Free Open Source Software for Geoinformatics (FOSS4G)

A Practical Example – System for Automated Geoscientific Analyses (SAGA)

Zlatko Horvat, MSc

DGU Područni ured za katastar Čakovec

Give a Basic Introduction to Free and Open Source Software (FOSS)

Give an Overview on FOSS for Geoinformatics (FOSS4G)

Talk on SAGA and Introduce the Basic Concepts of Software

A Basic Introduction to Free and Open Source Software (FOSS)

FOSS Freedoms

"Free software is a matter of the user's freedom to run, copy, distribute, study, change and improve the software. More precisely, it means that the programs's users have the four essential freedoms:

- The freedom to run the program, for any purpose (freedom 0).
- The freedom to study how the program works, and change it so it does your computing as you wish (freedom 1). Access to the source code is a precondition for this.
- The freedom to redistribute copies so you can help your neighbor (freedom 2).
- The freedom to distribute copies of your modified versions to others (freedom 3). By doing this you can give the whole community a chance to benefit from your changes. Access to the source code is a precondition for this".

-from the Free Software Definition
http://www.gnu.org/philosopy/free-sw.html

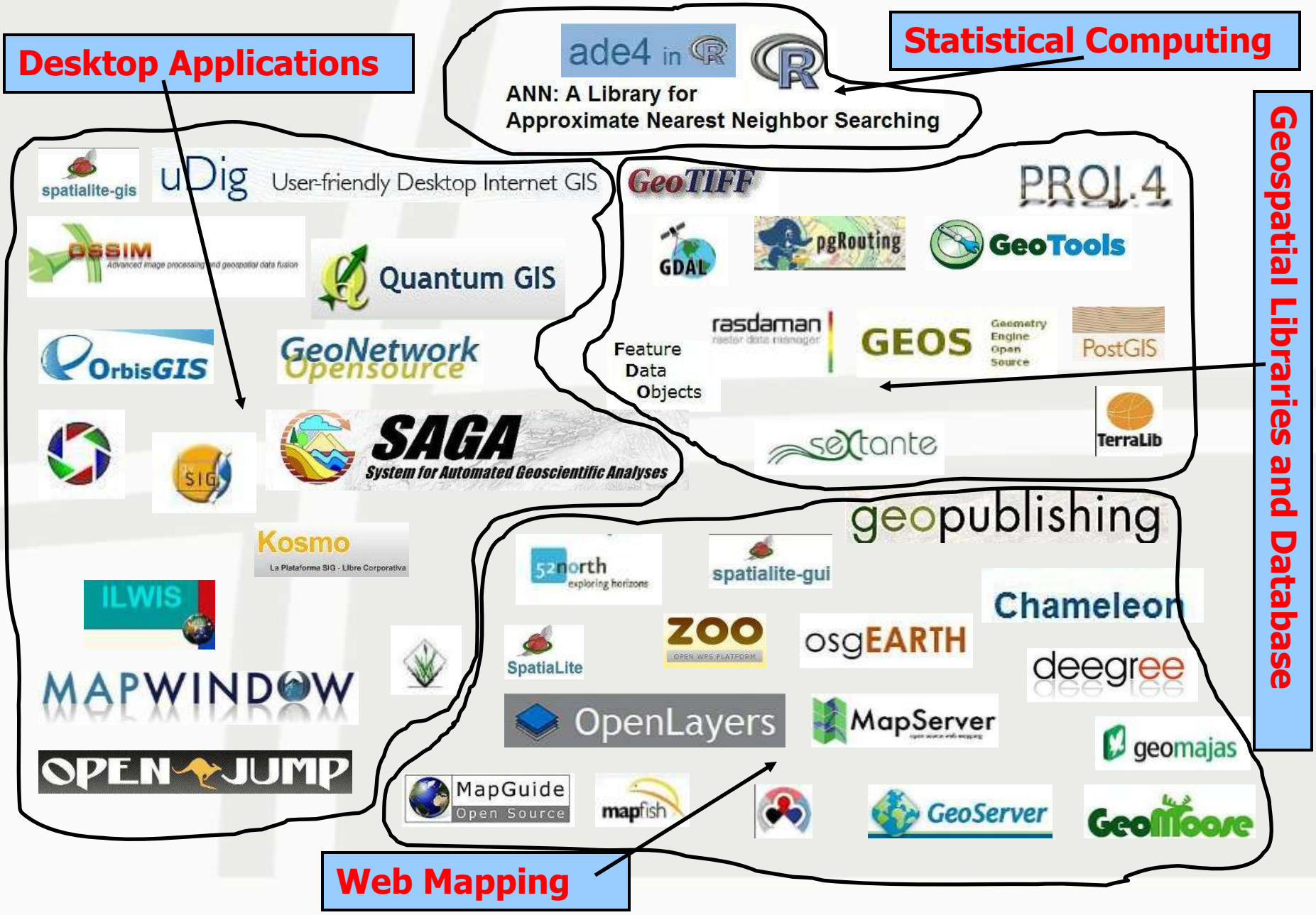
FOSS4G

The Open Source Geospatial Foundation (OSGeo) was created to support the collaborative development of open source geospatial software, and promote its widespread use.

