Bayesian-area-to-point-kriging

Source code in the R programming language, belonging with paper: *Model based geostatistics from a Bayesian perspective: Investigating area-to-point kriging with small datasets*. Luc Steinbuch, Thomas G. Orton, Dick Brus. Accepted by Mathematical Geosciences (https://www.springer.com/journal/11004); will be published in 2019 or 2020. The associated spatial real world dataset is available on request; ask the first author (Luc Steinbuch).

Updates will be available at repository https://git.wur.nl/stein012/Bayesian-area-to-point-kriging

Contents of this README.pdf

Source code functionality

1) Generate a **single spatial simulation**, average this to area means, perform parameter estimation and Bayesian inference, predict using area-to-point kriging, and validate (`main_1D_single_simulation.R`, `main_2D_single_simulation.R`)
2) Generate **many spatial simulations** as mentioned above, also with different properties, and summarise the validation results (`main_1D_simulation_ensemble.R`, `main_2D_simulation_ensemble.R`)
3) Apply Bayesian and non-Bayesian area-to-point-kriging to a **real world dataset** (`main_case.R`)
4) **Create specific plots** to support theory (`main_plot_reference_prior_1D_simulation.R`, `main_plot_reference_prior_case.R`)

All other .R files are accessed, directly or indirectly, by one of the R-scripts mentioned above; the dependency of all coded functions is graphically represented on page 2 in this README document.

Note that this source code is primarily meant to reproduce the research in above mentioned paper, rather than being used for production purposes. Improved versions of the source code in the `./bayesian_areal_kriging/` subdirectory will probably become separately available in the future.

Directories

`./`: and `./bayesian_areal_kriging/`: R source code, described in page 2
`./data_burkina_faso/`: Spatial agronomical data about Burkina Faso, **AVAILABLE ON REQUEST**
`./export_tables_exportbw/` and `./exportcolour/`, export directories for the algorithm. Contains produced `.pdf` and `.tex` (LaTex) files.
`./session_results_1D_sim/` and `./session_results_2D_sim/`: Temporally storage of simulation results. Contains produced `.RData` (R) files.

