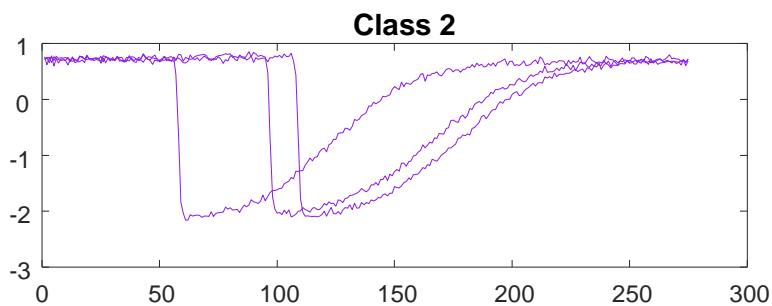
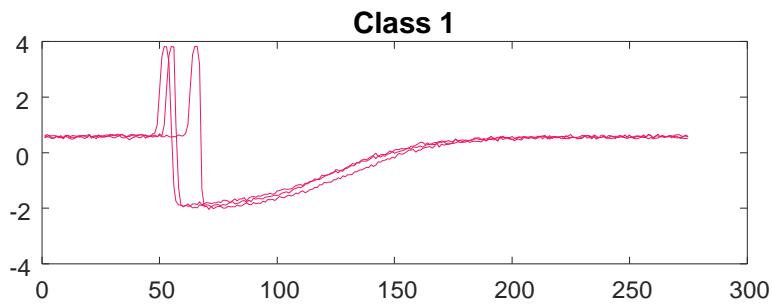
ToeSegmentation2

One exemplar per class,
with z-normalization



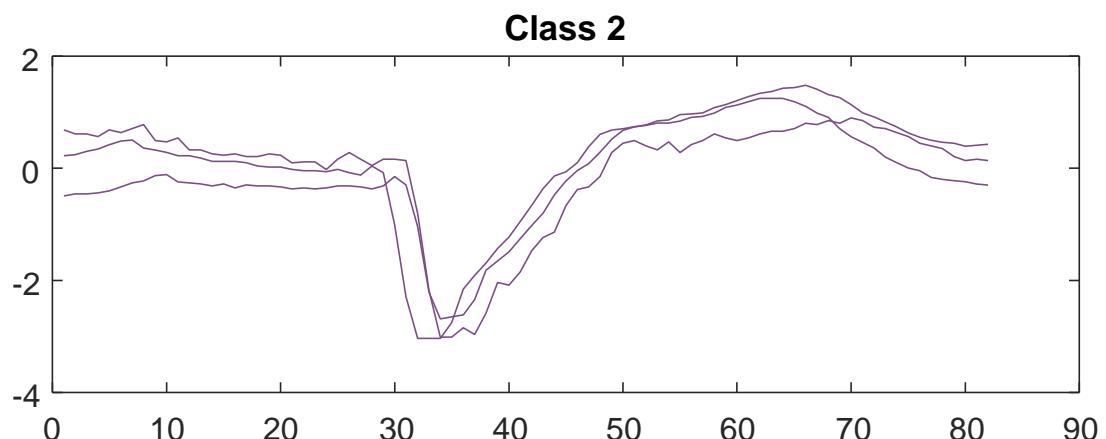
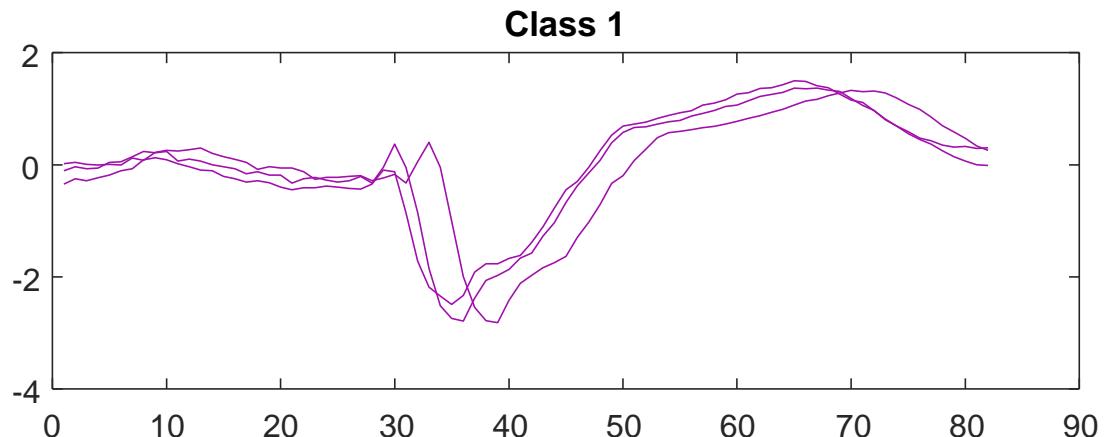
Trace