- The FOSS4G was first coined in early 2004 as an acronym for Free and Open Source Software for Geoinformatics by a research group working on I18N of GRASS and MapServer
- The name of an event hosted today by the Open Source Geospatial Foundation
- Open source geospatial software refers to GIS, GPS, spatial data management and related developer tools and end user applications delivered with an open source license.
- The name FOSS4G is not registered as a trademark

FOSS4G 2013 will be in Nottingham

FOSS4G Explosion



Introduction to Basic Concepts of SAGA

SAGA – Basic Information – What is SAGA

SAGA is the abbreviation for System for Automated Geoscientific Analyses

SAGA is a Geographical Information System (GIS) desktop software

SAGA supports the implementation of new functions with a very effective Application Programming Interface (API)

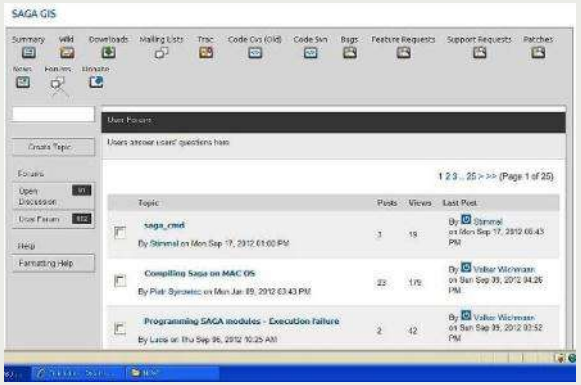
SAGA is a comprehensive, growing set of geoscientific methods for geodata processing and analysis

SAGA is programmed in the object-oriented C++ language

SAGA is a Free Open Source Software (FOSS)

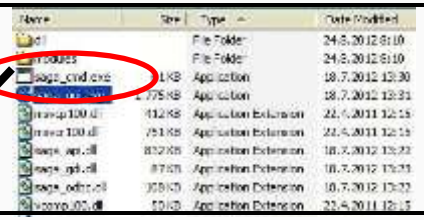
SAGA runs under Windows, Linux and FreeBSD operating systems

SAGA functions are organized as modules and can be accessed via GUI or various scripting environments

