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

Juan Arévalo-Torres

Javier Martínez-López

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**

The Spdynmod library on CRAN

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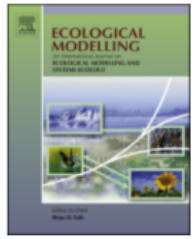

An open-source spatio-dynamic wetland model of plant community responses to hydrological pressures

Javier Martínez-López[a,*], Julia Martínez-Fernández[b,c], Babak Naimi[d,e], María F. Carreño[a], Miguel A. Esteve[a]

[a] Ecology and Hydrology Department, University of Murcia, Campus de Espinardo, E-30100 Murcia, Spain
[b] Applied Biology, University Miguel Hernandez de Elche, Edificio Torreblanca, Av. de la Universidad s/n, E-03202 Elche, Alicante, Spain
[c] Sustainability Observatory of Murcia Region, Institute for Water and Environment, University of Murcia, Edificio D. Tercera Planta, Campus de Espinardo, E-30100 Murcia, Spain
[d] InBio/CIBIO, University of Èvora, Largo dos Colegiais, 7000 Èvora, Portugal

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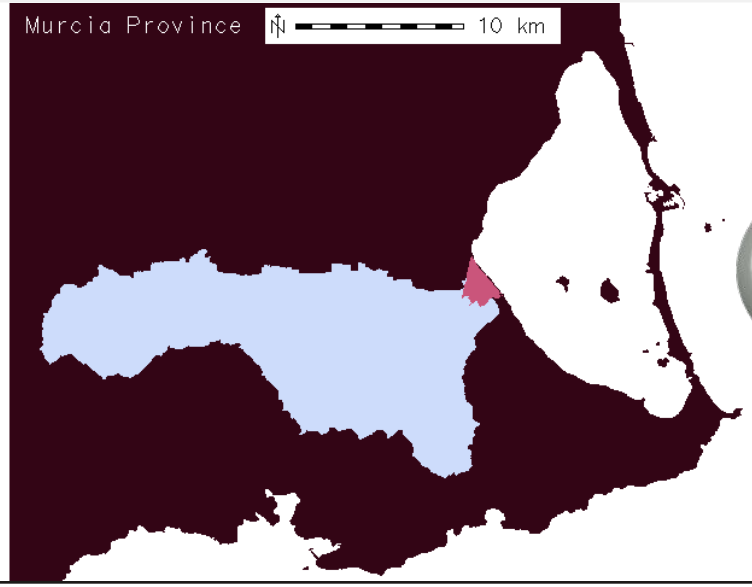
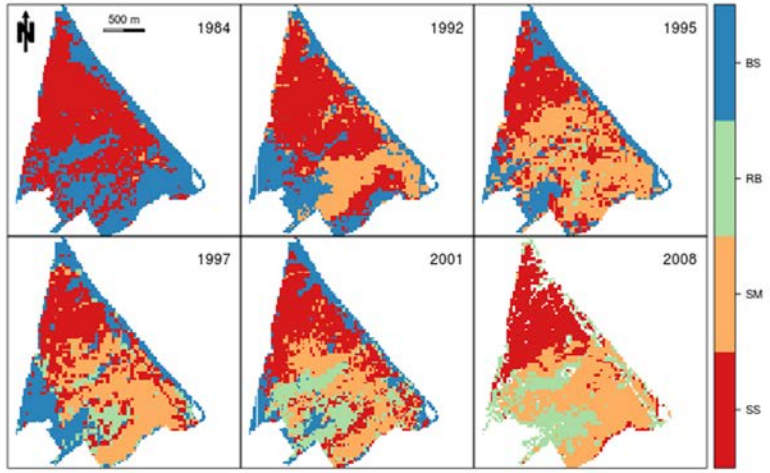
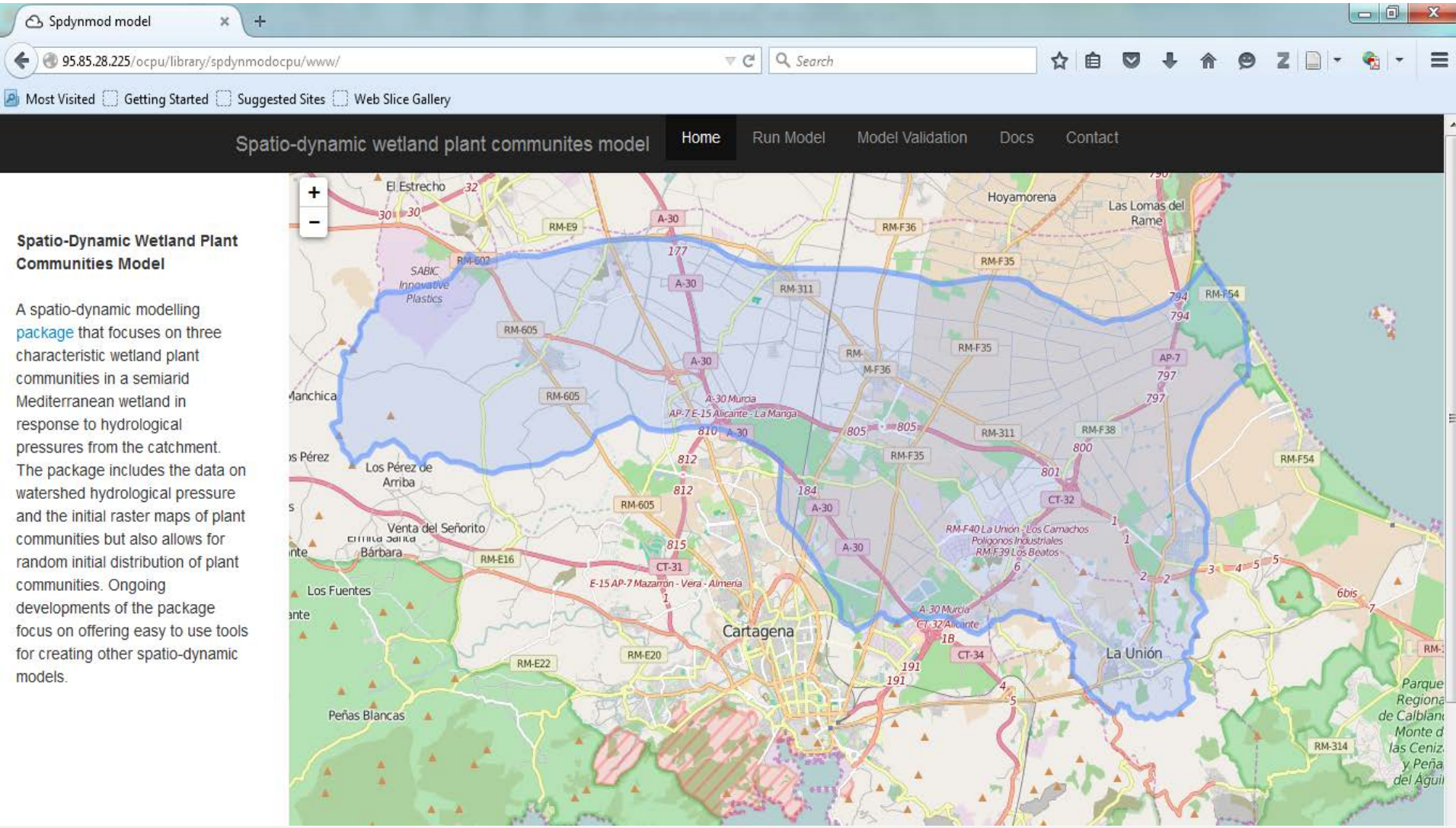
Watershed Irrigation and Wetland plant communities





Spdynmod**ocpu** (R library using OpenCPU)



