Contents


```
clear; close all; clc
```

Assessing clustering methods' performance and efficacy

Cluster analysis organizes data into groups based on similarities between the data points. Sometimes the data contains natural divisions that indicate the appropriate number of clusters. Other times, the data does not contain natural divisions, or the natural divisions are unknown. In such a case, you might to determine the optimal number of clusters to group your data. (from MATLAB)

Part 1- Creating a fake dataset

```
nRow_fake_dataset = 3000; % it should actually be 30000, but for elapsed
% running time of the code, 3000 is chosen.
nCol_fake_dataset = 600; % it should actually be 6000, but for elapsed
% running time of the code, 600 is chosen.

temp0 = randn(ceil(nRow_fake_dataset/5), ceil(nCol_fake_dataset/5));
temp1 = repmat(temp0, 5, 5);
fake_dataset = temp1(1:nRow_fake_dataset, 1:nCol_fake_dataset);
```

Part 2- Performing linear dimensionality reduction (or noise suppression) alg.

```
[coeff, score, ~, ~, explained, ~] = pca(fake_dataset);
explained_variance_threshold = 99.5; % for the FFT dataset, a threshold of
% 99 or 99.5 is thought to be more suitable.

cumulative_explained = cumsum(explained);
numFeatures = find(cumulative_explained >= explained_variance_threshold);
numFeatures = numFeatures(1);
reduced_dataset_by_pca = score(:, 1:numFeatures);
inputs = reduced_dataset_by_pca.';
```

```
Warning: Columns of X are linearly dependent to within machine precision.
Using only the first 120 components to compute TSQUARED.
```

Part 3- Investigating different clustering methods (1-SOFM & 2-LVQ)

```
numClusters = 3;
```

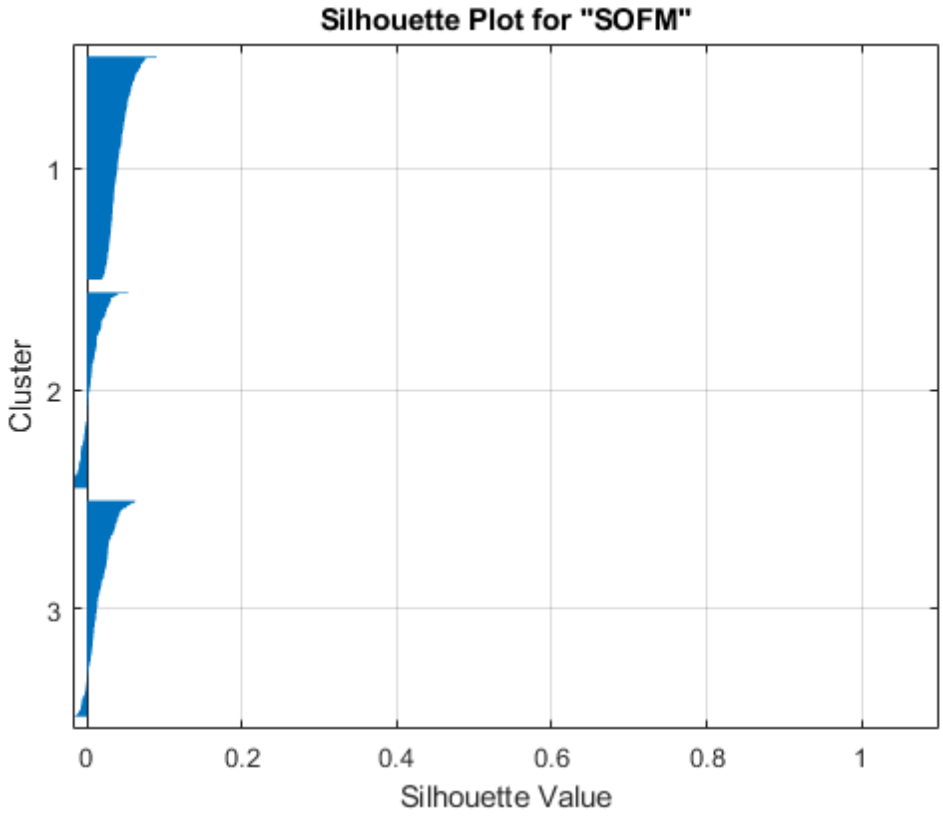
Part 3-1-1- Training SOFM

```
row_nodes = 3; column_nodes = 1;
% Note: the result of the product "row_nodes * column_nodes", should be
% equal to "numClusters".

dimensions = [row_nodes, column_nodes];
SOFM_net = selforgmap(dimensions);
SOFM_net = train(SOFM_net, inputs);
SOFM_oneHotClasses = SOFM_net(inputs); SOFM_classes = vec2ind(SOFM_oneHotClasses).';
```