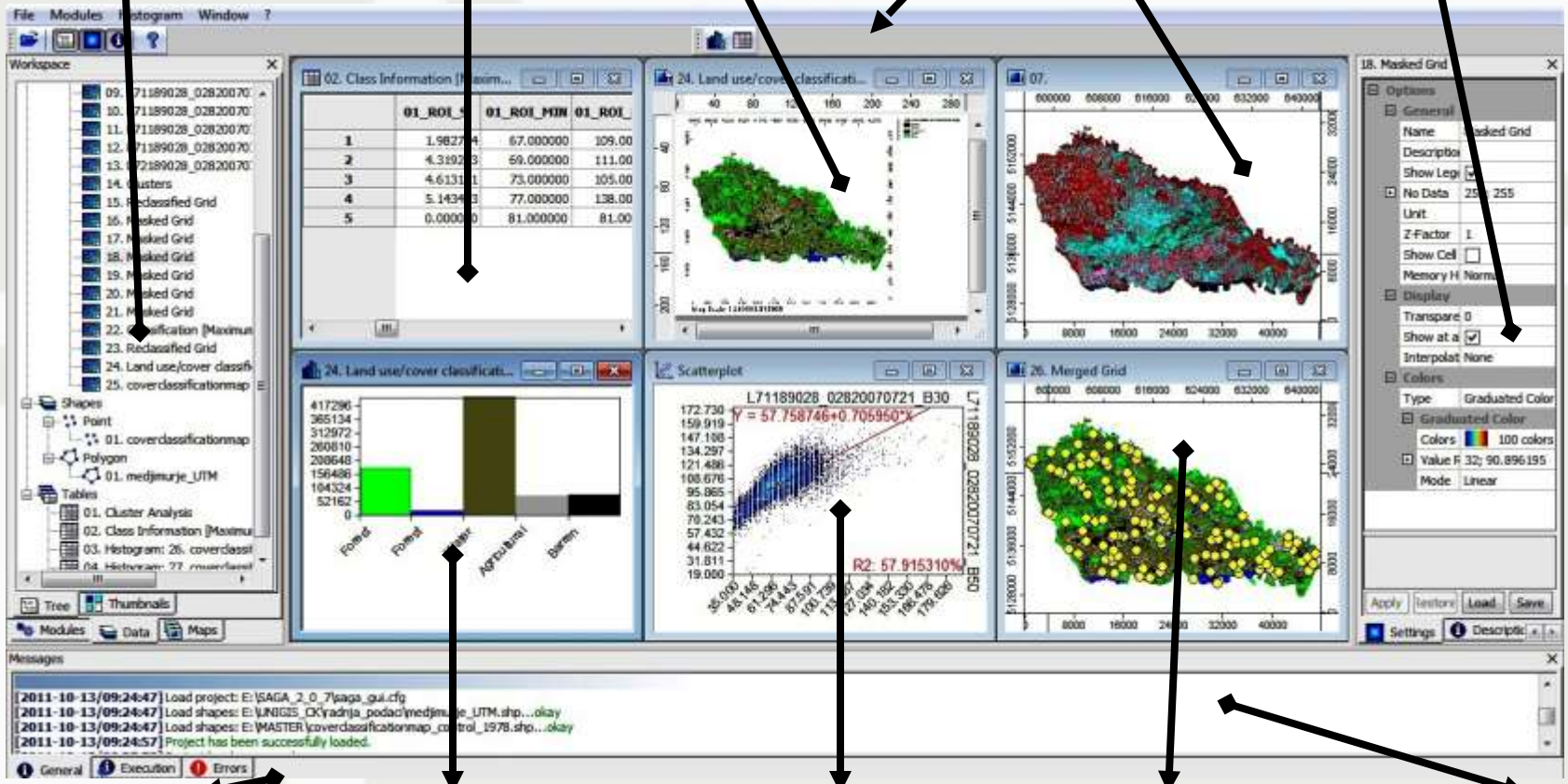


SAGA – Basic Information – Graphical User Interface

SAGA is a so-called portable software, there is no installation routines. Just download, unzip files and start "saga_gui.exe".



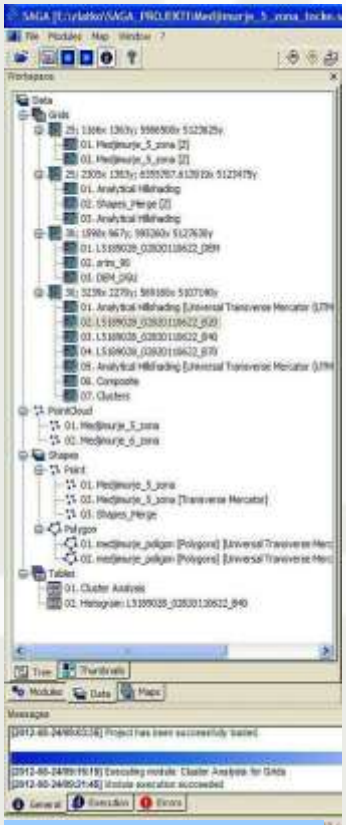
Workspace | **Attributes** | **Print Layout** | **Map View** | **Object Properties**



Status Bar | **Histogram** | **Scaterplot** | **Map View** | **Notifications**

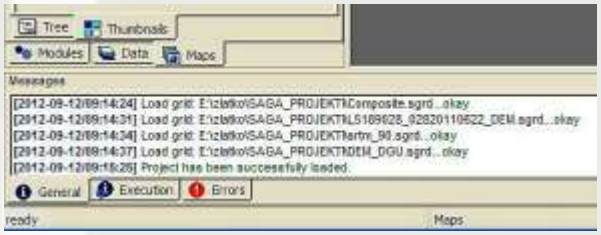
SAGA – Basic Information – Graphical User Interface

