1 Sequential quadratic programming

Wikipeadia: http://en.wikipedia.org/wiki/Sequential_quadratic_programming.

Examples by using SA and SQP

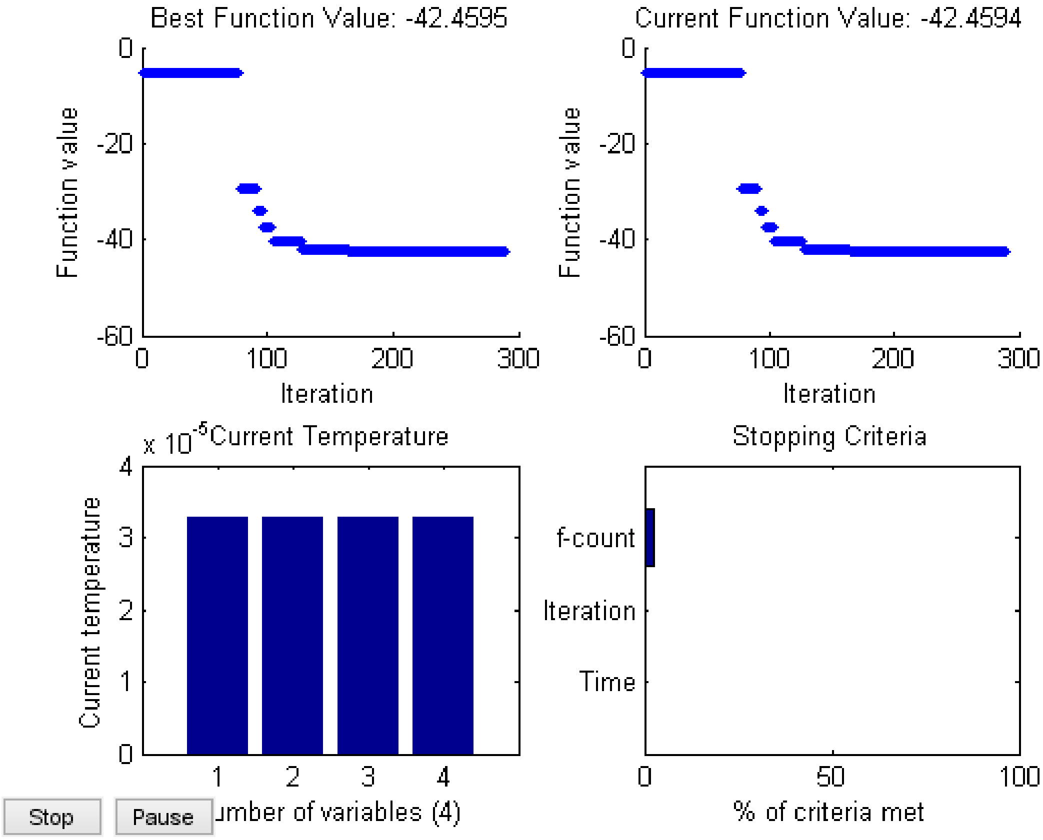

Figure 1. Output of SA for task1

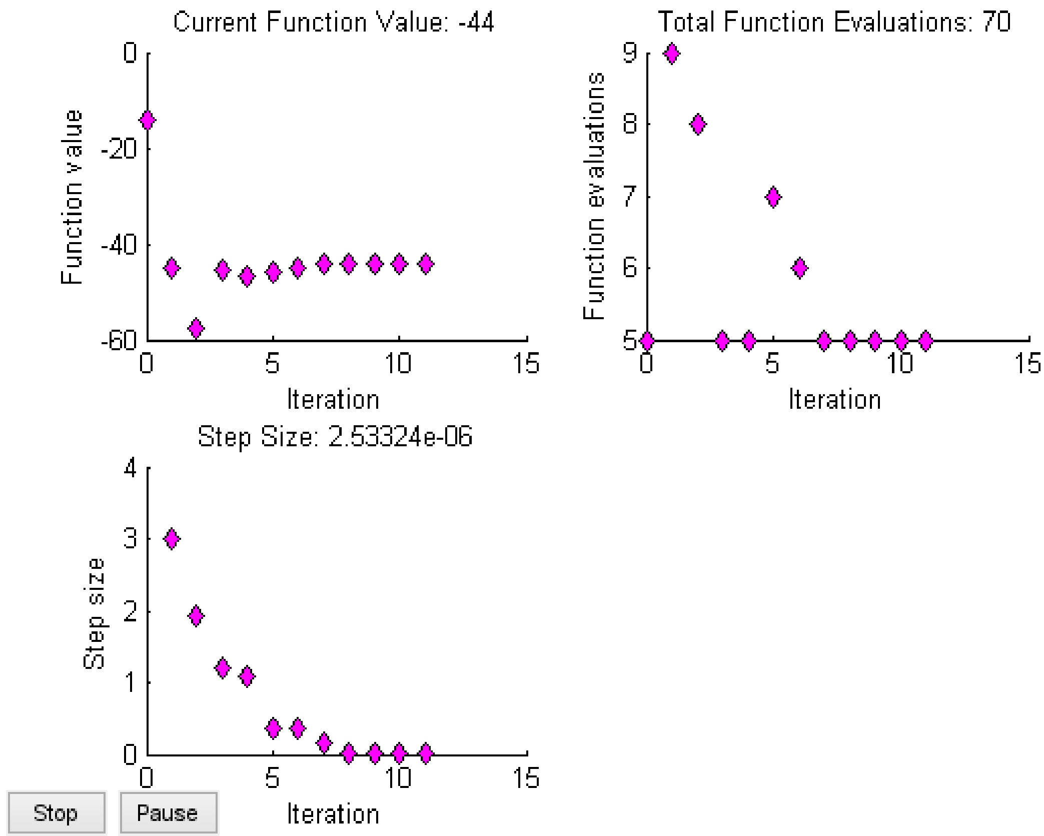