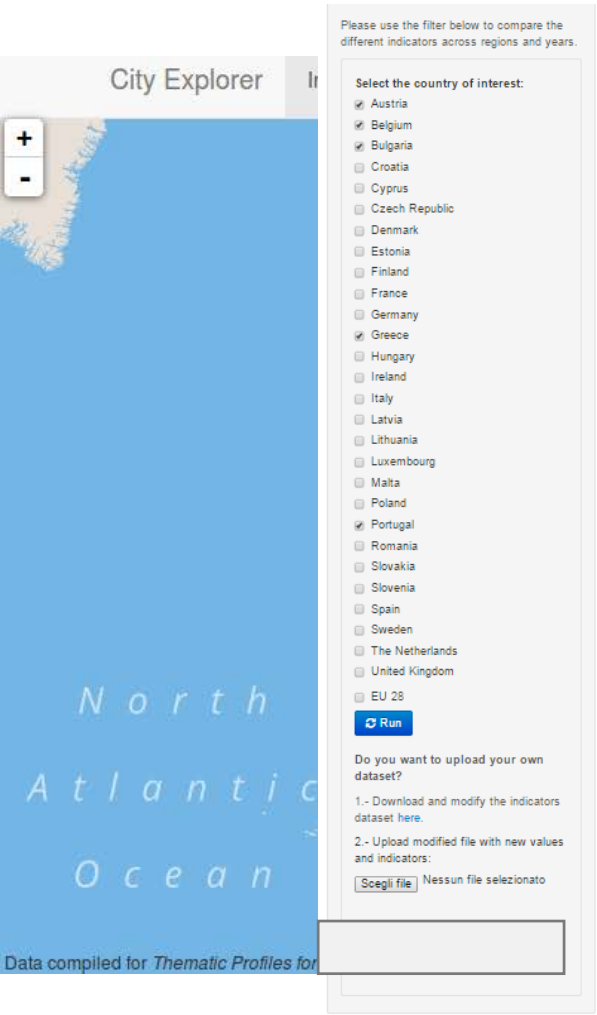
What is OpenCPU?

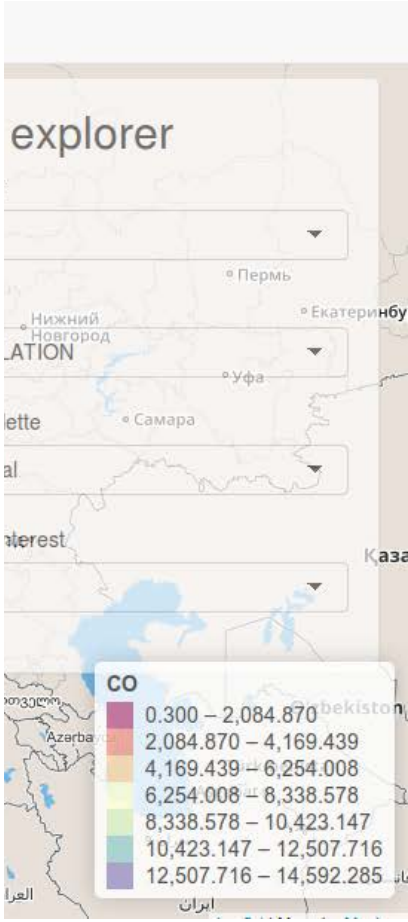
- Web application framework for R (user library and server)
- System exposes an HTTP API for embedded scientific computing with R
- Can run as a single-user development server or as a high performance multi-user cloud server
- OpenCPU JavaScript client library provides full integration of R and other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

OpenCPU vs Shiny

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

Examples of Shiny apps





Spdynmod GUI (server/desktop app)

Spdynmod GUI (model run)

Spatio-dynamic wetland plant communites model | Home | Run Model | Model Validation | Docs | Contact