Modules



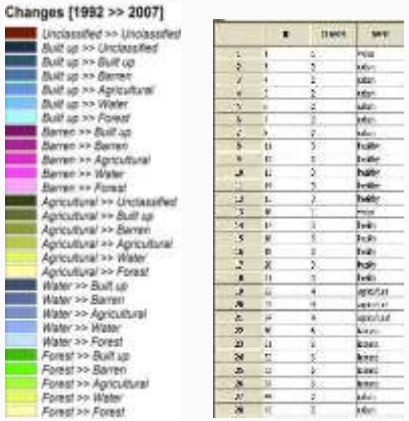
Data

Maps



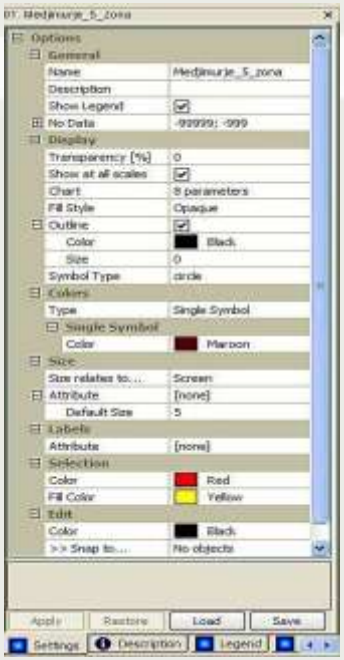
Notifications, Messages

Description



Legend Attributes

History



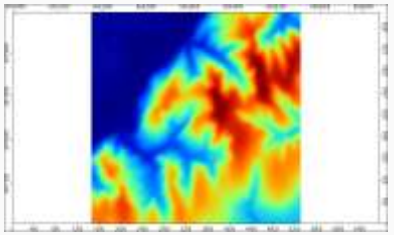
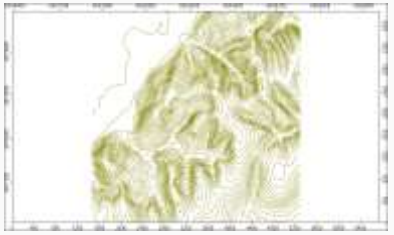
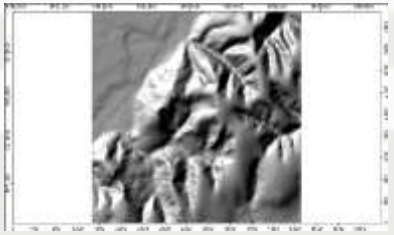
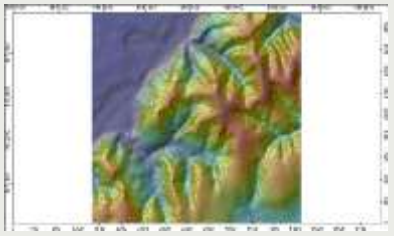
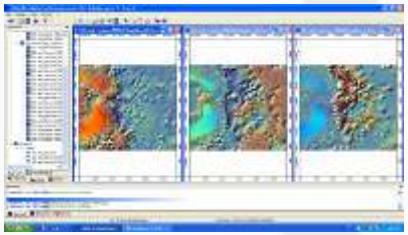
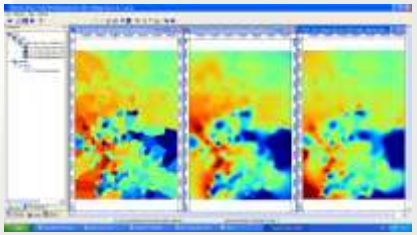
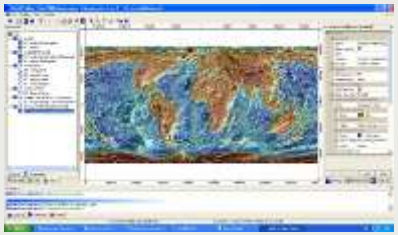
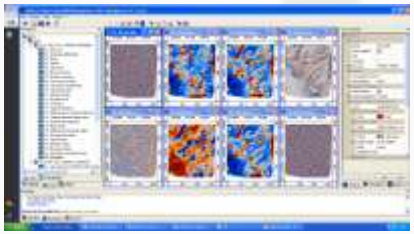
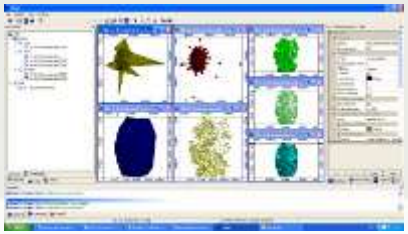
Settings

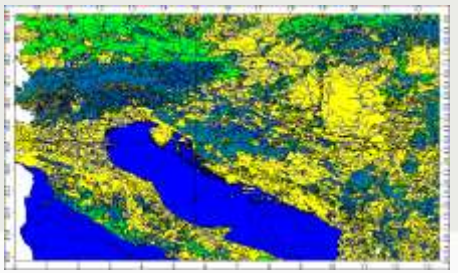
SAGA – Development

A comprehensive and growing set of free modules and libraries, some of them represents the state of the art in their field of analysis

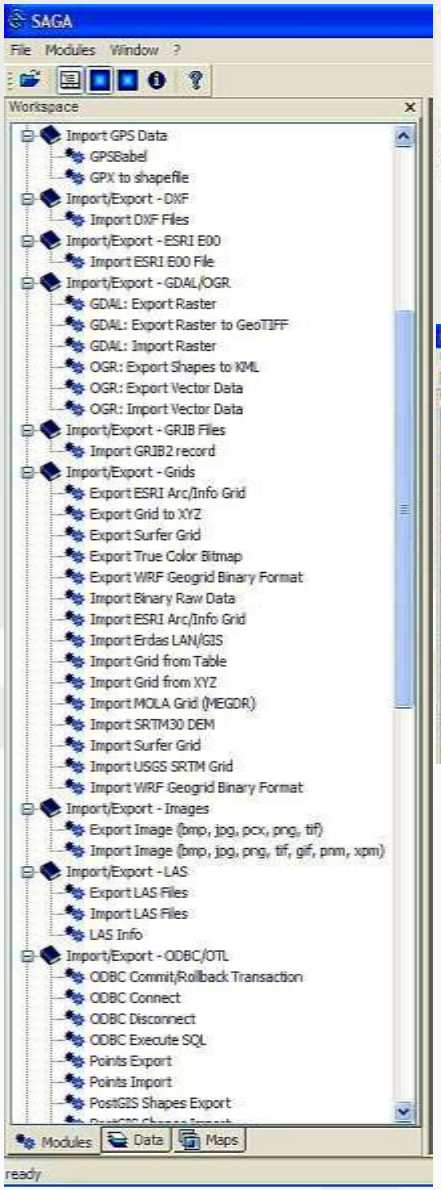
Saga v1.2 2005 – 34 libraries and 119 modules (as FOSS)
Saga v2.0.0, 2007 – 42 libraries and 234 modules
Saga v2.0.3, 2008 – 48 libraries and 300 modules
Saga v2.0.4 2009 – 49 libraries and 330 modules
Saga v2.0.5, 2010 – 56 libraries and 401 modules
Saga v2.0.7, 2011 – 63 libraries and 447 modules
Saga v2.0.8, 2012 – 64 libraries and 469 modules
Saga v2.1 2012 – 65 libraries and 516 modules (beta)

SAGA was created and developed by group of scientists from the Göttingen University and scilands GmbH Göttingen.

