MinFinder v2.0: An improved version of MinFinder

Ioannis G. Tsoulos *, Isaac E. Lagaris

Department of Computer Science, University of Ioannina, 45110 Greece

A R T I C L E   I N F O

Article history:
Received 14 April 2008
Accepted 29 April 2008
Available online 9 May 2008

PACS:
02.60.-x
02.60.Pn
07.05.Kf
02.70.Lq

Keywords:
Global optimization
Stochastic methods
Monte Carlo
Clustering
Region of attraction

A B S T R A C T

A new version of the “MinFinder” program is presented that offers an augmented linking procedure for Fortran-77 subprograms, two additional stopping rules and a new start-point rejection mechanism that saves a significant portion of gradient and function evaluations. The method is applied on a set of standard test functions and the results are reported.

New version program summary

Program title: MinFinder v2.0
Catalogue identifier: ADWU_v2_0
Program summary URL: http://cpc.cs.qub.ac.uk/summaries/ADWU_v2_0.html
Program obtainable from: CPC Program Library, Queen’s University, Belfast, N. Ireland
No. of lines in distributed program, including test data, etc.: 14 150
No. of bytes in distributed program, including test data, etc.: 218 144
Distribution format: tar.gz
Programming language used: GNU C++, GNU FORTRAN, GNU C
Computer: The program is designed to be portable in all systems running the GNU C++ compiler
Operating system: Linux, Solaris, FreeBSD
RAM: 200 000 bytes
Classification: 4.9
Catalogue identifier of previous version: ADWU_v1_0
Does the new version supersede the previous version?: Yes
Nature of problem: A multitude of problems in science and engineering are often reduced to minimizing a function of many variables. There are instances that a local optimum does not correspond to the desired physical solution and hence the search for a better solution is required. Local optimization techniques can be trapped in any local minimum. Global optimization is then the appropriate tool. For example, solving a non-linear system of equations via optimization, one may encounter many local minima that do not correspond to solutions, i.e. they are far from zero.
Solution method: Using a uniform pdf, points are sampled from a rectangular domain. A clustering technique, based on a typical distance and a gradient criterion, is used to decide from which points a local search should be started. Further searching is terminated when all the local minima inside the search domain are thought to be found. This is accomplished via three stopping rules: the “double-box” stopping rule, the “observables” stopping rule and the “expected minimizers” stopping rule.
Reasons for the new version: The link procedure for source code in Fortran 77 is enhanced, two additional stopping rules are implemented and a new criterion for accepting-start points, that economizes on function and gradient calls, is introduced.
Summary of revisions:
1. Addition of command line parameters to the utility program make_program.
2. Augmentation of the link process for Fortran 77 subprograms, by linking the final executable with the g77 library.
3. Addition of two probabilistic stopping rules.
4. Introduction of a rejection mechanism to the Checking step of the original method, that reduces the number of gradient evaluations.
Additional comments: A technical report describing the revisions, experiments and test runs is packaged with the source code.

Running time: Depending on the objective function.

© 2008 Elsevier B.V. All rights reserved.

Acknowledgements

All experiments were run on the cluster at the “Research Center for Scientific Simulations” of the University of Ioannina, which consists of 200 computing nodes with dual CPUs (AMD OPTERON 2.2 GHz 64 bit) running Redhat Enterprise Linux, assembled by Hewlett-Packard.