

Bayesian Efficient Global Optimization (EGO)

This document provides a brief description of how to run the MATLAB code for Bayesian EGO as described in the paper “A Fully Bayesian Approach to Efficient Global Optimization Algorithm” by S. Tajbakhsh, E. del Castillo, and J.L. Rosenberger.

After unzipping the .zip file, all of the .m files should be copied to the current path of the MATLAB. Also, there are six .mat data files which include the initial design data, response values at design points and some input parameters for five deterministic test functions and the stochastic inventory model. The program consists of four major .m files:

- a. EGO.m – This file is the body of the program in which three other major files are called, it basically includes the Bayesian EGO algorithm.
- b. newPointFinder.m – This file performs the maximization of the Bayesian expected improvement (EI) function.
- c. postPred.m – This function evaluate the Bayesian Expected Improvement at any new location x through finding posterior predictive distribution at location x .
- d. bayesianEI – This file runs the MCMC chains to sample from posterior distribution of the Gaussian Process (GP) parameters.

To run the program, follow the following steps:

1. Load the data (.mat files) corresponding to one of the test functions or the inventory model to the work space.
2. Run the main function EGO.m using the following command:

```
function [X_min D_min EI nTot nOpt Xnew Ynew IT] =  
EGO(X, LB, UB, noOfInitPoints, maxChainLeng, noPosteriorSamples, maxNoOfAllow  
ableItr, fIndc);
```

All of the input parameters are included in the .mat data file. “fIndc” is an indicator which determines which function (any of the five test functions or the inventory model) is under investigation.

X_{\min} is the location of the global minimum found by the algorithm, D_{\min} is the distance of X_{\min} from the true global minimum, EI is Bayesian expected improvement at X_{\min} , nTot is the total number of runs (including the initial design), nOpt is the run which resulted in the minimum function value, Xnew is the initial design updated with the new points found by the algorithm and Ynew are corresponding function values, finally IT is a vector containing each iteration’s duration in seconds.