THE HORTON MACHINE FOR DATA ANALYSIS TO HELP SCIENTISTS... AND NOT ONLY

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WHO AM I?

- cofounder of HydroloGIS
- HydroloGIS is member of GvSIG Association
- Osgeo Charter Member and GFOSS advocate
- develop and coordinate Geopaparazzi
- develop and coordinate the HortonMachine project (former JGrasstools)
- working on integration of the HortonMachine and Geopaparazzi in gvSIG



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Supported over the years by the Universities of Trento (prof. Rigon) and Bolzano (prof. Tonon), HydroloGIS

L.E.S.T.O. - LiDAR tools Entering gvSIG

2014 2015

JGRASSTOOLS? HORTONMACHINE?

Due to historical reasons and due to the first releases of the gvSIG plugins in the last month the JGrasstools project decided to go back to its original name: **The Horton Machine**



It is beyond the scope of this presentation to discuss further about it.

THE HORTONMACHINE IN GVSIG Most functionalities can be accessed from the main menu:



THE SPATIAL TOOLBOX





THE SPATIAL TOOLBOX

The GUI



Models are grouped by categories:

- HortonMachine: geomorphology analysis
- Raster and vector processing
- Mobile tools: support for Geopaparazzi (digital field mapping)
- LESTO: LiDAR Empowered Science Toolbox Open Source



HORTONMACHINE MODULES

Drainage direction, total contributing area, network and watershed extraction, rescaled distances and hydrologic attributes, slope, curvatures, hydrologic indexes and geomorphologic attributes.







STATISTICS

Interpolation of meteorological data with Kriging (rainfall and temperature) and Jami (temperature, pressure, humidity and wind).



PEAKFLOW

Evaluation of the maximum discharge for a given precipitation (works also with statistical information rainfall Intensity-Duration Curves)



SAINT VENANT & HECRAS

Simplified 1D hydraulic model: it is **based on Saint Venant** equations, is GIS based, i.e. input and output are GIS layers.

Water depth and velocity are calculated for each section and lateral contributes (inflow and outtakes) are handled.





SHALSTAB

Hillslope stability: Shalstab Critical rainfall



The stability condition is calculated for a given precipitation.



unconditionally stable 0 [mm/day]<qcrit<50 [mm/day] 50 [mm/day]<=qcrit <100 [mm/day]

.gcrit>=200 [mm/day] unconditionally unstable

📕 100 [mm/day]<=qcrit< 200 [mm/day

DEBRISFLOW

Triggering, propagation in network and final propagation on the fan



LESTO

Developed in collaboration with the Free University of Bolzano. At the moment the toolbox is mainly dedicated to forestry analysis.



ADAPTIVE TIN, GENERATION OF DTM FROM LIDAR



EXTRACTION OF BUILDINGS FROM LIDAR DATASETS





SINGLE TREE EXTRACTION

Vegetation: individual tree crown approaches are followed, aimed to detect position and main characteristics of each single tree.



Modules that work both on raster and point clouds.



THE RASTER MAP CALCULATOR The mapcalc is a tool that can be use to perform map

algebra on raster maps.

Let's assume you want to know which part of an elevation model between 1000 and 1300 meters looks towards south.

Once you calculated the aspect map with the Spatial Toolbox, you can use a mapalgebra formula like this:

```
if (dtm_all>1000 && dtm_all<1300 && aspect >160 && aspect <200 ) {
  result = dtm all;
else {
  result = -9999.0;
```

THE RASTER MAP CALCULATOR

The GUI of the mapcalc looks like the following. And the map from the previous formula like the one in the map view.



GEOPAPARAZZI TOOLS FOR GVSIG

The plugins contain a set of tools dedicated to the interaction with the digital field mapping app for android Geopaparazzi.

It is beyond the scope of this presentation to describe these tools.

To summarize in gvSIG it is possible to:

- create the map background data as .mbtile
- export all the data contained in the project as shapefiles
- and browse the images linked in the shapefiles

EPANET

EPANET is a powerful and well known software for water supply system management (analysis) and design.



Again, it is beyond the scope of this presentation to describe these tools.

TOOLS AND UTILITIES

The Horton Machine plugins contain a set of small tools and utilities that can be useful in a number of situation.

We often need them when we create new modules and need to test them on large rasters.

Most of them can be accessed from the main menu:





THE POSITION INFO TOOL

This tools allows the user to view the clicked coordinates and see them in a different projection and also copies them into the clipboard:





WKT GEOMETRY TOOL

One can select a geometry in the layer and extract the WKT representation of the geometry. The same way one can write/paste some WKT geometry and insert it in the layer.



THE PROJECTION TOOL

A projection can be chosen and customized in the textarea (ex. missing Bursa Wolf Parameters).

This tool will do nothing more than create the prj file for the layer's source.

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THE FEATURE BROWSER

The feature browser is a simple yet very usefull tool when you need to check a dataset. The tool puts the features in a list and allows the user to browse them back and forth.





The raster styler can be accessed from the main menu or from the context menu (right click) on raster layers:



Right now, when one defines a colortable for a map, he gets 255 color rules and an unreadable legend.



The map of aspect ranges between 0 and 360 degrees, usually coloured from white to black between 0 and 180, and from black to white between 180 and 360. \rightarrow 3 rules

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If we style also an elevation model and add some transparency, we get a nice 3D feeling



And then there are maps that need categories. Ex. to nicely read a map of flowdirections you need to have a legend showing the directions.



We often need to analize small portions of large rasters. Everything looks the same, due to the fact that the colortable is calculated on the whole raster. A local **colortable** would be handy:





This is what the Raster Graphics View it here for. Once opened from the context menu of the selected raster, it openes a small window:





Once selecting the options show cells and no text, it is possible to view the local colortable:





It is also possible to view the raster values:

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...or the cols/rows of the loaded raster file... or both.

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It is also possible to have a look at the steepest direction of each cell. Pits are shown as red fat dots.





RASTER VALUES COPY

Have you ever needed to analyze small portions of large rasters? And maybe extract those portions to faster investigate them?





RASTER VALUES COPY

Once triggered, it copies the visible portion of the map into the system clipboard as an ascii raster map, ready to be copied into a file and be used:







THANKS FOR YOUR ATTENTION!

Homepage: http://www.hortonmachine.org

Need help? Join the Mailinglist. http://groups.google.com/group/jgrasstools **Useful links**:

https://www.slideshare.net/search/slideshow?q=jgrasstools http://jgrasstechtips.blogspot.it



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