Parameters

Potential growth rate of reed beds

0.005

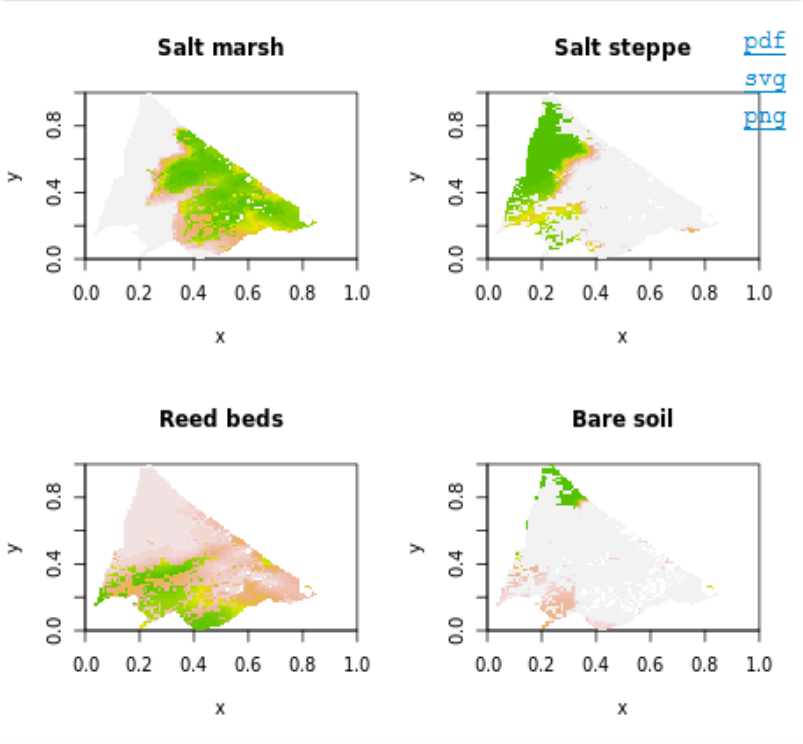
Random initial conditions

FALSE

Potential growth rate of salt marsh

0.2

Run model



Spdynmod GUI (model validation)

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Goodness of fit Parameters

Year of interest

1992

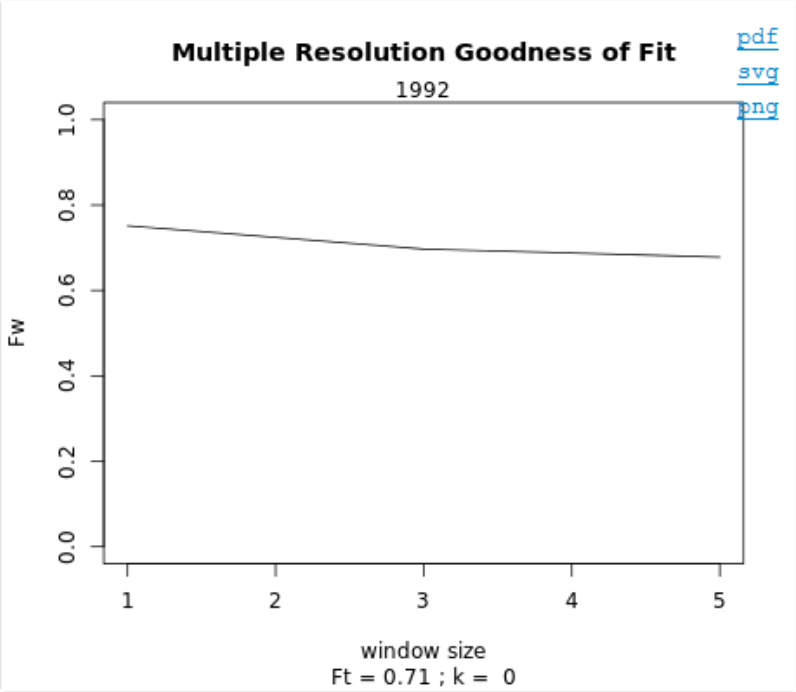
Initial Window Size

1

Final Window Size

5

Run Goodness of fit



Spdynmod documentation

95.85.28.225/ocpu/library/spdynmodocpu/www/wma.html

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What is this model about?

The spdynmod model

Semiarid Mediterranean saline wetlands are semi-terrestrial ecosystems, which yearly undergo dry periods of several months, and shelter a rich, endemic and sensitive biota. In the last decades, the expansion of agricultural irrigated areas in semiarid Mediterranean catchments has led to alte more generalist and opportunistic taxa, such as *Phragmites australis* (reed beds) (Figure 1). A spatio-dynamic model and library were developed that aimed to explain the spatial distribution of three characteristic wetland plant communities in a semiarid Mediterranean wetland site in respon

Figure 1. From left to right: reed beds, salt marsh and salt steppe plant communities.