Three exemplars per class,
with z-normalization



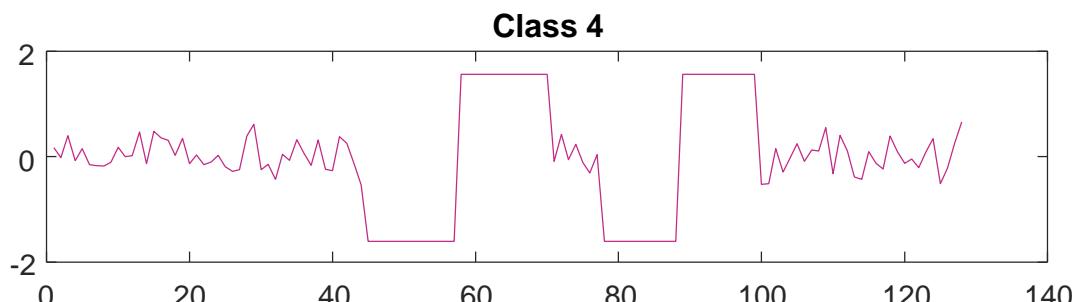
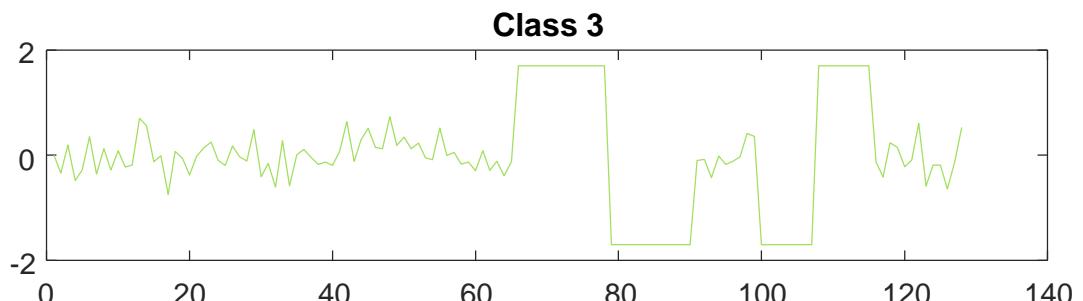
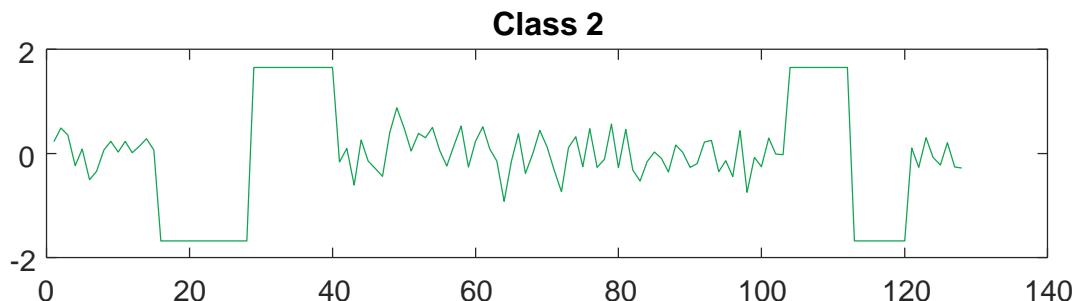
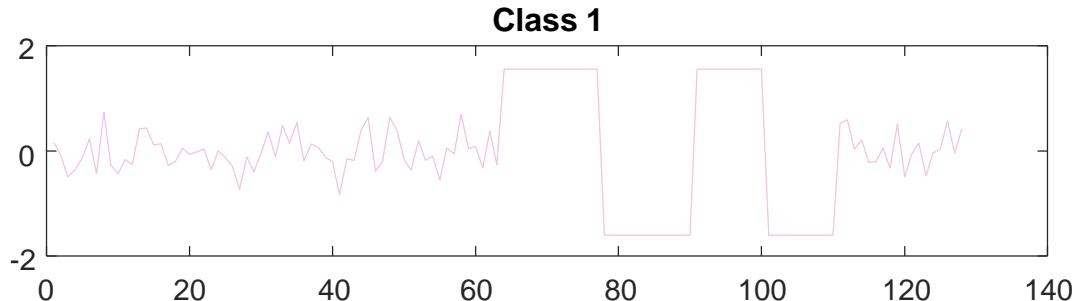
TwoLeadECG

