Arabesque

gflowiz project team

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Figure 1: Logo d'Arabesque

About *Arabesque*

Arabesque is a web application for thematic mapping of flow and spatial networks datasets. This first version allows the exploration, filtering, geovisualization and representation of complex matrices. it provides a full toolset to filter you origin-destination data and simplify it in order to make clearer and understandable maps.

Arabesque allows the creation of flow maps from a web browser - equipped with Mozilla or Chrome, from its own datasets. It is based on current technological possibilities, in particular those offered by the new web visualization (built in javascript and HTML 5) and mapping libraries (openlayers, d3, OSM, Turf, NaturalEarthData).

Challenges

The challenge of *Arabesque* consists in offering a set of tools for the analysis and tne cartographic representation of complex matrices (categorical and temporal). Its methodology is innovative : it articulates several dimensions of a matrix, interactivity and animation). Its techniques allow an easy exploration, a fluidity of the display in a simple configuration facilitating the appropriation of flow mapping by different audiences (academic, institutional, socio-economic, educational...).

Contributors

Contributors are:

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- Development & Design Etienne Côme (coord.), Thomas Bapaume and Paul Fabre.

Figure 2: Logo du projet GFlowiz

- Documentation Nicolas Roelandt (coord.), Françoise Bahoken

General project and funding

The geographic flow vizualisation (gflowiz) project

Arabesque is part of the Gflowiz research project on flow maps in the geoweb. One of its goals is the web design of a geo visualization application for flow or traffic data to analyze the geographical determinants of spatial mobility. To this end, it aims to allow data describing geographical interactions to be explored and represented graphically, from different points of view, by focusing on statistical and geographical data filtering, spatial scale issues specific to certain data sets (the world scale or local scale) and their temporality.

Funding

The project is funded by former IFSTTAR's scientific direction (VP Recherche Univ. Gustave Eiffel), with the participation of the Projet federateur Mobilities and numeric transitions (PF MobTransNum). The team is strengthened by the participation of members of CNRS laboratories, as well as it is supported by the research GDR Magis through the GEOWEB prospective action (2019).

About *Arabesque* documentation

This document aims to present how *Arabesque* works and how to use it using example datasets provided.

The documentation is segmented in several parts:

- Main page
- Main functionnalities
- Import a dataset

Please find the application at this address : arabesque.ifsttar.fr and more information on the project here : geoflowiz.hypotheses.org.

Please report any issue on GitHub. This is a Free and OpenSource project, feel free to help us make it better.

Chapter 1

Main page

The main page welcomes you and provides several informations about the application and a couple ways to enter it.

It is a page that you can scroll down. It is segmented in several parts:

- Welcome page
- Documentation and demos
- Gallery
- General informations on the Gflowiz project
- Detailed informations on the Arabesque application

1.1   Welcome page

1. Arabesque logo : click on it to return to the main page
2. Gallery button : to go directly to the gallery
3. Guide button : go to the guide
4. Project : visit the project website
5. New map : creating a new map with you own dataset
6. Load saved map : reload a map you created before
7. Scroll down to access more informations

1.2   Documentation and demos

1. You can come to this documentation by clicking on the link
2. Arabesque comes with 2 preloaded maps on several subjects:

- London Bike Traffic

Figure 1.1: Welcome page

- Swiss Migration

1.3 Gallery

A caroussel display several screenshots of maps realized with Arabesque.

1.4 General informations

The main page provides general information on :

1. the application (funding and contributors)
2. the Gflowiz project that Arabesque is part of.

1.5 Detailed informations

Finally you can find detailled informations about the application :

Figure 1.2: Demos

Figure 1.3: Gallery

Figure 1.4: General informations

Figure 1.5: Detailed informations

- Software libraries
- Source datasets
- Licence
- Link to the source code
- Contact us policy

Chapter 2

Functionnalities

2.1 Launching an example

In order to test the differents functionnalities provided by Arabesque, we will use the Swiss communting demo. Please find it in the Demo section and click on the `Explore` button (1).

You might be greeted by a warning message. This is normal, if Arabesque find nodes without links or links without nodes, it will remove them. It is based on a join on nodes IDs.