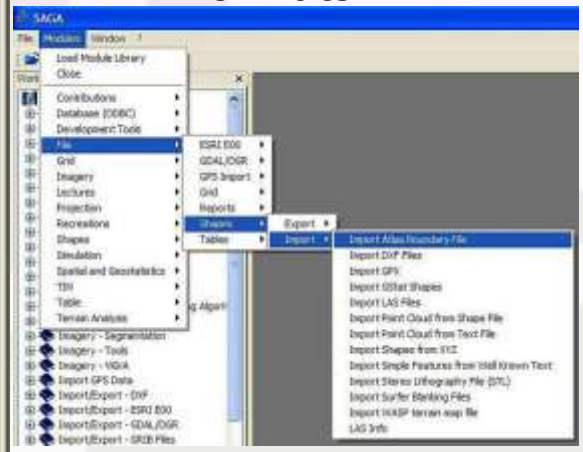


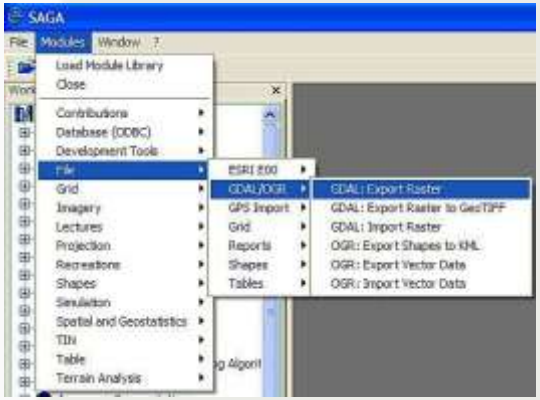
SAGA – GDAL and PROJ.4 Libraries



GDAL - Geospatial Data Abstraction Library

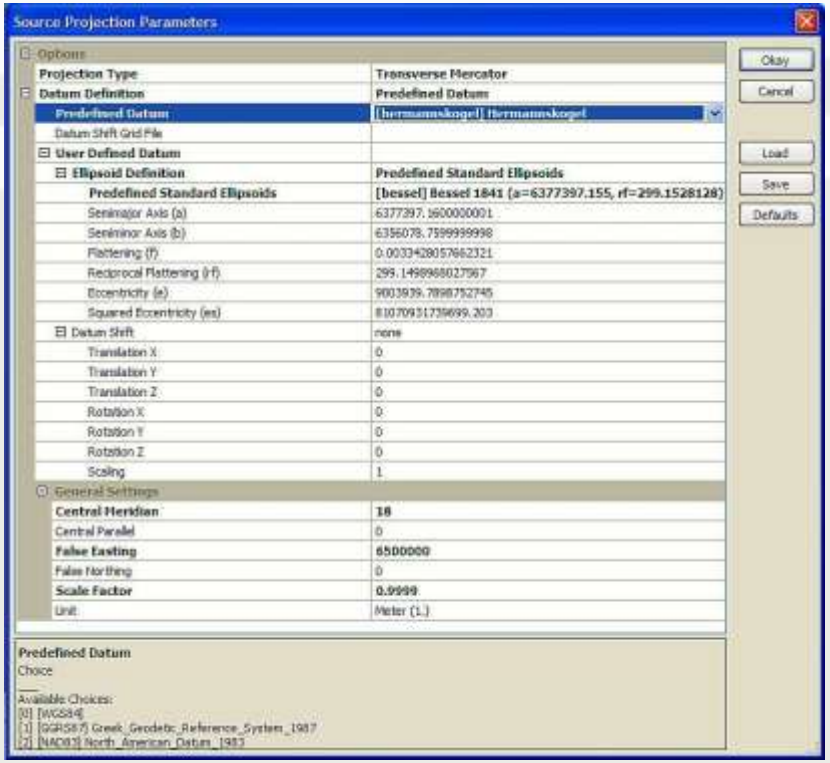
A library for reading and writing a variety of geospatial raster and vector formats