Three exemplars per class,
with z-normalization



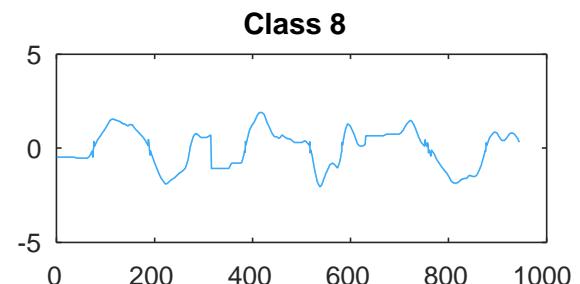
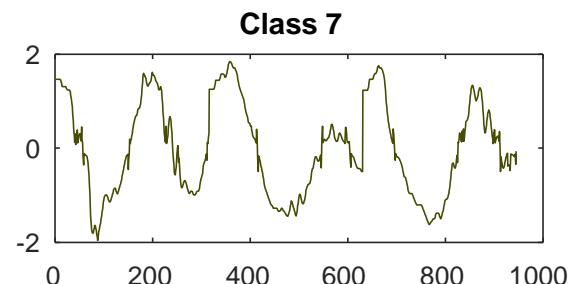
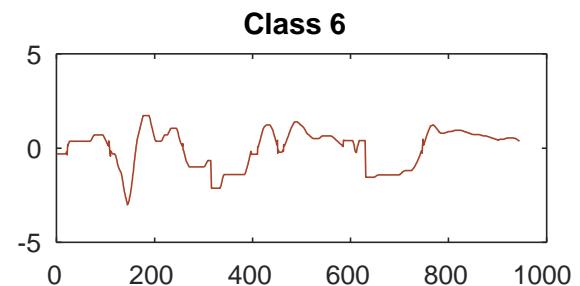
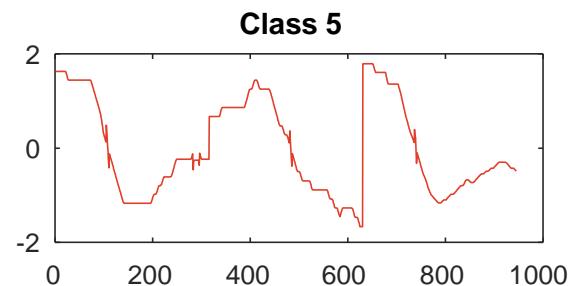
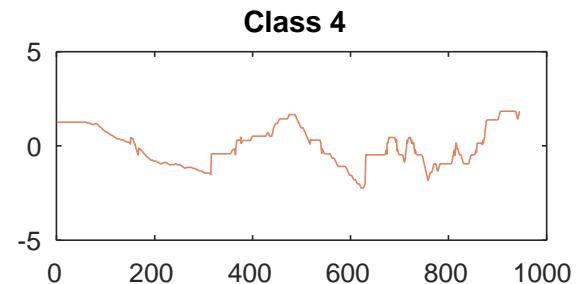
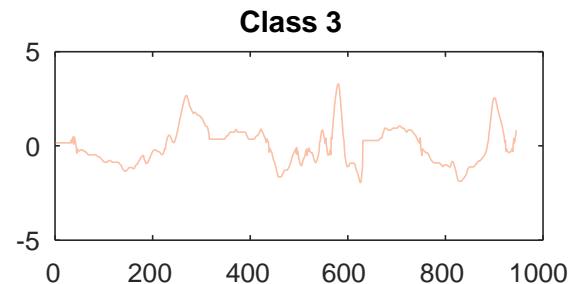
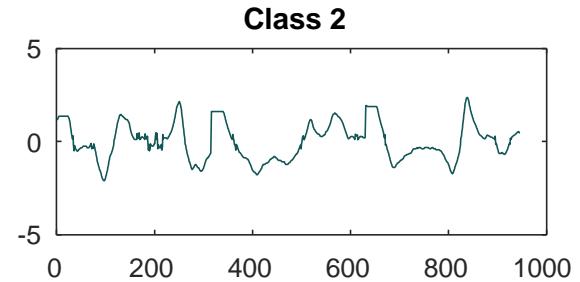
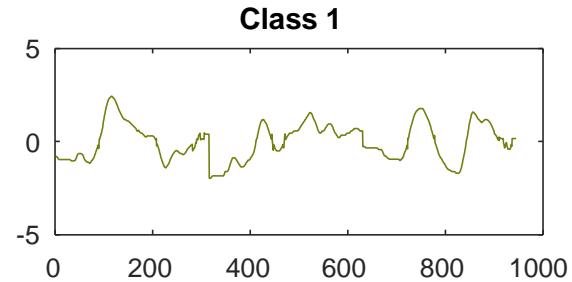
TwoPatterns

One exemplar per class,
with z-normalization



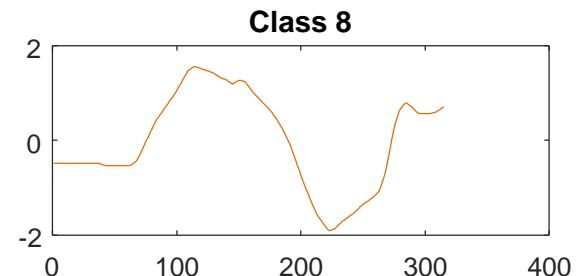
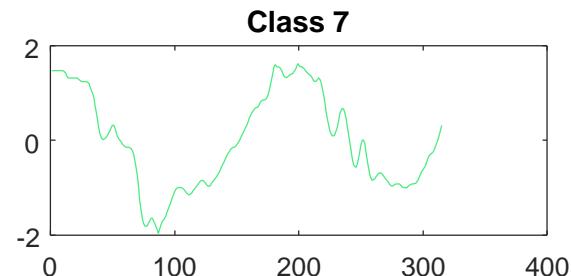
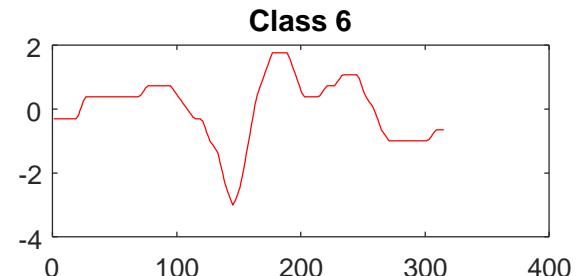
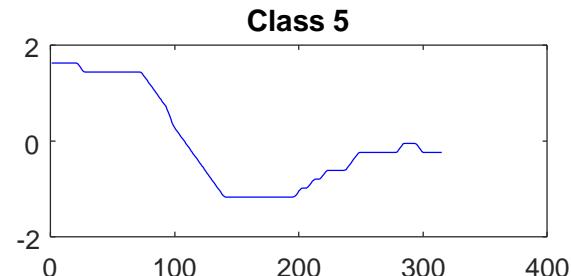
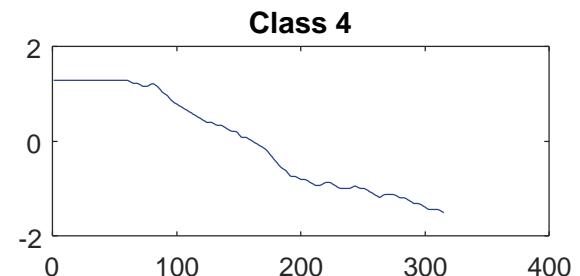
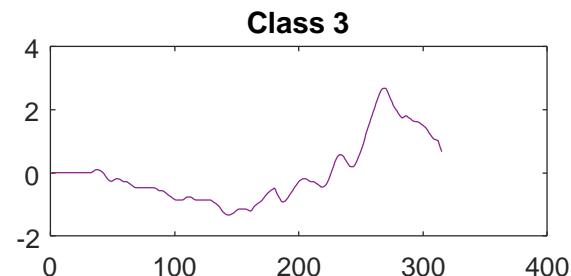
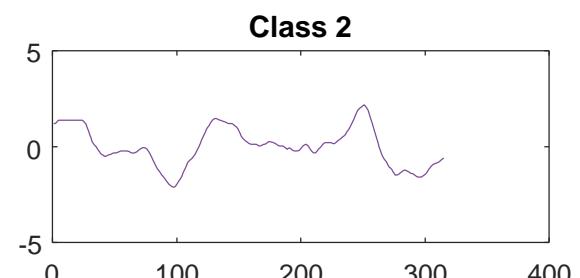
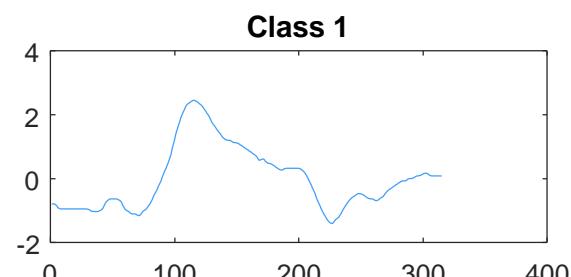
UWaveGestureLibraryAll