1. Click on `Ok`.

2.2 Panels general presentation

Arabesque is divided by default in 3 panels:

1. Geographical layer management panel
2. Map panel
3. Statistical data filtering panel

The map panel The central part of the application is dedicated to geovisualization itself. After a few simple settings, it is possible to obtain a meaningful map quite easily, as shown below.

The side panels (geographic layer and data) can be hidden by clicking on the

arrows on the side.

Figure 2.1: Launching Swiss communting example

Figure 2.2: Cleaning the dataset

Figure 2.3: Arabesques panels

2.3 Geographical layer management panel

The left panel deals with geographical entities: from the addition of internal or external geonumeric layers, whatever their scale, local (OpenStreetMap, for example) or global (naturalearthdata, for example), their possible reprojection, to their graphic symbolization, particularly developed for the design of links. In addition to the fact that several types of linear shapes are already available, it is possible to play on all the geometrical dimensions of the figures (width, length, surface, curvature).

This layer panel contains several buttons and tools to handle the layers.

1. Home button to get back to Welcome page
2. Projection : click to deploy the projection tool
3. Title : dialog box to change map title
4. Add layers: toolbox to add geographical layers
5. Layers : area where you can manipulate the layer

Let's see those how they work.

2.3.1 Projection tool

By default, entry data and project are into WGS84 (EPSG:4326), which is a Geographic Coordinnate system. If it is great for dataset on a global scale, for more local ones, it might be interesting to use *projected coordinate system*. Arabesque provides a series of preset projection but you can also provide an EPSG code and the application will look for its definition on the website epsg.io.

Figure 2.4: Arabesques panels

Figure 2.5: Projection toolbox

1. Click on the *Projection* button to deploy the toolbox
2. You can choose a projection from the list of provided ones
3. Or you can enter an EPSG code to get the definition from the web.

2.3.1.1   Use a predefined projection

1. Click on the button to deploy the drop-down list
2. Choose the projection you want
3. Click on *Change* to change the map projection to the new one

2.4   Map panel

The map panel cannot be hide, it is always visible. The map is automatically redraw when a side panel is opened/close.

Figure 2.6: Projection toolbox

Figure 2.7: Projection change

1. Zoom in 2. Zoom out 3. Save project (archive the project settings in a zip file) 4. Export map as .png or .geojson file 5. Center map on current links 6. Export filtered data (csv in zip file) 7. Display fullscreen map 8. Hide/show layer management panel 9. Hide/show data handling panel 10. Legend 11. Scale 12. Base map attributions

2.5 Statistical data filtering panel

The right-hand panel is dedicated to statistical data: it offers different interactive filtering possibilities to be applied on nodes and/or links, depending on the types of variables available in your dataset. Additional filtering possibilities according to the classical indicators of graph theory (for nodes) and/or distance travelled for links are also proposed by default.

Figure 2.8: Data filtering panel organisation

The data handling provide several tools to filtering nodes (places) and links (flows) values.

From this panel, you can filter the data with

1. Add filter button
2. Data summary
3. Distance filtering
4. Count filter

The procedure to add a filter is detailed below.

The data summary provides some useful information about the filered information:

- Percentage of link represented on the map
- Percentage of volume represented
- Percentage of node represented

Figure 2.9: Data histogram

All those values are from the kinks and nodes that were loaded.

Please note that Arabesque automatically filter at first load.

The distance and count filters are provided by default.

2.5.1 Filtering procedures

Nodes and links can be filtered using the origin-destination flow distribution diagram

The distribution diagrams allows to filter the data using a slider, in order to manipulate a range of bounded values (between the MIN and MAX). So you can : - enter / change min and max value ; - resize and move the slider on the dataset

2.5.1.1 Change min / max

You can change the min and/or the max values in the fields below the histogram. For example, you want all data from a distance of 60 to 180. When you enter the new values, the grey window will change to fit the new values.

This window represent the filtered data, the data that are displayed. This data window can be resized and displaced.

You can also verify that the data summary as changed

2.5.1.2 Resize and move the data window

You can move the window by moving the cursor other it. When the cursor change to a cross, you can click on it and move it to the left or the right using your mouse.

Figure 2.10: Data filtering

Figure 2.11: Move the window

Figure 2.12: Resize the data window

You can see that the values in the min and max fields and the data summary has change.

