Assignment 9

Scientific Computing with MATLAB
due: Dec 13, 2019

1. Curve Fitting

Here are 10 pairs of (x,y) data:

```
x = [ 1, 2,  3,  4,  5,   6,   7,   8,   9,  10];
y = [18, 5, 17, 38, 40, 106, 188, 234, 344, 484];
```

Your task is to fit a function to the data. The function has the form:

$$\hat{y}_i = \beta_0 + \beta_1 x_i + \beta_2 x_i^2 + \beta_3 x_i^3 \tag{1}$$

and the cost function J is:

$$J = \sum_{i=1}^{10} (\hat{y}_i - y_i)^2 \tag{2}$$

Use whatever optimizer you wish. Plot the data as a scatter plot of x vs y, and plot the function that corresponds to the parameter values β that minimize J.

2. Local Minima

Generate some noisy (x,y) data using the following MATLAB code:

```
x = 0:0.01:3;
y = sin(2*pi*x) + randn(size(x))*0.5;
```

Generate a scatterplot of the data, plotting x on the abscissa and y on the ordinate.

Your task is to fit a function of the following form to the data:

$$\hat{y} = \sin(\beta x) \tag{3}$$

The (single) parameter to be optimized is β. Your cost function J is:

$$J = \sum_{i=1}^{n} (\hat{y}_i - y_i)^2 \tag{4}$$

where n is the number of (x,y) pairs in the data.

Compute the cost function J for values of β ranging from -10.0 to +10.0, and plot the cost landscape (plot J as a function of β)

Use an optimization method of your choosing to find the value of β that minimizes the cost function J. Plot the data and the overlay the best fitting function. Justify that you have found a global minimum and not a local minimum.

Please submit your MATLAB script to OWL.