ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE
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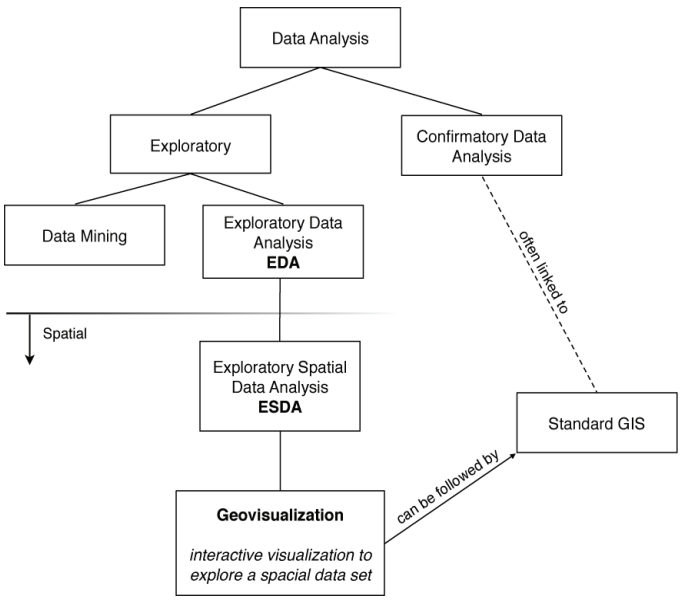
Geovisualisation Tools Applied to Landscape Genetics

This Bachelor thesis treats the capacities and limits of exploratory spatial data analysis and geovisualization applied to genetic diversity in Swiss goat breeds and to environmental information characterizing places where these animals are living.

Geovisualization



Geovisualization is an exploratory approach to data analysis, derived from exploratory data analysis and adapted to a spatial context.

The main characteristics of this method are interactivity, dynamic visualization and combination of different statistical tools and graphs.

