

R documentation

of all in ‘man/’

February 23, 2012

R topics documented:

RcppProgress-package 1

Index 4

RcppProgress-package

An interruptible progress bar with OpenMP support for c++ in R packages

Description

This package allows to display a progress bar in the R console for long running computations taking place in c++ code, and provides support for interrupting those computations even in a multithreaded code using OpenMP.

Details

When implementing CPU intensive computations in C++ in R packages, it is natural to want to monitor the progress of those computations, and to be able to interrupt them, even when using multithreading for example using OpenMP. Another feature is that it can be done so that the code will still work even without OpenMP support.

This package offers some facilities to help implementing those features. It is biased towards the use of OpenMP, but it should be compatible when using multithreading in other ways.

quick try: There are two test functions provided by the package so that you can quickly have a test of what can be done.

These tests are:

RcppProgress:::test_sequential(max, nb, display_progress) - a sequential code, i.e. single threaded

RcppProgress:::test_multithreaded(max, nb, threads, display_progress) - a multithreaded code using OpenMP

Both tests call the very same function that implements a long computation. The **max** parameter controls the number of computations, and **nb** controls the duration of a single computation, that is quadratic in **nb**. The **threads** is as expected the number of threads to use for the computation. The **progress** parameter toggles the display of the progress bar.

On my platform,

```
system.time( RcppProgress:::test_multithreaded(100, 3000, 4) )
```

is a good start.

c++ usage:

There are usually two locations in the c++ code that needs to be modified. The first one is the main loop, typically on the number of jobs or tasks. This loop is a good candidate to be parallelized using OpenMP. I will comment the code corresponding to the tests included with the package.

```
void test_multithreaded_omp(int max, int nb, int threads
                           , bool display_progress) {

#ifdef _OPENMP
    if ( threads > 0 )
        omp_set_num_threads( threads );
    Rprintf("\nNumber of threads=%i\n", omp_get_max_threads());
#endif

    Progress p(max, display_progress); // create the progress monitor
#pragma omp parallel for schedule(dynamic)
    for (int i = 0; i < max; ++i) {
        if ( ! p.is_aborted() ) { // the only way to exit an OpenMP loop
            long_computation(nb);
            p.increment(); // update the progress
        }
    }
}
```

Here we create a Progress object with the number of tasks to performed, then before performing a task we test for abortion (`p.is_aborted()`), because we can not exit an OpenMP loop the usual way, using a break for example, then when after the computation, we increment the progress monitor.

Then let us look at the computation function (that is completely useless) :

```
void long_computation(int nb) {
    double sum = 0;
    for (int i = 0; i < nb; ++i) {
        if ( Progress::check_abort() ) // check for abortion
            return;
        for (int j = 0; j < nb; ++j) {
            sum += Rf_dlnorm(i+j, 0.0, 1.0, 0);
        }
    }
}
```

Here the only interesting line is the `Progress::check_abort()` call. If called from the master thread, it will check for user interruption, and if needed set the abort status code. When called from another thread it will just check the status. So all the art is to decide where to put his

call : it should not be called not too often or not frequently enough. As a rule of thumb it should be called at a frequency of the order of a second.

Using RcppProgress in your package:

Here are the steps to use RcppProgress in a new package:

skeleton create a package skeleton using Rcpp

```
library(Rcpp)
Rcpp.package.skeleton( "RcppProgressExample" )
```

DESCRIPTION edit the **DESCRIPTION** file and add RcppProgress to the **Depends:** line.
e.g.

```
Depends: Rcpp (>= 0.9.4), RcppProgress (>= 0.1)
```

MakeVars edit **src/MakeVars** and replace its content by

```
PKG_LIBS = '$(R_HOME)/bin/Rscript -e "Rcpp:::LdFlags()" '$(SHLIB_OPENMP_CXXFLAGS)'
'$(R_HOME)/bin/Rscript -e "RcppProgress:::CxxFlags()"' and
PKG_CXXFLAGS += -Ilibsrc '$(SHLIB_OPENMP_CXXFLAGS)' '$(R_HOME)/bin/Rscript
-e "RcppProgress:::CxxFlags()"'
```

c++ code Put your code in **src**. You may for instance copy the RcppExample/src/tests.cpp file in **src**, and RcppExample/R/tests.R in **R**, and try to compile the package (R CMD INSTALL -l test .) and execute the tests:

```
>library(RcppProgressExample, lib.loc="test")
>RcppProgressExample::test_multithreaded(100, 600, 4)
```

Author(s)

Karl Forner

Maintainer: Karl Forner <karl.forner@gmail.com>

See Also

OpenMP API specification for parallel programming: <http://openmp.org>

Rcpp <http://r-forge.r-project.org/projects/rcpp>

Index

*Topic **package**

RcppProgress-package, [1](#)

RcppProgress

(*RcppProgress-package*), [1](#)

RcppProgress-package, [1](#)