### Purpose

**SpatialEpiApp** is a **Shiny** web application that allows to visualize spatial and spatio-temporal disease data, estimate disease risk and detect clusters.

The application allows to fit Bayesian disease models to obtain risk estimates and their uncertainty by using **R-INLA**, and to detect clusters by using the scan statistics implemented in **SaTScan**.

The application allows user interaction and creates interactive visualizations such as maps supporting padding and zooming and tables that allow for filtering. It also enables the generation of reports containing the analyses performed.

### Structure

The application consists of three pages:

* ‘Inputs’ where the user can upload the input files and select the type of analysis
* ‘Analysis’ where statistical analyses are carried out, results can be visualized, and reports can be generated
* ‘Help’ containing information about the application use and references.

**Inputs page**

The ‘Inputs’ page is the first page we see when we launch the application. In this page we can upload the required files and select the type of analysis to be performed. It is composed of four components: - Upload map - Upload data - Select analysis - Contents

**Start analysis button**

When we click the ‘Start analysis’ button the application checks the files and options entered are correct and calculates the expected counts for each area and date. It also computes the ratio of the observed divided the expected. This ratio is called SIR irrespectively if data refers to mortality or incidence. Then the application redirects to the ‘Analysis’ page.

**Analysis page**

In the ‘Analysis’ page we can visualize the data, perform the statistical analyses, and generate reports. On the top of the page there are four buttons:

* ‘Edit Inputs’ button is used when we wish to return to the ‘Inputs’ page to modify the analysis options or upload new data.
* ‘Maps Pop O E SIR’ button creates plots of the population, observed, expected and SIR variables.
* ‘Estimate risk’ button is used for estimating the disease risk and their uncertainty
* ‘Detect clusters’ is used for the detection of disease clusters

The ‘Analysis’ page also contains four tabs called ‘Interactive’, ‘Maps’, ‘Clusters’ and ‘Report’ that include tables and plots with the results.

**Help page**

Both the ‘Inputs’ and the ‘Analysis’ pages include a ‘Help’ button that redirects to the ‘Help’ page. This page shows information about the use of the application, the statistiscal methodology and the developing tools employed.

### Dependencies

**SpatialEpiApp** has been developed using **R** and **Shiny** and is dependent on the following software and **R** packages:

|  |  |
| --- | --- |
| **Software** |  |
| R | Language and environment for statistical computing and graphics |
| SaTScan | Software that analyzes spatial, temporal and space-time data using scan statistics |
| **R packages** |  |
| dplyr | A fast, consistent tool for working with data frame like objects, both in memory and out of memory |
| dygraphs | Interface to ‘Dygraphs’ Interactive Time Series Charting Library |
| ggplot2 | Creates elegant data visualisations using the grammar of graphics |
| htmlwidgets | Provides a framework for easily creating R bindings to JavaScript libraries |
| knitr | Tool for dynamic report generation in R |
| leaflet | Create Interactive Web Maps with the JavaScript ‘Leaflet’ Library |
| mapproj | Converts latitute/longitude into projected coordinates |
| maptools | Set of tools for manipulating and reading geographic data, in particular ESRI shapefiles |
| RColorBrewer | Provides color schemes for maps and other graphics |
| rgdal | Provides bindings to Frank Warmerdam’s Geospatial Data Abstraction Library (GDAL) |
| rgeos | Interface to Geometry Engine - Open Source (GEOS) using the C API for topology operations on geometries |
| rmarkdown | Convert R Markdown documents into a variety of formats including HTML, MS Word, PDF, and Beamer |
| R-INLA | Performs full Bayesian analysis on generalised additive mixed models using Integrated Nested Laplace Approximations |
| shiny | Web Application Framework for R |
| shinyjs | Perform common useful JavaScript operations in Shiny apps that will greatly improve the apps without having to know any JavaScript |
| sp | Classes and Methods for Spatial Data |
| SpatialEpi | Contains methods for cluster detection, disease mapping and plotting methods |
| spdep | Contains a collection of functions for spatial dependence: weighting schemes, statistics and models |
| xts | Extensible time series class and methods |

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