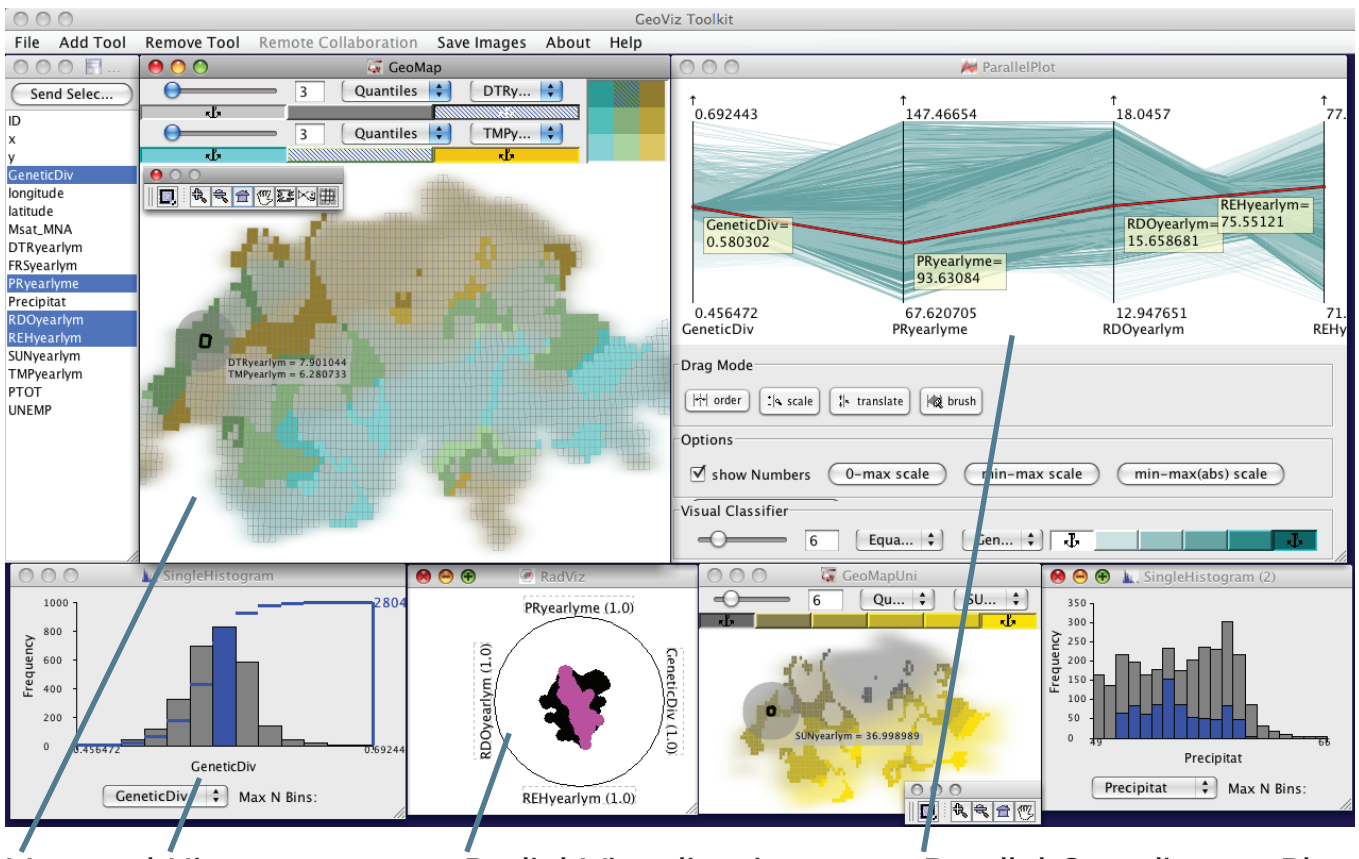
Software

Three typical geovisualization software were evaluated with the help of the following criterias.

	Weight	CommonGIS	GeoDA	GeoViz Toolkit
Manipulating data	1	3	2	1
Varying symbolisation	2	3	1	2
Manipulating the user's viewpoint	1	2	1	3
Highlighting portions of a data	2	3	2	3
Multiple views	1	2	2	2
Animation	1	2	2	2
Linking maps with other forms of display	1	2	2	3
Access to miscellaneous resources	1	3	2	1
Automatic map interpretation	1	1	1	1
Interactivity	2	1	2	3
User-friendly design	1	1	2	2
Documentation	1	3	3	1
Total (max. 45)		33	27	32

CommonGIS and GeoViz Toolkit obtain both a good result, being just one point apart. Since CommonGIS was already applied to landscape genetics, GeoViz Toolkit was selected to analyse genetic diversity in Swiss goat breeds, and its relationships with environmental information.

Application to landscape genetics



Map and Histogram

The choroplete map allows comparing two variables in a spatial context.
In addition, a middle genetic diversitiy is selected in the histogram. The selection affects all other tools as well.

Radial Visualization

This tool visualizes multidimensional data using the Hooke's law taken from mechanics. Each data point is „pulled" to the variables on the circle with the force of its value.

Parallel Coordinates Plot

Every observation is drawn as a line passing its values on the vertical axes. In the case of middle genetic diversity, the observations are distributed over nearly the whole range of the other variables.

Data Set

The data set contains a 4 km^2 cell grid (vector) on the whole area of Switzerland with genetic diversity, original farm data and some environmental variables. The genetic diversity variable and the environmental data are interpolated.

Main Question

The main goal of the analysis is to find possible influences of any environmental parameter affecting genetic diversity in Switzerland. Do relationships between environmental and genetic data exist, and if yes, what particular association could be detected?
In the end, some hypotheses were derived, which could initiate a confrimatory data analysis.

Conclusion

Geovisualization is an approach helping to get a first impression of a data structure and, possibly, to extract some knowledge from a data set, and encouraging further investigation. Beyond these observations, it is important to master each visualisation tool very well.

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