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Using the GC3Pie high-throughput library for model calibration and distributed optimization workflow

Wednesday, 18 September 2013 11:20 (20 minutes)

Model calibration is the process of modifying the input parameters to a computational model to find the best match against an observed set of data (reference model).
The proposed talk introduces the GC3Pie optimizer library and shows how it can be used to write robust and scalable calibration models. The main advantage of such a library is the complete transparency w.r.t. the underlying computational infrastructure: GC3Pie allows one to execute the same calibration workflow on a laptop or a large scale computational infrastructure like an HPC cluster, a distributed grid, or an EC2-like cloud, without modification to the Python code.

Description of Work

Model calibration is the process of modifying the input parameters to a computational model to find the best match against an observed set of data (reference model).

Most of the time, model calibration is computed on local resources (e.g. one's own laptop computer), so it can be very time-consuming and limiting the possibilities for a researcher to explore larger parameter sets.

At the same time, scaling model calibration to a large computational infrastructure is not always a trivial task: several independent architectural concerns must be taken into account: - the decomposition of the computational model for a given set of input parameters to fit the underlying infrastructure; - the synchronization of the results for the evaluation of the match against the reference model (convergence); - the handling of partial failures inherent to large scale computations; - the iteration that generates new input parameters and re-evaluate the model.

Oftentimes, adapting an existing calibration model to a large scale computational infrastructure, requires a re-write of a large part of the calibration program.

The proposed talk introduces the GC3Pie optimizer library and shows how it can be used to write robust and scalable calibration models. The main advantage of such a library is the complete transparency w.r.t. the underlying computational infrastructure: GC3Pie allows one to execute the same calibration workflow on a laptop or a large scale computational infrastructure like an HPC cluster, a distributed grid, or an EC2-like cloud, without modification to the Python code.

The proposed talk will also illustrate few examples taken from validated financial model, highlighting the basic steps of writing a model calibration using the differential evolution algorithm of the GC3Pie Python library.

URL for further information

https://code.google.com/p/gc3pie/

Wider Impact of this Work

The library has been validated for a calibration of a financial model where the differential evolution algorithm of the GC3Pie optimizer library, has been used to calibrate a computationally intense economic model aimed to understand the co-movement of the interest rates and exchange rates as explained in:

Scheuring, Simon and Jonen, Benjamin, "Time-Varying International Diversification and the Forward Premium"(September 16, 2011). Available at SSRN: http://ssrn.com/abstract=1787370 or http://dx.doi.org/10.2139/ssrn.1787370

Session, double-session

session

Printable Summary

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Session Classification: Using clouds - experiences and requirements from the community