

Implementation of Hybrid Algorithm for Non-Smooth Optimization in R

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1 Result(upto midterm)

Hanso library is ported from Matlab to R. The rHanso package is available now at R-forge with project name "rns".

2 Algorithm

BFGS phase: BFGS is run from multiple starting points, taken from the columns of x_0 , if provided, and otherwise 10 points generated randomly. If the termination test was satisfied at the best point found by BFGS, or if $nvar > 100$, HANSO terminates; otherwise, it continues to:

Gradient sampling phases: 3 gradient sampling phases are run from lowest point found, using sampling radii: $10 \cdot evaldist$, $evaldist$, $evaldist/10$.

Check the documentation for the library for more details.

3 Examples

$$\text{minimize: } f(\mathbf{x} = (x_1, x_2)^T) = 100(x_2 - x_1^2)^2 + (1 - x_1)^2 \quad (1)$$

```
> library(rHanso)
> fr <- function(x) { ## Rosenbrock Banana function
+   x1 <- x[1]
+   x2 <- x[2]
```

```

+      100 * (x2 - x1 * x1)^2 + (1 - x1)^2
+ }
> grr <- function(x) { ## Gradient of 'fr'
+   x1 <- x[1]
+   x2 <- x[2]
+   c(-400 * x1 * (x2 - x1 * x1) - 2 * (1 - x1),
+     200 * (x2 - x1 * x1))
+ }
> res=bfgs(fr,grr,nvar=2) # using all the default parameters, using weak wolfe sea
> res$x
      [,1]      [,2]      [,3]      [,4]      [,5]      [,6]      [,7]
[1,] 0.4488545 -0.8372784 2.083095 -1.033042 -0.5753470 -0.6762483 -0.8585818 0.3
[2,] 0.1355237 0.6821628 3.564105 1.257865 0.1991013 0.4001857 0.7691967 -0.0
> res$f
      [1] 0.7386574 3.4112084 61.2637116 7.7694984 4.2220806 3.1361471 3.5569440
      [10] 2.7768382

```

With Nesterov's function variant 1.

$$\text{minimize: } f(\mathbf{x} = (x_1, \dots, x_n)^T) = (x_1 - 1)^2 + \sum_{j=1}^{n-1} |x_{j+1} - x_j^2 + 1| \quad (2)$$

```

> fnNesterov1 <- function(x) {
+   n <- length(x)
+   x2 <- x[2:n]; x1 <- x[1:(n-1)]
+   1/4*(x[1]-1)^2 + sum(abs(x2-2*x1^2+1))
+ }
> res=hanso(fnNesterov1,nvar=2)
Hanso: Best value found by BFGS = 0.0562844
gradsamp: not descent direction, quit at iter= 62
gradsamp: completed iteration= 100
gradsamp: completed iteration= 100
Best value found by Gradient Sampling = 1.686984e-07
> res$x
      [,1]
[1,] 0.9992413
[2,] 0.9969664

```

```
> res$f  
[1] 1.686984e-07
```

4 Next Phase

I hope to work on SIDPSM. But because it uses many external libraries, it might be difficult to implement it in native R.