One exemplar per class,
with z-normalization



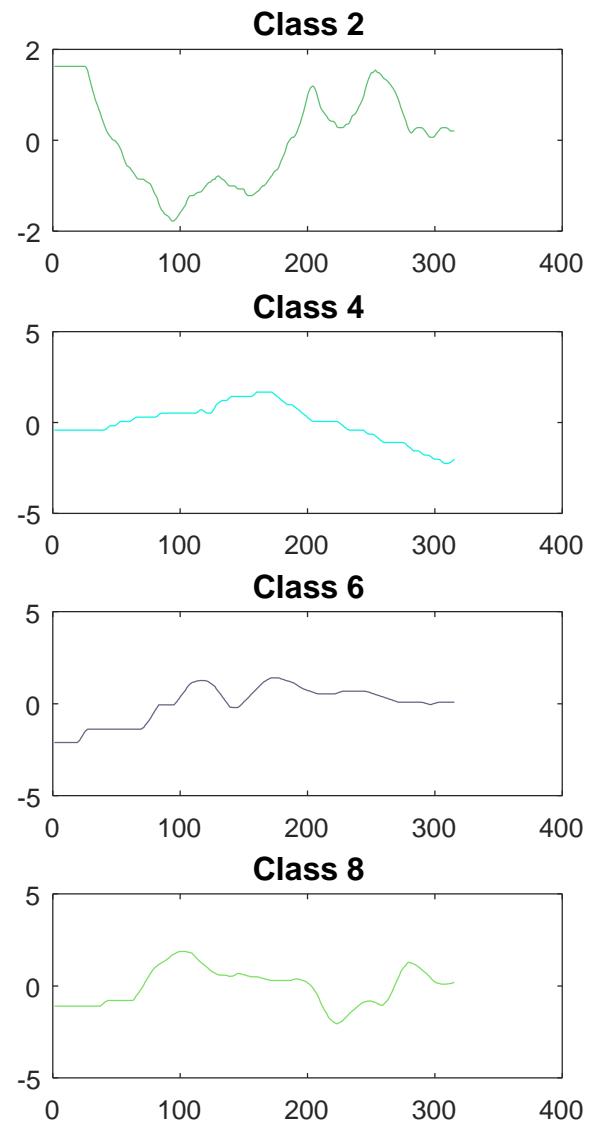
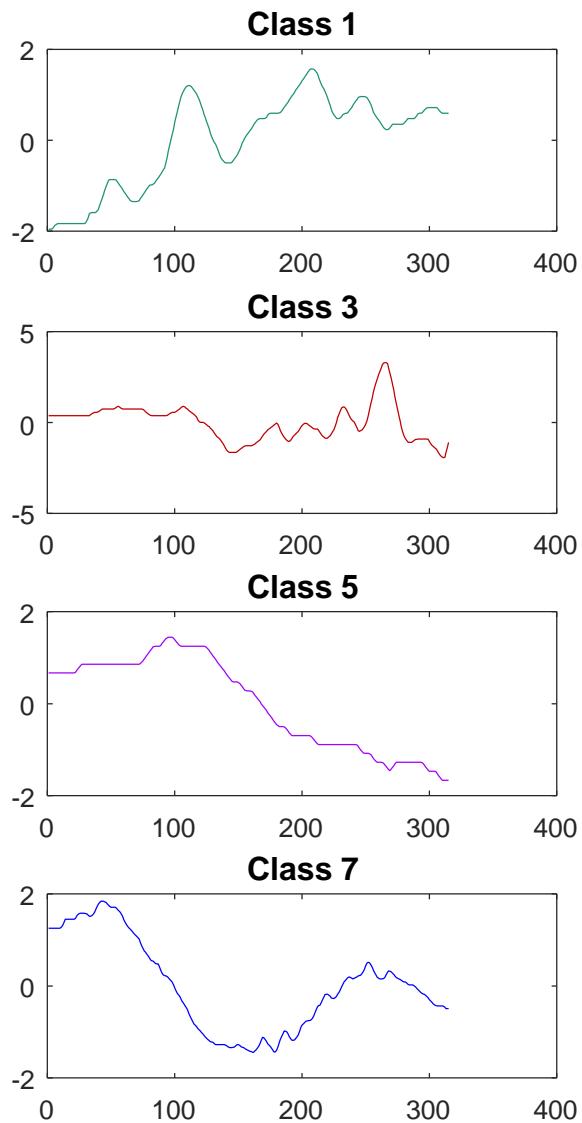
UWaveGestureLibraryX