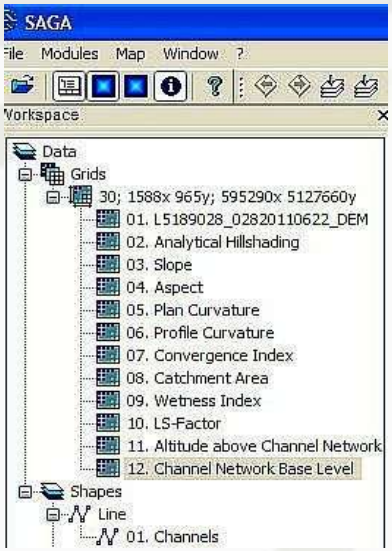
PROJ.4

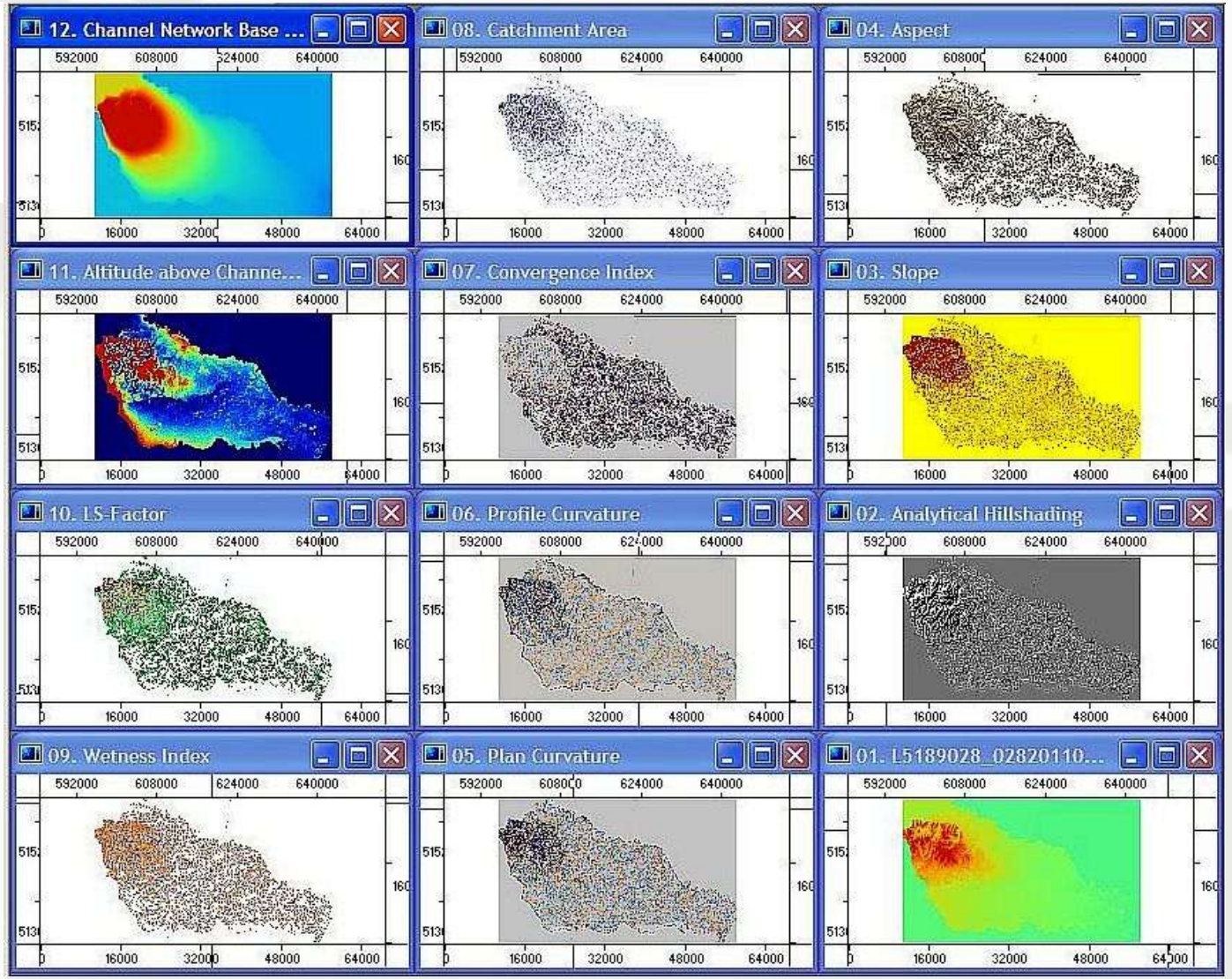
Cartographic Projections Library



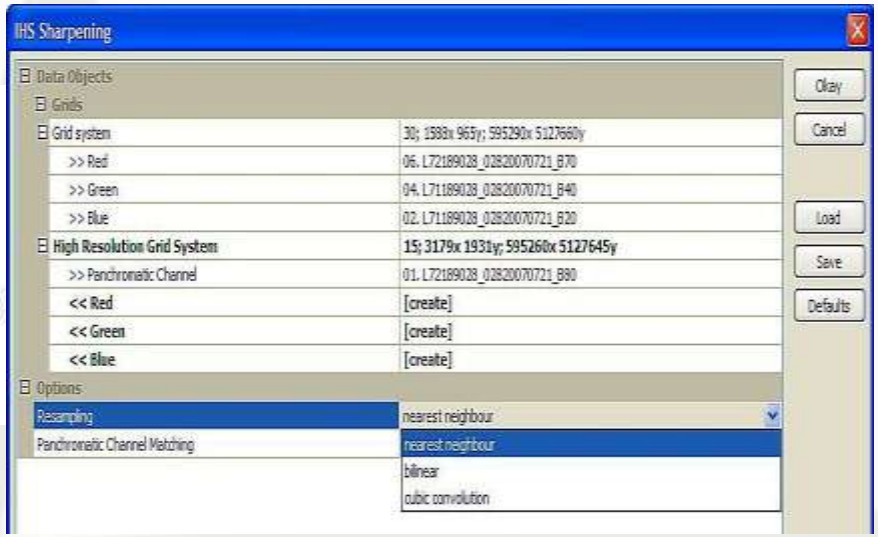
SAGA (Automated) – Basic Terrain Analysis