Figure 2. Output of SQP for task 1

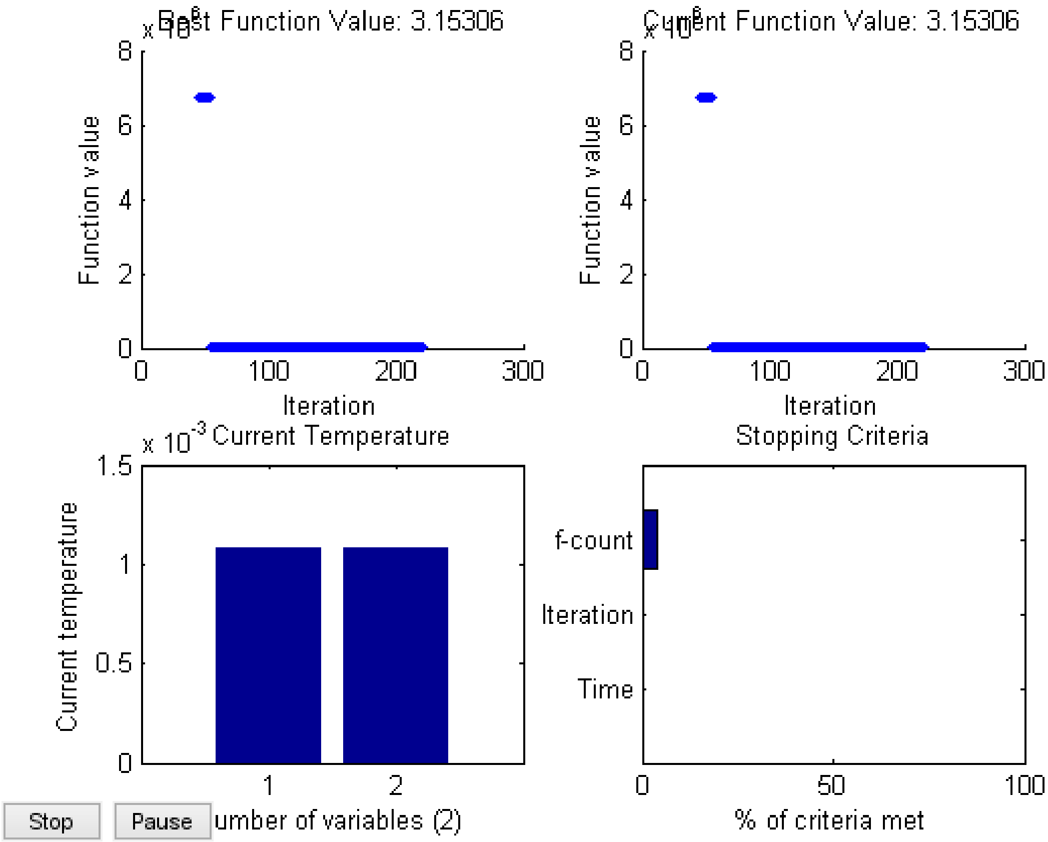

Figure 3. Output of SA for task 2

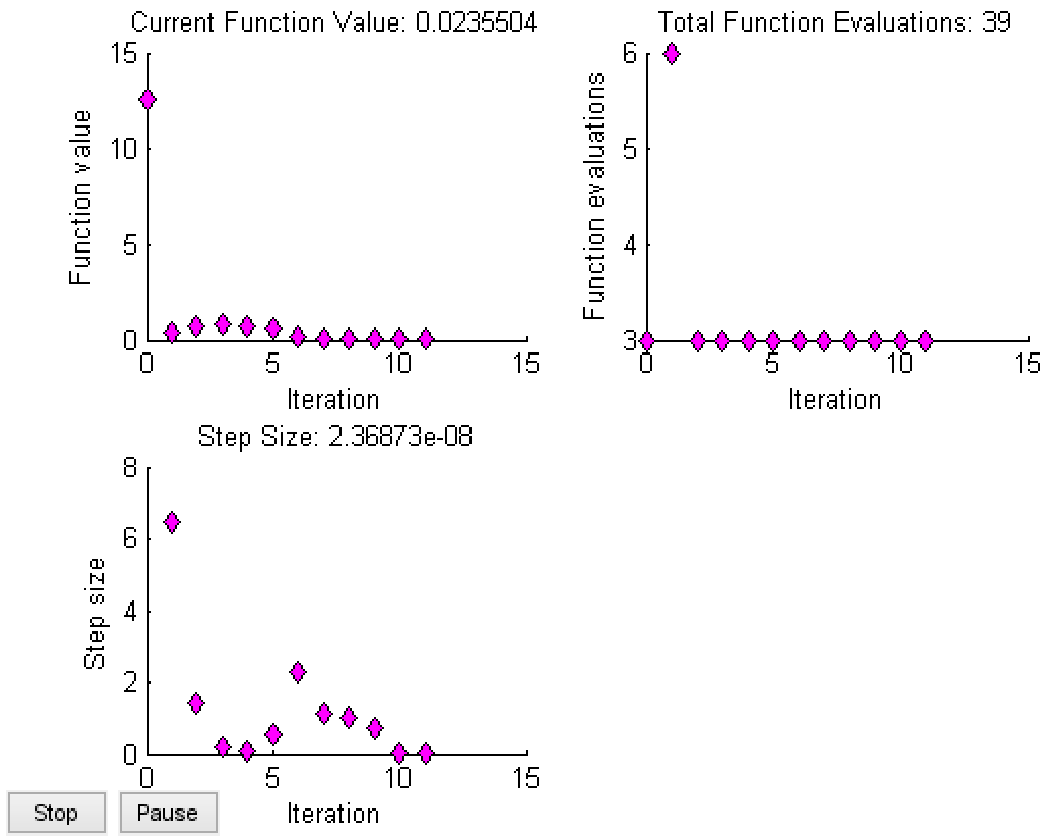

Figure 4. Output of SQP for task 2

Derive the shift and variance

$$\log\left(\Delta S_i\right) = \left(\mu - \frac{1}{2}\sigma^2\right)\Delta t_i + \sigma\sqrt{\Delta t_i}\boldsymbol{\xi}_i$$

$\Longrightarrow$

$$\log\left(\Delta S\right) \sim N\left(\left(\mu - \frac{1}{2}\sigma^2\right)\Delta t, \sigma^2\Delta t\right)$$