One exemplar per class,
with z-normalization



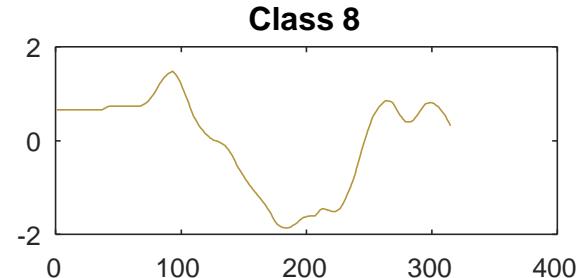
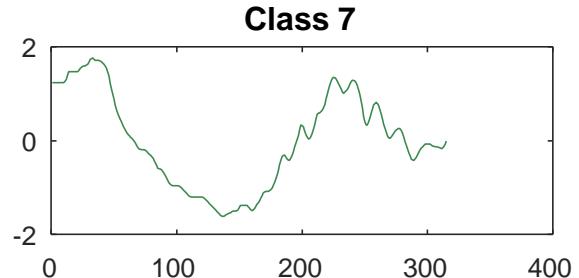
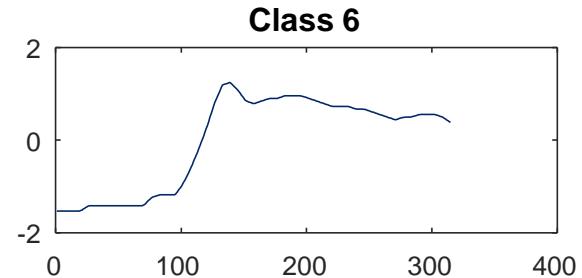
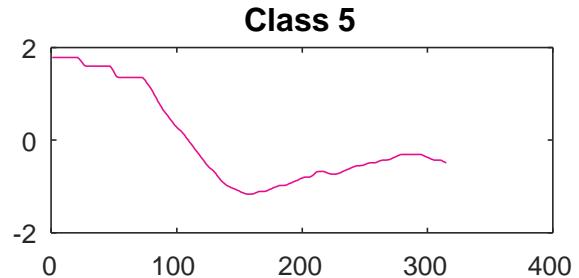
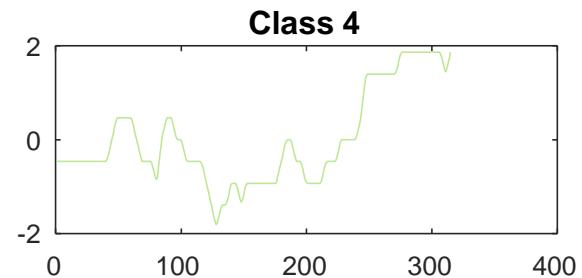
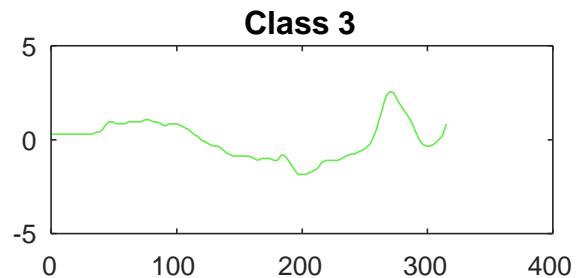
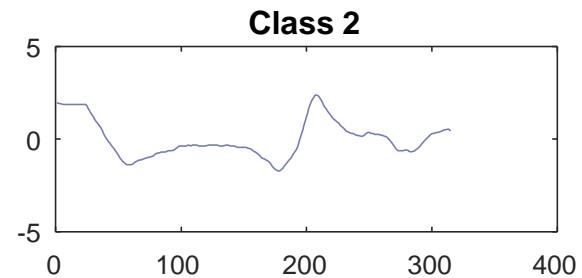
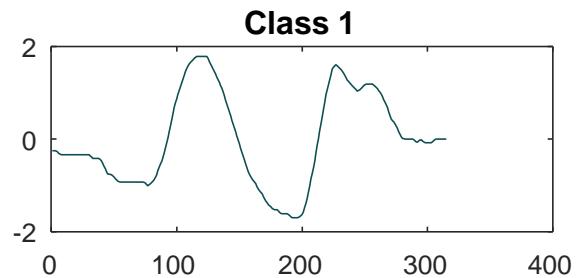
UWaveGestureLibraryY

