

Kriging Surface Construction and Evaluation Software Manual

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last update: July 7, 2016

This manual explains the Matlab software written to construct and evaluate Kriging surfaces to be used as test-bed surfaces. The construction and evaluation is performed in separate functions to enable the user to evaluate the surfaces at many different designs easily. The sections below detail the inputs of the software, the outputs of the software, and give an example of how to run the software.

1 Inputs

The syntax to run the Kriging surface construction code for the simulator-only setting is as follows:

```
MakeKrigSurf(nsurf, d, mu, sig2, rho, id)
```

where all inputs must be present in the order specified in the syntax. The syntax to run the Kriging surface evaluation code for the simulator-only setting is as follows:

```
K = EvalKrigSurf(id, Xnew)
```

where again, all inputs must be present in the order specified in the syntax. The inputs in the syntax above are listed in further detail below. See Section 3 for a specific example that uses all inputs that are described below.

- $nsurf \in \mathbb{N}$ – defines the number of surfaces to be constructed
- $d \in \mathbb{N}$ – defines the number of surface input dimensions
- $\mu \in \mathbb{R}$ – defines the mean of the Kriging surface to be constructed
- $sig2 \in \mathbb{R}^+$ – defines the variance of the Kriging surface to be constructed
- ρ – the $nsurf \times d$ matrix of simulator correlation parameters. Each row is used for a separate surface, and each element must be in $[0, 1]$.
- id – the character string used to identify which example is being run
- $Xnew$ – the $n \times d$ design matrix of inputs at which the surface is to be evaluated, where $n \in \mathbb{N}$ is the number of observations to be taken

2 Output

In the construction code `MakeKrigSurf.m`, no variables are directly output to the user. Instead, all surface construction information is stored in a `.mat` file that is designated by the user through the character input variable 'id'. There is a single output for the evaluation code `EvalKrigSurf.m`:

- K – the $n \times nsurf$ matrix of Kriging surface evaluations, where $n \in \mathbb{N}$ is the number of observations to be taken

3 Example

```
%%% This script shows an example of how to use the functions
%%% 'MakeKrigSurf.m' and 'EvalKrigSurf.m' to construct and evaluate
%%% Krigifier surfaces, respectively, for use as test bed functions.

% Clean work space
clear all
close all
format compact
format shortG

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%% Construct and Evaluate Krigifier Surfaces %%%%%%%%%%%%%%%
% User-specified section - only change items in the following section! %
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

% state the number of surfaces to be constructed
nsurf = 5;

% state the number of input dimensions for the surfaces
d = 3;

% state the mean (mu) and variance (sig2) to be used to construct the
% Krigifier surfaces
mu = 100;
sig2 = 10;

% state a nsurf x d matrix of correlation parammeter values to be used to
% construct the Krigifier surfaces (each row is used for a new surface)
rho = .25 * ones(nsurf,d);

% state identification name to be used to save files
id='example';

% state the design points at which you would like to evaluate the surfaces
Xnew = lhsdesign(15,d);

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

% construct the Krigifier surfaces
MakeKrigSurf(nsurf, d, mu, sig2, rho, id)

% evaluate the Krigifier surfaces
K = EvalKrigSurf(id, Xnew)

str = sprintf(strcat('***The Krigifier surface evaluations are located in',...
' the Matlab variable K. ***'));
disp(str);
```