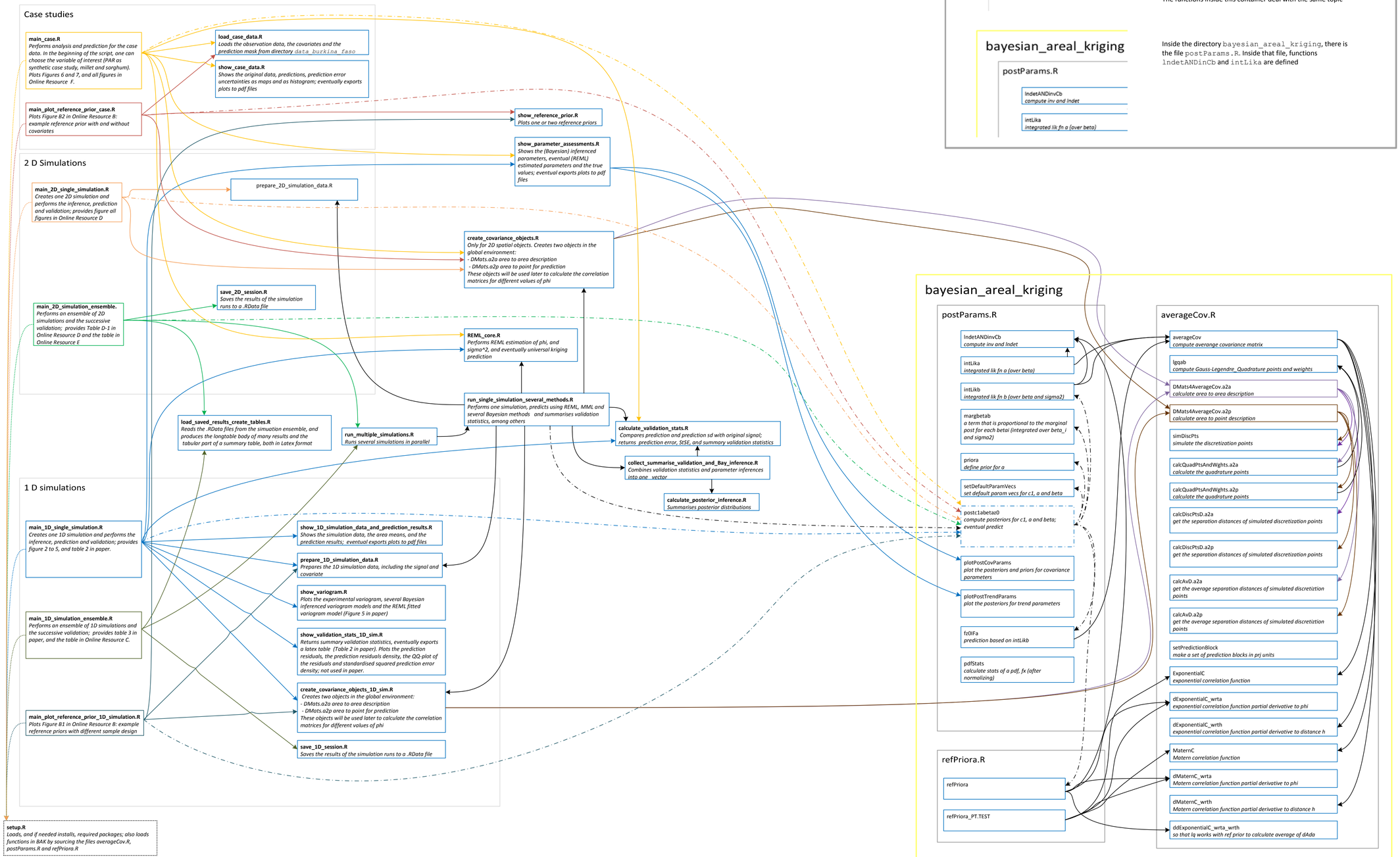
Contact

For questions about the source code in the `./bayesian_areal_kriging/` subdirectory, we direct to the second author (Thomas G. Orton). For questions about the rest of the code and the real-world dataset, we direct to the first author (Luc Steinbuch, https://orcid.org/0000-0001-6484-0920).

Coding conventions

Except for the "bayesian_areal_kriging" subdirectory, almost all code is divided into code sections according to RStudio, for convenient code folding and navigation. Example: `'#### A Descriptive Name ####'`. See also https://support.rstudio.com/hc/en-us/articles/200484568-Code-Folding-and-Sections .
Many variables and list elements have a prefix indicating their type/class, for example '`li_`..' means a list, '`bo_`..' a single boolean, '`n_`...' a single number and '`vn_`...' a vector of numbers.
While in the paper we use greek letters such as phi, sigma^2 and tau^2, in this code you will find '`a`', '`c1`' and '`c0`' respectively, alongside with `phi`, `sigmasq`/`sigma2`, `tausq`/`tau2` etc. All those names are equivalent.

Functions, .R files and dependencies



License

Appropriate credit is made if you cite the paper this code belongs with - see above.

The case data provided in subdirectory "DataBurkinaFaso" is available upon request; even then still under the notion that this study (and thus datacollection) was supported by the SIGMA European Collaborative Project (FP7-ENV-2013 SIGMA-Stimulating Innovation for Global Monitoring of Agriculture and its Impact on the Environment in support of GEOGLAM-project).

Session info

Our code worked under the following operating systems, R versions and package versions:

Desktop (all scripts except for the simulation ensembles):

```
>  sessionInfo()
R version 3.5.1 (2018-07-02)
Platform: x86_64-w64-mingw32/x64 (64-bit)
Running under: Windows 7 x64 (build 7601) Service Pack 1

Matrix products: default

locale:
[1] LC_COLLATE=English_Australia.1252  LC_CTYPE=English_Australia.1252    LC_MONETARY=English_Australia.1252
LC_NUMERIC=C
[5] LC_TIME=English_Australia.1252

attached base packages:
[1] grid      parallel  stats     graphics  grDevices utils     datasets  methods   base

other attached packages:
[1] lattice_0.20-35 raster_2.6-7    rgdal_1.3-4     xtable_1.8-3    statmod_1.4.30  DEoptim_2.2-4   invgamma_1.1
sp_1.3-1

loaded via a namespace (and not attached):
[1] compiler_3.5.1 tools_3.5.1    yaml_2.2.0     Rcpp_0.12.19
```

HPC cluster (`main_1D_simulation_ensemble.R`, `main_2D_simulation_ensemble.R`):

```
> sessionInfo()
R version 3.5.3 (2019-03-11)
Platform: x86_64-pc-linux-gnu (64-bit)
Running under: Scientific Linux 7.6 (Nitrogen)

Matrix products: default
BLAS: /cm/shared/apps/R/3.5.3/lib64/R/lib/libRblas.so
LAPACK: /cm/shared/apps/R/3.5.3/lib64/R/lib/libRlapack.so

locale:
 [1] LC_CTYPE=en_US.UTF-8       LC_NUMERIC=C               LC_TIME=en_US.UTF-8        LC_COLLATE=en_US.UTF-8
 [5] LC_MONETARY=en_US.UTF-8    LC_MESSAGES=en_US.UTF-8    LC_PAPER=en_US.UTF-8       LC_NAME=C
 [9] LC_ADDRESS=C               LC_TELEPHONE=C             LC_MEASUREMENT=en_US.UTF-8 LC_IDENTIFICATION=C

attached base packages:
[1] parallel  stats     graphics  grDevices utils     datasets  methods   base

other attached packages:
[1] RandomFields_3.3        RandomFieldsUtils_0.5.1 geoR_1.7-5.2.1          statmod_1.4.30
[5] DEoptim_2.2-4           invgamma_1.1            sp_1.3-1

loaded via a namespace (and not attached):
[1] MASS_7.3-50     compiler_3.5.3  tools_3.5.3     yaml_2.2.0      grid_3.5.3      splancs_2.01-40 lattice_0.20-38
[8] tcltk_3.5.3
```