Template Model Builder - (TMB)

Introduction

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Outline

Compiler

required to build model

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TMB

history, components, usage

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Install

basic installation, Virtual TMB, configuration

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Compiler

required to build model

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Install

basic installation, Virtual TMB, configuration

Test

verify that TMB is ready to use

C++ compilers

GCC

default compiler in Linux and Windows (with Rtools)
free software, Linux/Mac/Windows

C++ compilers

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default compiler in Linux and Windows (with Rtools)
free software, Linux/Mac/Windows

Clang

default compiler in Mac (with Xcode)
free software, Linux/Mac/Windows

History of TMB

2009

Kasper Kristensen begins developing TMB

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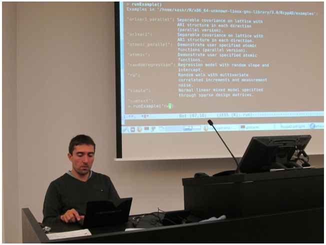
2013

uploaded to GitHub

demonstrated at ADMB workshop in Reykjavik

History of TMB

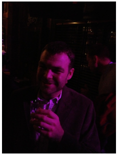
Flashbacks from Reykjavik 2013



```
> runExample()
Examples in '/home/kaskr/R/x86_64-unknown-linux-gnu-library/3.0/RcppAD/examples':

"ar1xar1_parallel": Separable covariance on lattice with
                    AR1 structure in each direction
                    (parallel version).
"ar1xar1":          Separable covariance on lattice with
                    AR1 structure in each direction.
"atomic_parallel":  Demonstrate user specified atomic
                    functions (parallel version).
"atomic":           Demonstrate user specified atomic
                    functions.
"randomregression": Regression model with random slope and
                    intercept.
"rw":               Random walk with multivariate
                    correlated increments and measurement
                    noise.
"simple":           Normal linear mixed model specified
                    through sparse design matrices.

"sumtest":
> runExample("rw")
1:**-  *R*          Bot (97,16)    (iESS [R]: run)------------------
```



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paper available on arXiv

package available on CRAN

TMB components

TMB

CRAN package: R functions, TMB.so/TMB.dll

Laplace approximation: integrate out random effects

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TMB

CRAN package: R functions, TMB.so/TMB.dll

Laplace approximation: integrate out random effects

C++

CppAD: automatic differentiation

BLAS and EIGEN: linear algebra in C++

CHOLMOD: sparse matrix routines

OpenMP: parallel computations

TMB components

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CRAN package: R functions, TMB.so/TMB.dll

Laplace approximation: integrate out random effects

C++

CppAD: automatic differentiation

BLAS and EIGEN: linear algebra in C++

CHOLMOD: sparse matrix routines

OpenMP: parallel computations

R

Matrix: linear algebra in R

nlminb: fit model

Using TMB

Basic steps

Prepare data

- Write R and C++ code
- Compile
- Run model

View results

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Prepare data

- Write R and C++ code
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View results

User environment

- Editor and R (separate)
- IDE (Rgui, RStudio, Emacs, other)

Using TMB

Short **TMB-IDE** demo

Basic installation

Linux

- Install TMB from CRAN

Basic installation

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- Install TMB from CRAN

Mac

- Install Xcode
- Install TMB from CRAN

Basic installation

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- Install TMB from CRAN

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- Install Xcode
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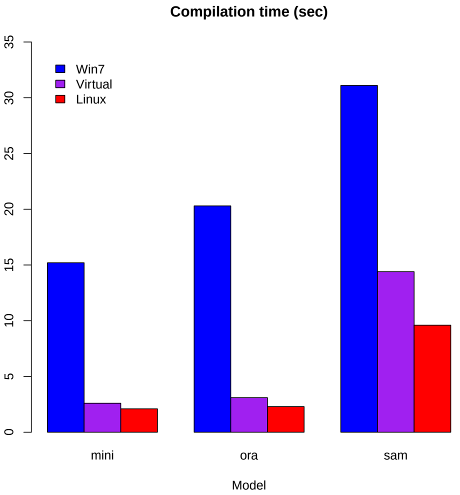
Windows

- Install Rtools, set PATH
- Install TMB from CRAN

Compilation takes a long time in Windows . . .



Virtual TMB

Linux

- Install TMB from CRAN

Mac

Install Xcode

Install TMB from CRAN

Windows

Install Rtools, set PATH

Install TMB from CRAN

. . . or

- Install VirtualBox
- Install Virtual TMB

Faster? Convenient?

- Install VirtualBox
- Install Virtual TMB

6 × faster

Configure

Linux and Mac

- Precompile
- Decide whether to use GCC or Clang
- Define environment variable `R_MAKEVARS_USER` and select compiler settings `CXX` and `CXXFLAGS`

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Virtual TMB

Fully configured, ready to use

Test installation

Open **R** and type:

```
library(TMB)
runExample("simple", clean=TRUE)
example(sdreport)
```

Linear regression

1. Create working folder like `c:/workshop/linreg`
2. Copy `linreg.cpp`, `linreg.dat`, and `linreg.R` into working folder
3. Build and run

Exercise

1. Copy `c:/workshop/linreg` to `c:/workshop/mu`
2. Rename `linreg.*` files to `mu.*`
3. Modify R and C++ code so the model estimates μ