

Practical Computing for Economists

Weeks 5 & 6 : An Introduction To Rapid R For Economists

Time and Location:

Harper Center, Weeks 5 & 6

Lecturer:

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Objectives

This part of the class is about showing you how to speed up your R code. We will very briefly discuss parallelism, but our focus will be on learning how to rewrite loops and linear algebra in C++. These are often the most computationally intensive parts of a large project and can be pushed to C++ very easily and with substantial speed gains - improvements of 60 to 100 times faster are not uncommon. We will use the `Rcpp` package to write C++ code that we can call from directly R, and the `RcppArmadillo` package to use very fast C++ linear algebra libraries with really easy syntax.

Structure

The first class will start by covering the situations in which C++ can really speed up your R code. We will then learn how to integrate C++ code into R. With the `Rcpp` package

and RStudio, this is phenomenally easy. So the remainder (and probably the bulk) of this class will be then devoted to learning the basics of the C++ language through a series of examples: input/output from R, functions, variable types, loops, conditionals.

The second class will focus on using `RcppArmadillo` to do very fast linear algebra. We will first cover the basics: initializing matrices, accessing submatrices, multiplication & addition, decomposition and inversion. Then we will cover an extended example - rewriting the Bayesian regression from Week 3 in C++ and bootstrapping it. If there is time we might do the Kalman Filter too, just for fun!

At some point we will also briefly discuss parallelism. This is another easy way to speed up your code, but is relatively easier to learn independently. The *Parallel R* book in the references is excellent for that.

Prerequisites

You should have Rstudio with R version 3.0.0 or higher, and have installed both the `Rcpp` and `RcppArmadillo` packages

References

- Seamless R and C++ Integration with Rcpp, Dirk Eddelbeuttel (Springer, 2013)
(Downloadable as pdf from the UC Library)
- <http://www.rcpp.org/> (Rcpp website)
- <http://adv-r.had.co.nz/Rcpp.html> (Hadley Wickham's Rcpp tutorial)
- <http://www.learncpp.com/> (General C++ website)
- <http://arma.sourceforge.net/> (Armadillo homepage)
- Parallel R, McCallum & Weston (O'Reilly) <http://www.parallelrbook.com/> (Reference for parallelism)