A selection of basic parameters and objects to be derived from a Digital Terrain Model using standard settings





SAGA – Pan Sharpening



Module

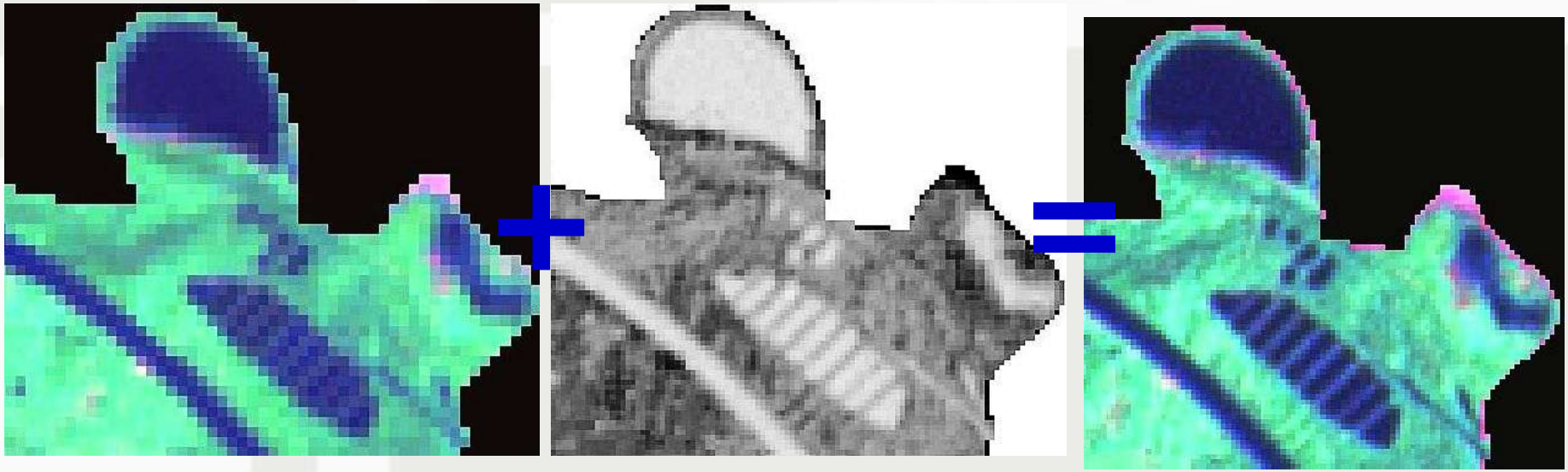
Name	IHS Sharpening
ID	4
Author	O.Conrad (c) 2011
Specification	grid

Description

Intensity, hue, saturation (IHS) sharpening.

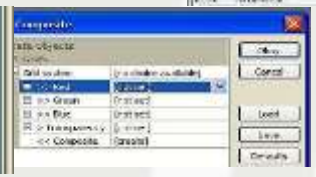
References:

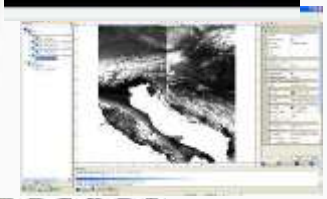
Haydn, R., Dalke, G. W., Henkel, J., Bare, J. E. (1982): Application of the IHS color transform to the processing of multisensor data and image enhancement. Proceedings of the International Symposium on Remote Sensing of Arid and Semi-Arid Lands, Cairo, Egypt (Environmental Research Institute, Ann Arbor, Mich., 1982), pp. 599–616.

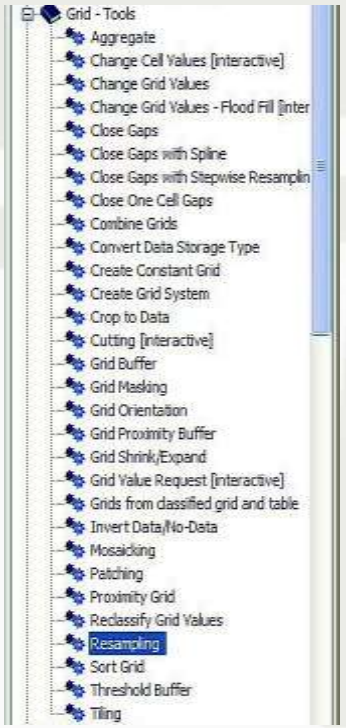


SAGA – Grids, Landsat, SRTM

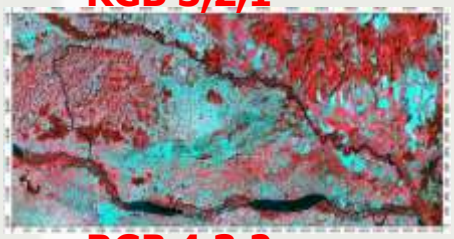
Landsat Satellite Imagery
Shuttle Radar Topography Mission
Free Available Data Sets



