Reducing the Number of Data Points

MATLAB Implementation

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Contents

1 Download and Installation

1.1 Download from MATLAB Central's File Exchange

The `shrink_data_set` function is available for download on MATLAB® Central's File Exchange at https://www.mathworks.com/matlabcentral/fileexchange/86218-reduce-number-of-data-points-shrink_data_set.

1.2 Download from GitHub

The `shrink_data_set` function is available for download on GitHub® at https://github.com/tamaskis/shrink_data_set-MATLAB.

1.3 Files Included With Download

There are **five** files included in the downloaded `zip` file:

1. `EXAMPLE.M` – *example for using the* `shrink_data_set` *function*
2. `LICENSE` – *license for the* `shrink_data_set` *function*
3. `README.md` – *markdown file for GitHub documentation*
4. `Reducing the Number of Data Points - MATLAB Implementation.pdf` – *this PDF*
5. **`shrink_data_set.m` – *MATLAB function to reduce the number of points in a data set***

1.4 Accessing the `shrink_data_set` Function in a MATLAB Script

There are **four** options for accessing the `shrink_data_set` function in a MATLAB script:

1. Copy the `shrink_data_set` function to the *end* of your MATLAB script.
2. Place the `shrink_data_set.m` file in the same folder as the MATLAB script.
3. Place the `shrink_data_set.m` file into whatever folder you want, and then use the `addpath(folderName)` command[1] where the `folderName` parameter is a string that stores the filepath of the folder that `shrink_data_set.m` is in *relative to* the folder that your script is in.
4. Make a toolbox by first opening `shrink_data_set.m`, then going to the `HOME` tab in MATLAB, and finally selecting `Package Toolbox` in the drop-down menu under `Add-Ons`. Once you package the `shrink_data_set` function as a toolbox, you can use it in any script.

[1] https://www.mathworks.com/help/matlab/ref/addpath.html

2 shrink_data_set

Reduces the number of data points in a data set to a specified number.

Syntax

```
X_shrunk = shrink_data_set(X,N)
X_shrunk = shrink_data_set(X,N,'columns')
X_shrunk = shrink_data_set(X,N,'rows')
```

Description

`X_shrunk = shrink_data_set(X,N)` shrinks a matrix `X` (storing a data set) so that it is left with only `N` rows. This syntax assumes the various variables are organized into separate columns. Therefore, `X_shrunk` will be the original matrix `X` shrunk down to `N` data points.

`X_shrunk = shrink_data_set(X,N,'columns')` shrinks a matrix `X` (storing a data set) so that it is left with only `N` rows. The input `'columns'` indicates that the variables are organized into separate columns, which implies that to remove data points, we need to remove rows. Therefore, `X_shrunk` will be the original matrix (i.e. data set) `X` shrunk down to `N` data points.

`X_shrunk = shrink_data_set(X,N,'rows')` shrinks a matrix `X` (storing a data set) so that it is left with only `N` columns. The input 'rows' indicates that the variables are organized into separate rows, which implies that to remove data points, we need to remove columns. Therefore, `X_shrunk` will be the original matrix (i.e. data set) `X` shrunk down to `N` data points.

NOTE: Sometimes, the function will not be able to return exactly `N` points (due to rounding issues). However, the purpose of this function is mainly to reduce the size of a data set when not all the points are needed. For example, plotting $y = x^2$ with 100 points rather than 1000 points will (to the naked eye) not be visually any worse, but will be a lot faster for the computer to perform.

Examples

Example 2.1

Define a data set $\{(x_i, y_i)\}_{i=1}^{1001}$ such that $y_i = x_i + \sin(x_i)\ \forall\ i \in [0, 1001]$ and for x in the domain $x \in [0, 10]$. Then, shrink this data set so it is left with only 5 data points.

■ *SOLUTION*

First, we define the data set. Let's define it as row vectors.

```
% defines data set
x = 0:0.01:10;
y = x+sin(x);
```

To use the `shrink_data_set` function, we must first compile this data set into a matrix. Since `x` and `y` are defined as row vectors,

```
% compiles data set into matrix
X = [x,y];
```

Now, we can use the `shrink_data_set` function with the specification `'rows'` to indicate that the variables (i.e. x and y) are separated into rows (in this case, x occupies the first row while y occupies the second row).

```
% shrinks data set to have only 5 points
X_shrunk = shrink_data_set(X,5,'rows');
```

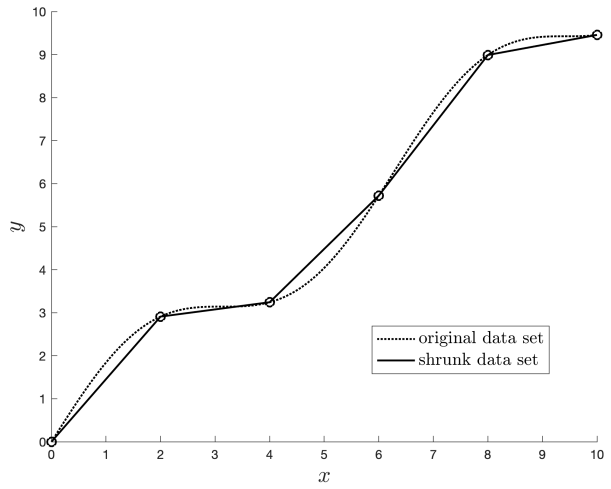
Since we started off with two individual vectors (`x` and `y`), it is usually useful to separate `X_shrunk` into the vectors `x_shrunk` and `y_shrunk`.

```
% extracts x_shrunk and y_shrunk from X_shrunk
x_shrunk = X_shrunk(1,:);
y_shrunk = X_shrunk(2,:);
```

Finally, we can create a plot to visualize the original and shrunk data sets.

```
% creates a plot
figure;
hold on;
plot(x,y,'k:','linewidth',1.5);
plot(x_shrunk,y_shrunk,'color','k','linewidth',1.5);
plot(x_shrunk,y_shrunk,'o','linewidth',1.5,'markersize',7,'color','k',...
    'handlevisibility','off');
hold off;
xlabel('$x$','interpreter','latex','fontsize',18);
ylabel('$y$','interpreter','latex','fontsize',18);
legend('original data set','shrunk data set','interpreter','latex',...
    'fontsize',14,'location','best');
```

The resulting plot is shown below.



Clearly, the shrunk data set has 6 data points, whereas we requested only 5. However, there is no direct way to resolve this; we do not wish to remove the endpoints from the data set, we want to select the points as uniformly as possible, and we can only select integer indices.