One exemplar per class,
with z-normalization



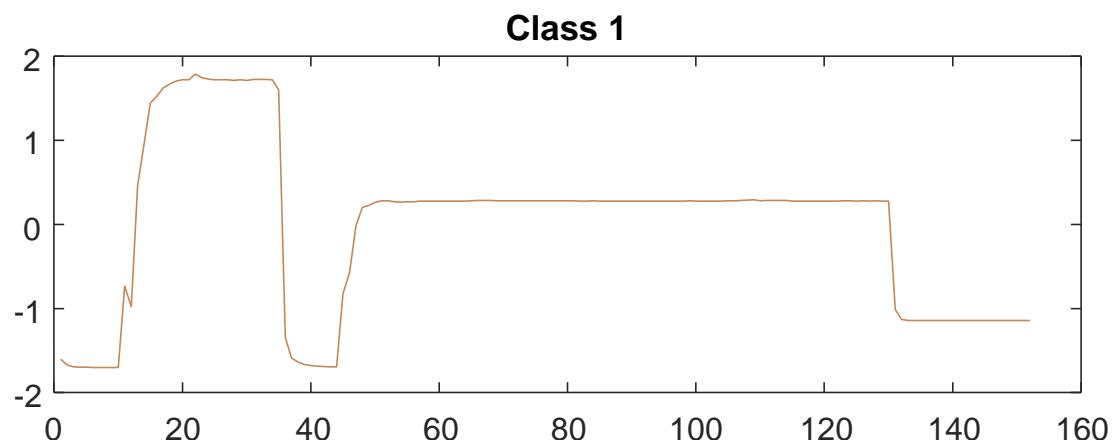
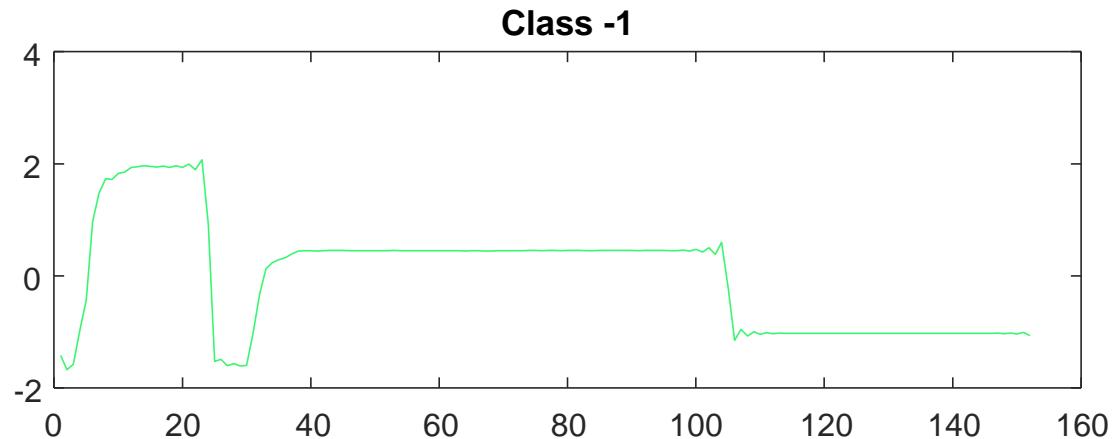
UWaveGestureLibraryZ

