COMMON PITFALLS: HW 1, PART 4

1. ABOUT THIS DOCUMENT

As part of an ongoing research project to provide high quality autonomous feedback in online courses, we are making this list of common errors from Homework 1 available to all current students. This list was generated by automatically mining "exemplar submissions" from hundreds of thousands of submissions in the previous iteration of this course. If you have any questions, complaints or general feedback, please email codewebresearch@gmail.com. And stay tuned for the release of our interactive feedback tool in a future homework!

2. COMMON ERRORS

Error 1. (Hardcoding the dimension)
A large number of submissions assumed that X was $m \times 2$ dimensional, but the correct solution needs to work for an arbitrary number of dimensions.

```
function [X_norm, mu, sigma] = featureNormalize (X)
  X_norm = X;
  mu = zeros (1, size (X, 2));
  sigma = zeros (1, size (X, 2));
  mu = mean (X)
  sigma = std (X)
  X_norm = [(X(:, 1) - mu(1)) / sigma(1), (X(:, 2) - mu(2)) / sigma(2)]
```

Error 2. (using / instead of ./)
This was a fairly common error. In the following example code, we really would like to perform an *element-wise* division by σ which is the *./ operator* in octave. In this context, using the ordinary / operator calls a least-squares solver (which is wrong).

```
function [X_norm, mu, sigma] = featureNormalize (X)
  X_norm = X;
  mu = zeros (1, size (X, 2));
  sigma = zeros (1, size (X, 2));
  mu = mean (X)
  sigma = std (X)
  for i = 1:size (X, 1)
    X_norm (i, :) = (X (i, :) - mu) / sigma
  endfor;
```

Error 3. (Forgetting to store result in X_norm)

```
function [X_norm, mu, sigma] = featureNormalize (X)
  X_norm = X;
  mu = zeros (1, size (X, 2));
  sigma = zeros (1, size (X, 2));
  for i = 1:size (X, 2)
    mu (i) = mean (X (:, i))
    sigma (i) = std (X (:, i))
    X (:, i) = (X (:, i) - mu (i)) / sigma (i)
  endfor;
```

Error 4. The following implementation computes the mean and standard deviation of only the first column of X.

```
function [X_norm, mu, sigma] = featureNormalize (X)
  X_norm = X;
  mu = zeros (1, size (X, 2));
  sigma = zeros (1, size (X, 2));
  mu = mean (X (:, 1))
  sigma = std (X (:, 1))
  X_norm = (X - mu) / sigma
```

Error 5. Another common error resulted from splitting the feature normalization into two steps (i.e., first centering the data, then scaling), but forgetting to use the centered data in the second step. Thus in the following example of this error, the last line should be: $X\_norm(:, i) = X\_norm(:, i)/sigma(i)$.

```
function [X_norm, mu, sigma] = featureNormalize (X)
  X_norm = X;
  mu = zeros (1, size (X, 2));
  sigma = zeros (1, size (X, 2));
  for i = 1:size (X, 2)
    mu (i) = mean (X (:, i))
    X_norm (:, i) = X (:, i) - mu (i)
    sigma (i) = std (X (:, i))
    X_norm (:, i) = X (:, i) / sigma (i)
  endfor;
```