Desarrollo de interfaces gráficas para librerías de R: OpenCPU y la librería “spdynmod”

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Who are we?

• **University of Murcia** Department of Ecology and Hidrology (Spain)

• **BC3** Basque Climate Change Centre (Bilbao)

• **Randbee Consultants** is a consulting firm made of a multidisciplinary team of researchers with a strong environmental science background (Malaga)
Objectives

- Create a GUI for an existing R model library
- Test OpenCPU for model GUI development and documentation
- Compare OpenCPU with Shiny
An open-source spatio-dynamic wetland model of plant community responses to hydrological pressures

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Watershed Irrigation and Wetland plant communities
Spdynammodocpu (R library using OpenCPU)

A spatio-dynamic modelling package that focuses on three characteristic wetland plant communities in a semiarid Mediterranean wetland in response to hydrological pressures from the catchment. The package includes the data on watershed hydrological pressure and the initial raster maps of plant communities but also allows for random initial distribution of plant communities. Ongoing developments of the package focus on offering easy to use tools for creating other spatio-dynamic models.
What is OpenCPU?

• Web application framework for R (user library and server)
• System exposes an HTTP API for embedded scientific computing with R
• Can run as a single-user development server or as a high performance multi-user cloud server
• OpenCPU JavaScript client library provides full integration of R and other JavaScript libraries
# OpenCPU vs Shiny

<table>
<thead>
<tr>
<th>OpenCPU</th>
<th>Shiny</th>
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<tbody>
<tr>
<td>Requires some <strong>basic knowledge</strong> on CSS and JavaScript</td>
<td><strong>Fast</strong> prototyping and development without knowledge of JavaScript and CSS languages</td>
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<td>OpenCPU server is <strong>easy</strong> to set up; it only takes a few minutes (<strong>100% open source</strong>)</td>
<td><strong>Easy</strong> to deploy Web apps using shinyapps hosting service and shiny server library (<strong>commercial</strong>)</td>
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<td><strong>No limit</strong> to the number of concurrent users</td>
<td><strong>Single</strong> R process per application</td>
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<tr>
<td>OpenCPU server provides a reliable and interoperable <strong>HTTP API</strong> for data analysis based on R</td>
<td>Shiny currently <strong>lacks</strong> of a REST API</td>
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<tr>
<td>Applications will naturally support <strong>parallel computing</strong> and <strong>asynchronous requests</strong></td>
<td>Shiny can <strong>potentially</strong> support parallel computing but it is rather a presentation tool</td>
</tr>
<tr>
<td><strong>Direct integration</strong> with any JavaScript library</td>
<td>Shiny uses <strong>only JavaScript libraries</strong> already implemented in R</td>
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Examples of Shiny apps
Spdynmod GUI (server/desktop app)

Bootstrap

OpenCPU

Leaflet

R
Spdynmod GUI (model run)

Parameters

Potential growth rate of reed beds
0.005

Random initial conditions
FALSE

Potential growth rate of salt marsh
0.2

Run model
Spdynmod GUI (model validation)

Goodness of fit Parameters

Year of interest
1992

Initial Window Size
1

Final Window Size
5

Run Goodness of fit

Multiple Resolution Goodness of Fit

1992

Fw

window size

Ft = 0.71 ; k = 0
How does the model work?

The Marina del Camòli wetland mainly comprises salt steppe, salt marsh and reed bed areas, which are distributed high water content and low salinity, whereas salt marsh occupies areas with intermediate water content and high salinity. Directly.

The model assumes only increasing or no water inputs, thus accounting only for the conversion of dry and marsh plant communities and bare soil in each pixel was limited to 25 units. Conversely, in this regard, the model only accounts for the growth and expansion of the reed bed and salt marsh communities by a deterministic approach based on the knowledge of the ecological tolerance of the plant communities and environmental conditions.

Figure 4. Growth rules among the state variables of the model.

Since reed bed stands were not dense enough to be mapped by remote sensors at that early stage, we did not map and analyze species which spread rapidly by extending its rhizomes in all directions, thus allowing ecological spatial neighborhood algorithms were developed and included in the model in order to allow the salt marsh cover to pixels containing bare soil or salt steppe, which are negatively affected by these pressures. Figure 5 shows the...
Conclusions

• OpenCPU good option for running models using GUIs

• Easy to link with existing JS and R libraries (spdynmod/spdynmodocpu)

• GUIs are useful for targeting different end-users and improve model documentation

• Easy to deploy, install and replicate (server/local):
  
  devtools::install_github("javimarlop/spdynmodocpu")
Thanks

Join us at the Spdynmod Community:

The spdynmod library: https://github.com/javimarlop/spdynmod
The interface library: https://github.com/javimarlop/spdynmodocpu

Join the Randbee Team: jobs@randbe.es