You can also resize the window.

When placing the cursor over the edge of the data window, the cursor will change to a left-right arrow. Click on the edge and move it to the right or the left to resize the window.

Again, min or max values changes and the data summary too.

2.5.2 Add a new filter

If the distance and count filters are provided by default, you can also create custom ones.

To create a filter, click on the `Add filter button` at the top of the data handling panel.

A new window will pop up on the screen to parametrize the new filter.

First operation is to select the layer you want to filter.

You can choose between the link layer or the node layer.

Then you can select a variable from this layer. It can be a variable from the dataset like a categorical variable or a variable provided by Arabesque.

Arabesque automatically compute several variables on the data:

- balance
- degree
- weigthed
- count

Select the type of the variable. In this case, the balance is numeral.

Figure 2.13: **Add filter** button

Figure 2.14: Select the layer

Figure 2.15: Select variable

Figure 2.16: Filter type

Figure 2.17: Add filter

Click on `ADD FILTER` to finalize the creation of the new filter.

The new filter appear in the bottom of the data handling panel.

Remove filter

To remove a filter, click on the bin icon on the right side of it.

Figure 2.18: Remove filter

Chapter 3

Import a dataset

In this part, we will show you how to import a dataset into the application.

This example will use the RICardo dataset provided here: https://github.com/gflowiz/sageo-ricardo

This dataset is about goods exchange between countries from the seventeenth century and early twentieth century.

We will use 2 CSV files :

- SAGEO_RICardo_nodes.csv that contains information on the nodes (position mainly);
- SAGEO_RICardo_edges_small.csv that contains informations on the links (or *edges*) who connects the nodes.

Arabesque will be able to link nodes and egdes using common IDs between those 2 files. Arabesque will automatically remove links or nodes that are not common to the 2 files.

3.1 Load the link data

To create a new map, you first start to load the link data. To do so, click on the *Browse* button.

Browse your files and select the `SAGEO_RICardo_edges_small.csv` file.

This file is Ricardo data aggregated by decades to make it smaller footprint.

The file `SAGEO_RICardo_edges_nona.csv` contains non aggregated data.

Click on `Open` to load the data in the application.

Figure 3.1: New map

Figure 3.2: Browse links

Figure 3.3: Add links

When the data has been loaded, the filename will appear in the box and you can click on the *Add* button.

3.2 Load the nodes data

A popup window will open to help you select the informations needed by the application.

Arabesque works with 3 columns:

- ID of the origin node
- ID of the destination node
- the column containing the information on the transferred volume

The RICardo dataset comes with columns named accordingly but the name is not very important.

You can also choose an aggregation function. *Arabesque* provides the most common ones (sum, mean, median, maximum, minimum).

Links needs to be spatialized. This is provided by the nodes.

There is 2 ways to add nodes to the map. By providing a node file or by using preset locations.

3.2.1 From a preset dataset

This feature is a work in progress and is not available yet.

Figure 3.4: Flow import

Figure 3.5: Aggregation functions

Figure 3.6: Import Nodes

3.2.2   From a file

You can provide your own nodes file.

On the previous menu, click on *Import Location*. This will pop up the following window.

Click on *Browse*, select the `SAGEO_RICardo_nodes.csv` file and click on `Open`.

This files need 3 columns:

- a column containing the node IDs
- a column with the latitude of the node
- a column with the longitude of the node

The node is always a point located in space with decimal geographical coordinates.

Before loading the file, *Arabesque* will need to know which column store IDs and lat/long information.

Use the drop-down lists to assign the right columns. Click on the *Arabesque* button to launch the map.

Figure 3.7: Browse files

Figure 3.8: Provides field identification

Figure 3.9: Nodes removal

Figure 3.10: Default map

3.3 New map

3.3.1 Removed nodes and links

When *Arabesque* connects nodes and links, it automatically remove orphans nodes (not related to any link) and links (links without nodes). *Arabesque* will inform you with a popup window.

For example: > 1382 nodes have been removed. > No links have for origin or destination these nodes

Click on OK

3.3.2 Default map

Arabesque will display a default map, with the most significative information and a default theme.

You can modify it like shown in the Functionnalities section.