One exemplar per class,
with z-normalization



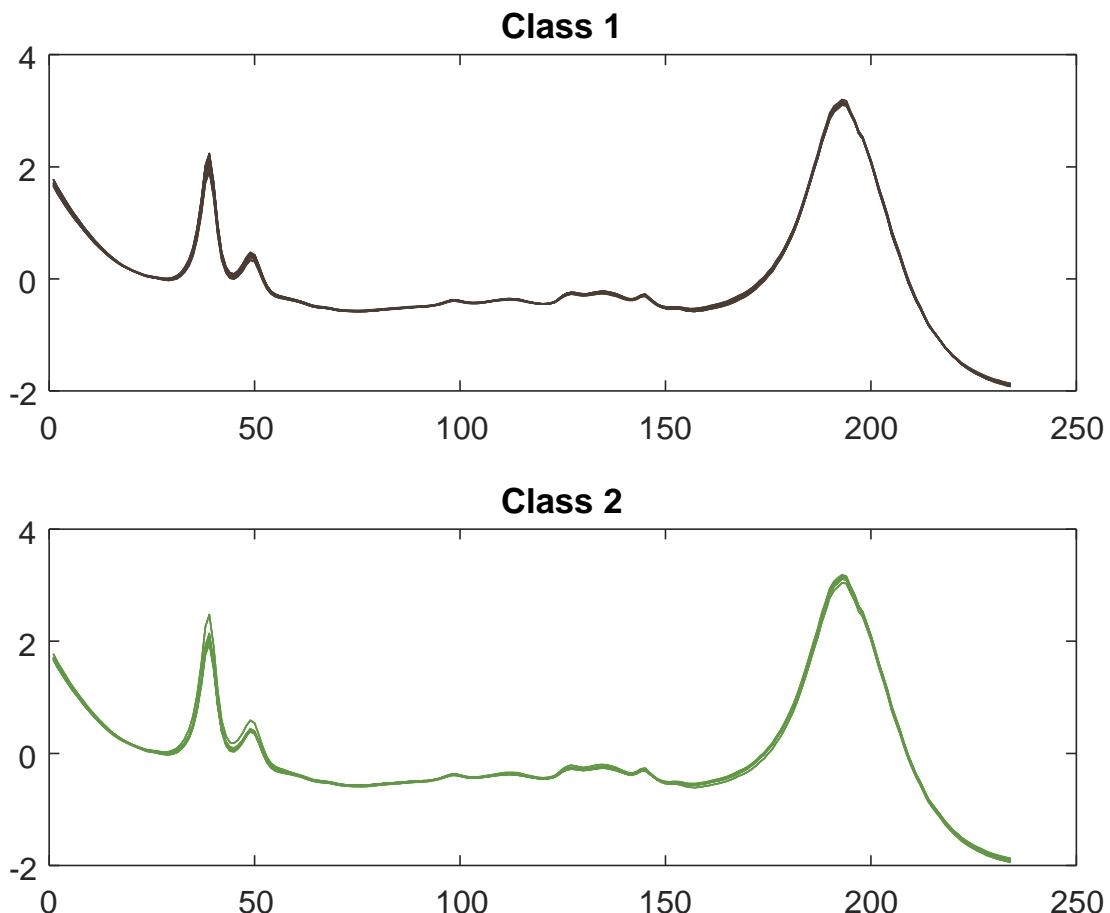
Wafer

One exemplar per class,
with z-normalization



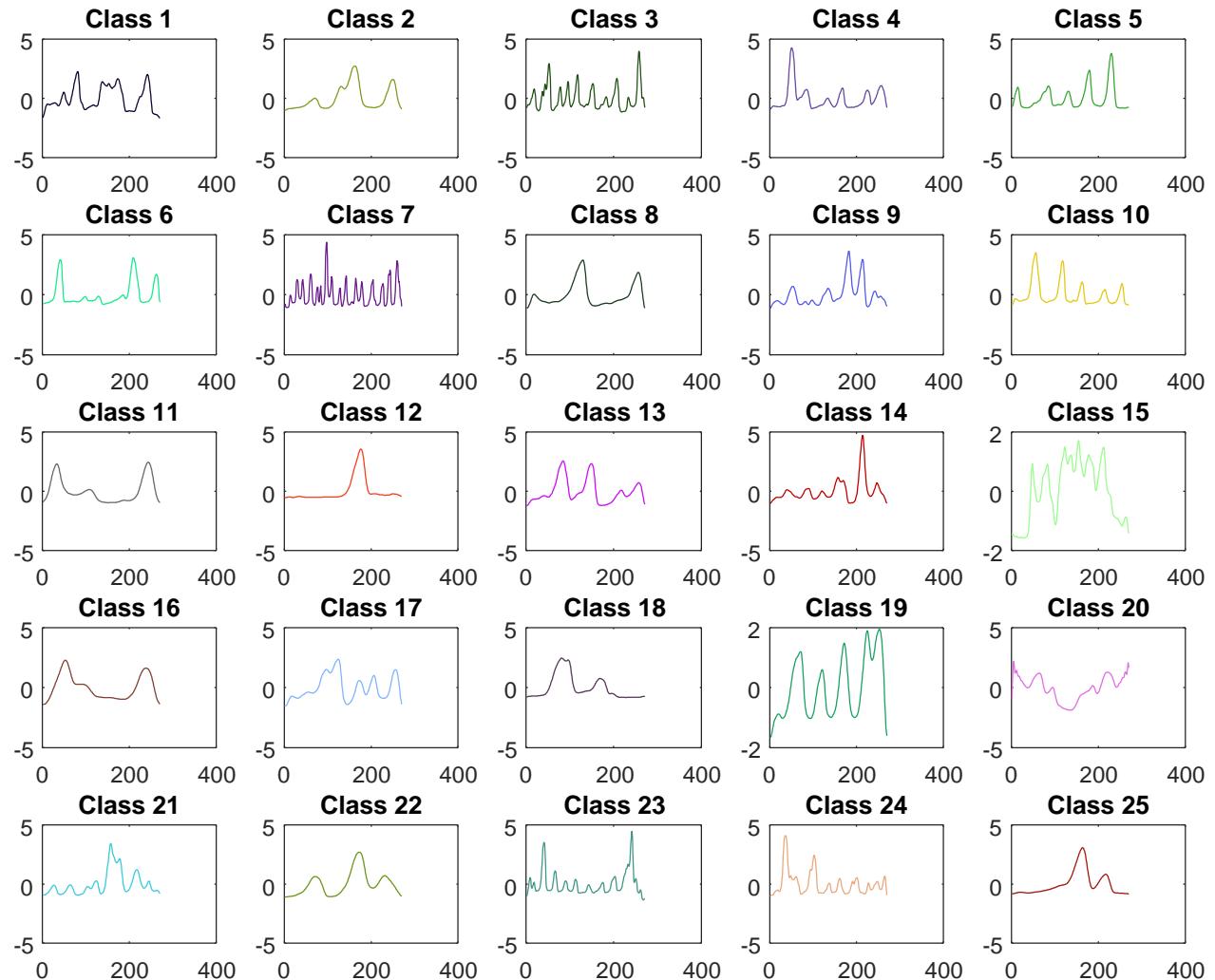
Wine

Twenty exemplars per class, with z-normalization



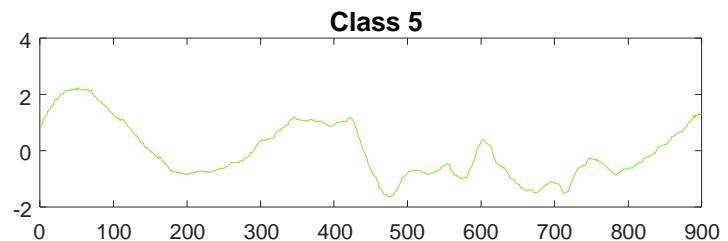
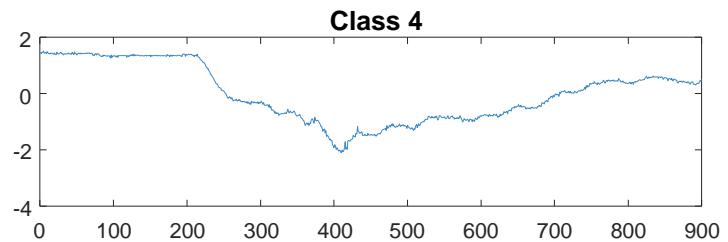
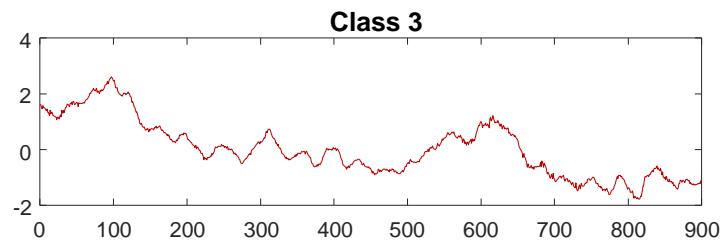