Wetland plant communities and watershed irrigated agricultural areas were mapped by means of remote sensing at several dates between 1984 and 2008 and were partly used as forcing inputs and validation data (Figures 2 and 3). A dynamic model was initially developed using Stella software

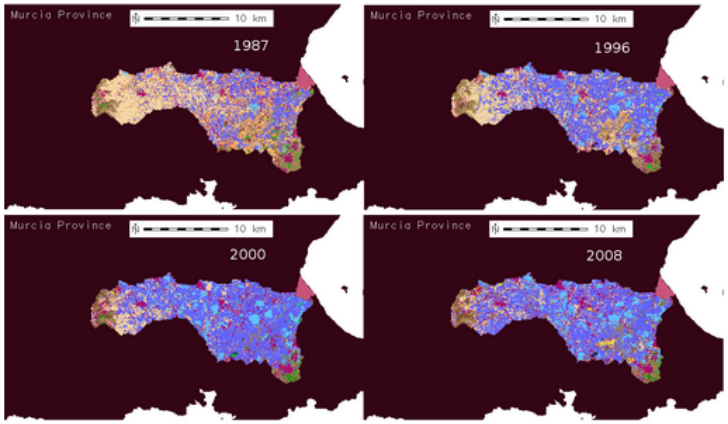

Figure 2. Remote sensing maps of the wetland watershed land cover during the study period. Blue and purple colours represent irrigated land areas.

The conversion between plant communities was caused by the increase in water inflows from the watershed, mediated by spatial parameters, such as the distance to ephemeral rivers and the flow accumulation map within the wetland site. Results of the model were in agreement with remote

95.85.28.225/ocpu/library/spdynmodocpu/www/hmw.html

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How does the model work?

The Marina del Carmoli wetland mainly comprises salt steppe, salt marsh and reed bed areas, which are distribu high water content and low salinity, whereas salt marsh occupies areas with intermediate water content and hig Directive.

The three above-mentioned plant community types (*i.e.* salt steppe, salt marsh and reed beds) and the bare soi were established by means of remote sensing in year 1984, originally resampled to a pixel size of 25x25 m.

The maximum total abundance of plant communities and bare soil in each pixel was limited to 25 units. Conve

The model assumes only increasing or no water inputs, thus accounting only for the conversion of drier and m

In this regard, the model only accounts for the growth and expansion of the reed beds and salt marsh communi deterministic approach based on the knowledge of the ecological tolerance of the plant communities and envir

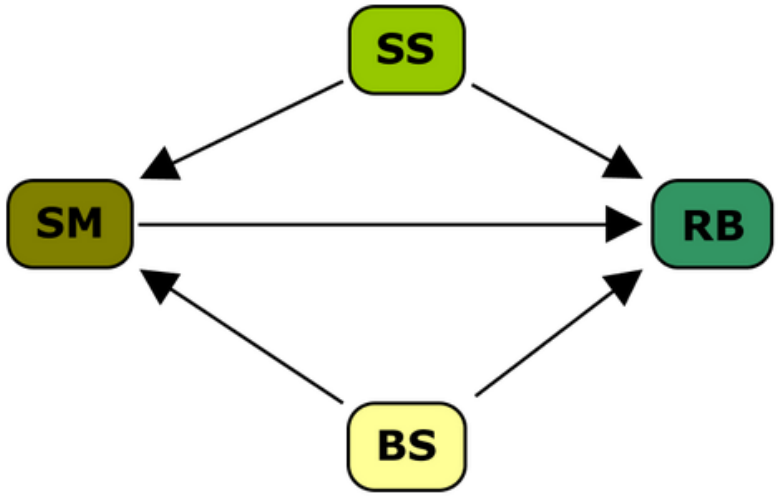

Figure 4. Growth rules among the state variables of the model.

Since reed bed stands were not dense enough to be mapped by remote sensors at that early stage, we did not kn and clonal species which spreads rapidly by extending its rhizomes in all directions, this seemed an ecologically

Spatial neighborhood algorithms were developed and included in the model in order to allow the salt marsh con pixels containing bare soil or salt steppe, which are negatively affected by these pressures. Figure 5 shows the c

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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@randbee.es