Part 3-1-2- Evaluating SOFM

```
SOFM_CalinskiHarabasz_index = evalclusters(inputs.', SOFM_classes, ...
    'CalinskiHarabasz')
SOFM_DaviesBouldin_index = evalclusters(inputs.', SOFM_classes, ...
    'DaviesBouldin')
SOFM_silhouette_index = evalclusters(inputs.', SOFM_classes, ...
    'silhouette')

% Creating a silhouette plot from the clustered data.
figure;
silhouette(inputs.', SOFM_classes); title(['Silhouette Plot for ', '"SOFM"'])
grid on
```

```
SOFM_CalinskiHarabasz_index =

  CalinskiHarabaszEvaluation with properties:

    NumObservations: 3000
         InspectedK: 3
    CriterionValues: 32.5652
           OptimalK: 3


SOFM_DaviesBouldin_index =

  DaviesBouldinEvaluation with properties:

    NumObservations: 3000
         InspectedK: 3
    CriterionValues: 7.9987
           OptimalK: 3


SOFM_silhouette_index =

  SilhouetteEvaluation with properties:

    NumObservations: 3000
         InspectedK: 3
    CriterionValues: 0.0216
           OptimalK: 3
```



Part 3-2-1- Training Competitive Layer

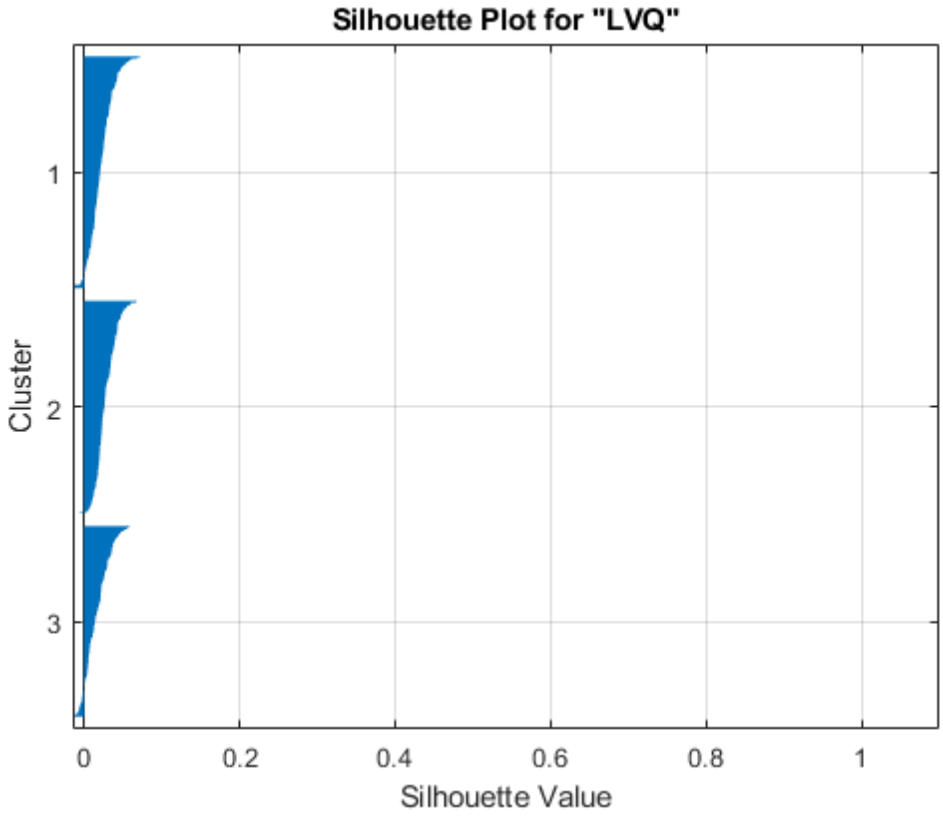
```
numEpochs = 100;
LVQ_net = competlayer(numClusters);
configure(LVQ_net, inputs);
LVQ_net.trainParam.epochs = numEpochs;

LVQ_net = train(LVQ_net, inputs);
LVQ_oneHotClasses = LVQ_net(inputs); LVQ_classes = vec2ind(LVQ_oneHotClasses).';
```

Part 3-2-2- Evaluating Competitive Layer

```
LVQ_CalinskiHarabasz_index = evalclusters(inputs.', LVQ_classes, ...
    'CalinskiHarabasz')
LVQ_DaviesBouldin_index = evalclusters(inputs.', LVQ_classes, ...
    'DaviesBouldin')
LVQ_silhouette_index = evalclusters(inputs.', LVQ_classes, ...
    'silhouette')

% Create a silhouette plot from the clustered data.
silhouette(inputs.', LVQ_classes); title(['Silhouette Plot for ', '"LVQ"'])
grid on
```

```
LVQ_CalinskiHarabasz_index =

  CalinskiHarabaszEvaluation with properties:

    NumObservations: 3000
         InspectedK: 3
    CriterionValues: 31.3788
```

```
            OptimalK: 3


LVQ_DaviesBouldin_index =

  DaviesBouldinEvaluation with properties:

    NumObservations: 3000
         InspectedK: 3
    CriterionValues: 8.0881
            OptimalK: 3


LVQ_silhouette_index =

  SilhouetteEvaluation with properties:

    NumObservations: 3000
         InspectedK: 3
    CriterionValues: 0.0222
            OptimalK: 3
```



Published with MATLAB® R2018b