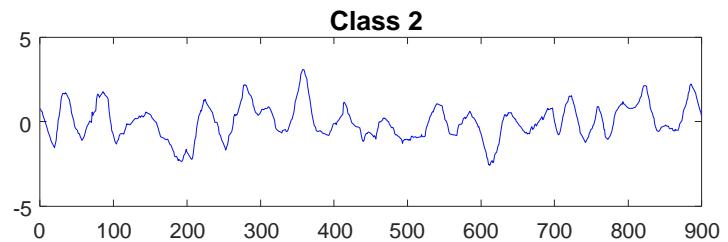
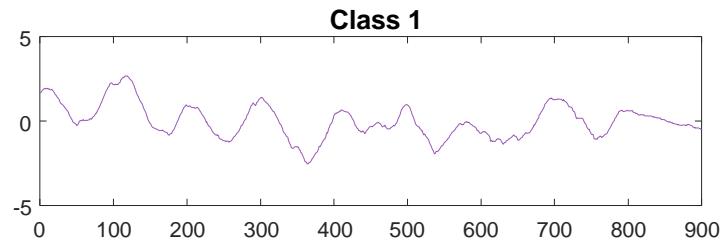
WordSynonyms

One exemplar per class,
with z-normalization



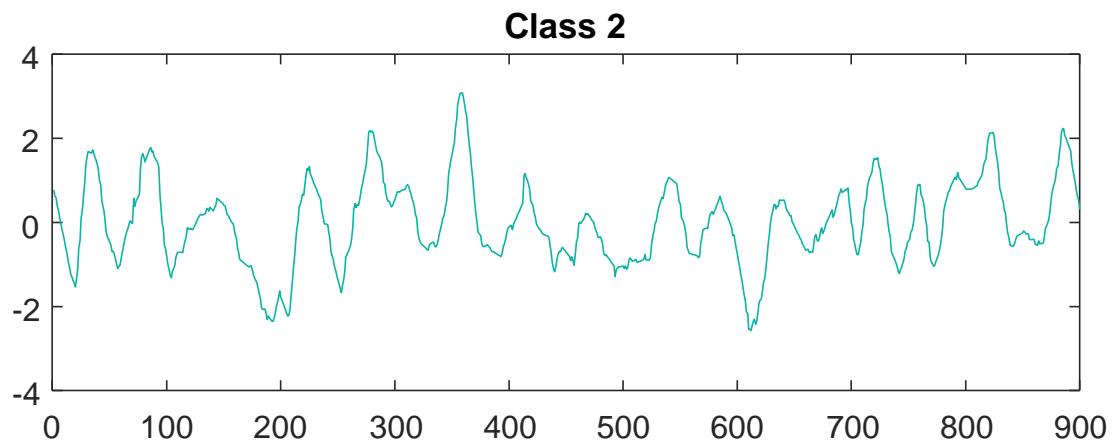
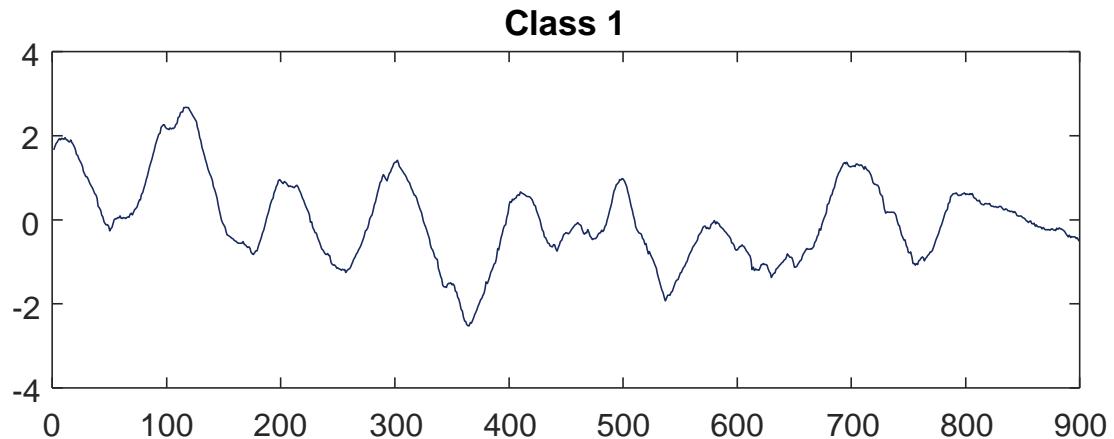
Worms

One exemplar per class,
with z-normalization



WormsTwoClass

One exemplar per class,
with z-normalization



Yoga

One exemplar per class,
with z-normalization