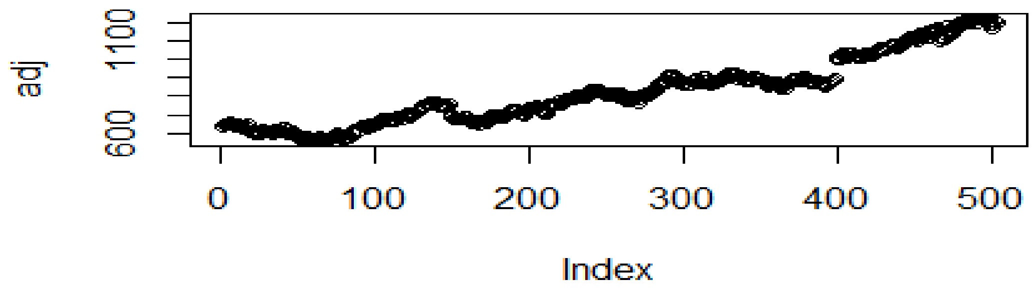

Figure 5. Google stock prices

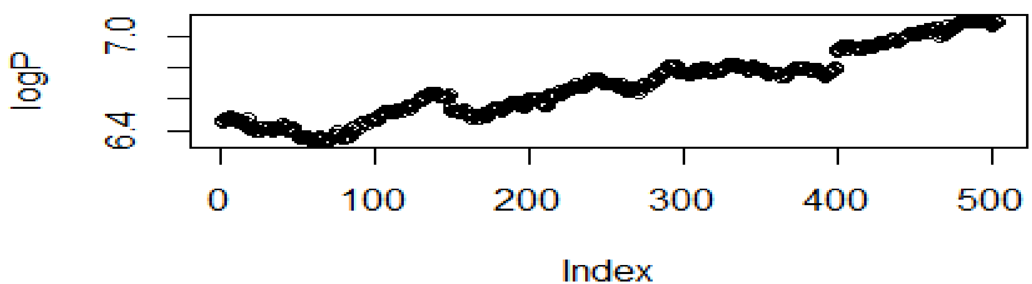

Figure 6. Google Log-prices

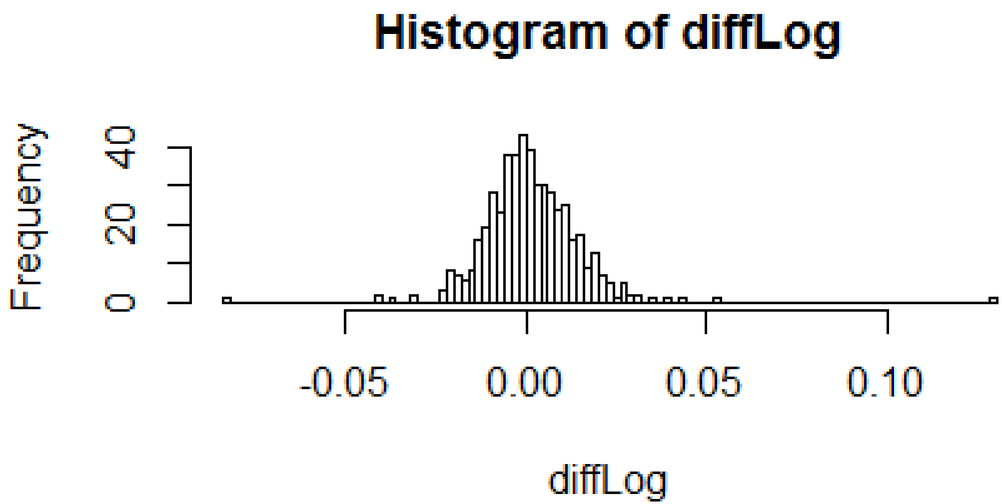

Figure 7. Histogram of difference of log-prices

Calculating σ^2 and μ

```
setwd("f:/")
priceTab = read.csv("Goog3Y.csv")
priceTab = priceTab[order(nrow(priceTab):1),];
adj = priceTab[,7];
logP = log(adj);
diffLog = diff(logP);
sigmaSq = var(diffLog);
mu = mean(diffLog) + 0.5*sigmaSq;
```

mu	0.00136680563478634
sigmaSq	0.000185877033783368

Figure 8. Output from R

Some observations and comments

1. historical price indicates the volatility is not constant, high volatility is usually followed by high volatility, so is low volatility. this phemomenon is called volatility cluster. people create GARCH model to explain this autocorrelated volatility;
2. price may have some great jumps, which can't be explained by this diffusion model. and that's why jump-diffussion models are studied after Black-Scholes.