Function **model = krigms(x,y,x_range)**

Purpose:

Creates a simple Kriging model for the inputs (x) and outputs (y)

Inputs:

x – Inputs for the sampled data

y – Outputs for the sampled data

x_range – Range of the inputs. Should have as many rows as input variables. The first column has the lower bound value and the second column has the upper bound value.

Outputs:

Model – Model structure from MATLAB containing all of the information necessary for the Kriging model prediction

Author:

Paul Arendt (April 10, 2012)

Functions Called:

gaussian_correlation_sigw(), log_likelihood(), vectorization(), constraints(), unvectorization()

Example:

```
x_range = [20 80; 200 1000];

x = [20    200;
     50    200;
     80    200;
     20    600;
     50    600;
     80    600;
     20    1000;
     50    1000;
     80    1000];

y = [1853.0619;
     741.2247;
     463.2655;
     764.3167;
     305.7267;
     191.0792;
     596.8310;
     238.7324;
     149.2078];

model1 = krigms(x,y,x_range);
```

Function **[y_hat, mse] = krigpred(models,x)**

Purpose:

From the Kriging model produced by krigms(), predicts the expected value (mean) and variance at prediction points defined by x.

Inputs:

models – Kriging model structure from krigms()
x – Desired prediction points based on the Kriging model, usually only one point. For multiple points either use a for loop, see example below or input a column vector of inputs (i.e., vector with the number of desired points for rows and columns are the input variable dimension).

Outputs:

y_hat – Expected value, mean, at the prediction points x
mse – Mean squred error, estimation of variance, at the prediction points x

Author:

Paul Arendt (April 10, 2010)

Functions Called:

gaussian_correlation_sigw(),vectorization(), unvectorization()

Example:

For the prediction at one point using model1 created by krigms, the prediction function call is

```
[yp, varp] = krigpred(model1,[50 500])
```

The next example creates Kriging prediction surfaces over the entire design space using the meshgrid and surf commands.

```
[x1, x2] = meshgrid(20:3:80,200:40:1000);
[m,n] = size(x1);
for i = 1:m
    for j = 1:n
        [yp(i, j), varp(i, j)] = krigpred(model1, [x1(i, j) x2(i, j)]);
end; end;
surf(x1,x2,yp)
```

Function **[] = plot_kriging_2inputs(model, x, y, x_range, num_points)**

Purpose:

This code creates a three dimensional plot of a Kriging metamodel for two inputs and one output. The code also plots upper and lower bound surfaces based on the Kriging metamodel prediction mean squared error. NOTE: If prediction and/or variance at distinct points is desired then use krigpred() function.

Inputs:

model – Kriging model structure creaded by the krigms function
x – Inputs for the sampled data
y – Outputs for the sampled data
x_range – Range of the input variables x with the first row being the lower bound and the second row the upper bound
num_points – Number of grid points for plotting. The more the smoother of a surface is plotted and the less produces a coarser surface. This is the number of points in between the upper and lower bound of x used for prediction and plotting of the surfaces.

Outputs:

None, a MATLAB figure is produced.

Author:

Paul Arendt (April 7, 2010)

Functions Called:

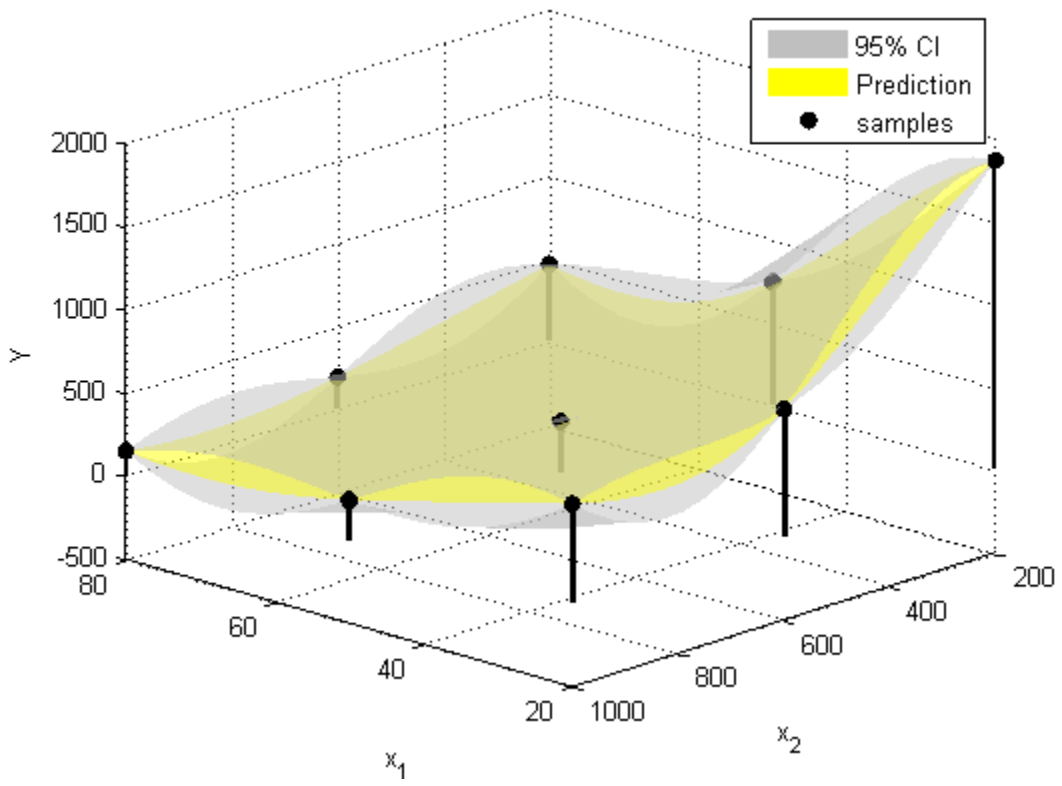
krigpred()

Example:

Based on the previous two examples, we call the function with

```
plot_kriging_2inputs(model1, x, y, x_range, 20)
```

The resulting plot is shown in the following figure.


95% CI
Prediction
samples
2000
1500
1000
500
0
-500
Y
80
60
40
20
x_1
1000
800
600
400
200
x_2