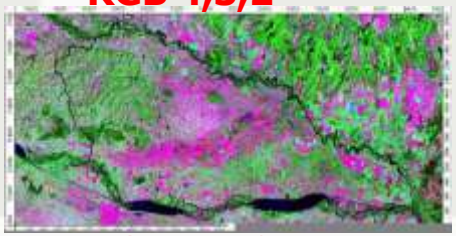




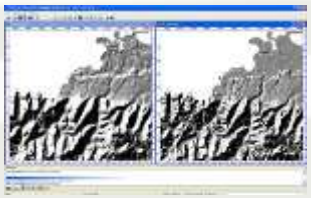
RGB 3,2,1

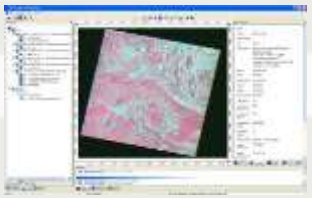


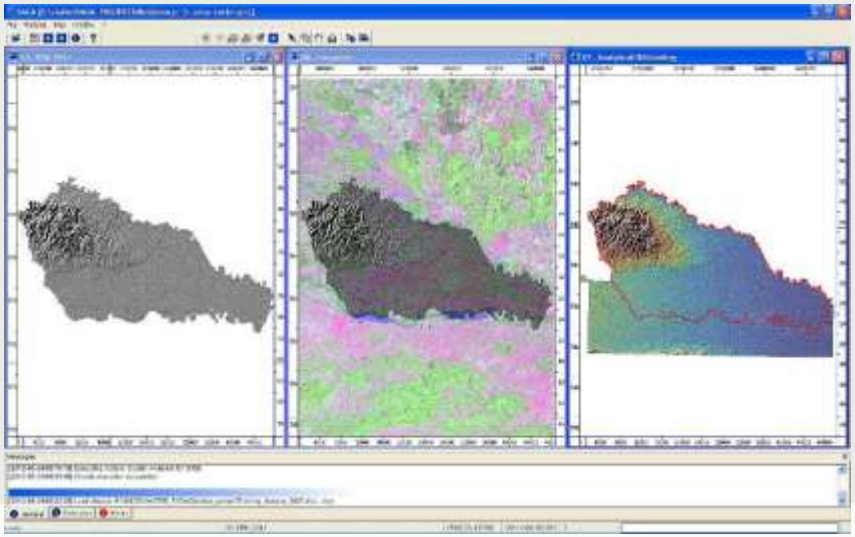
RGB 4,3,2



RGB 7,4,2

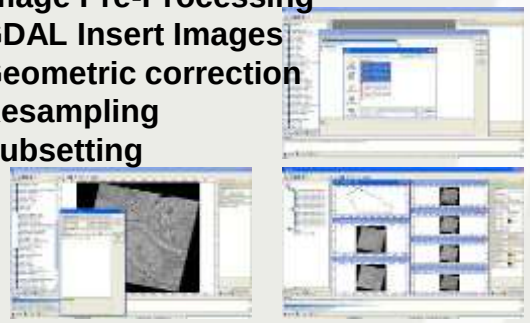




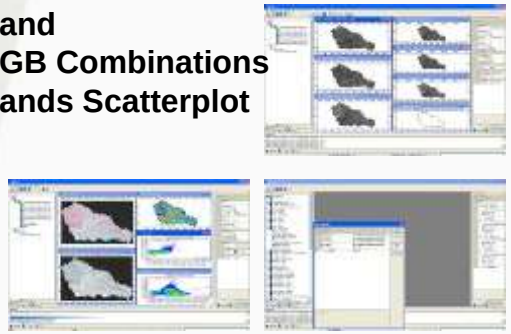


SAGA – Unsupervised and Supervised Classification, Change Detection

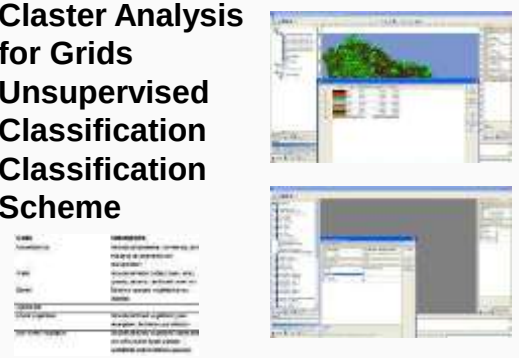
Image Pre-Processing
GDAL Insert Images
Geometric correction
Resampling
Subsetting



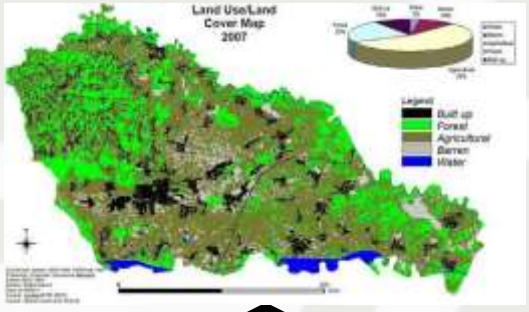
Band
RGB Combinations
Bands Scatterplot



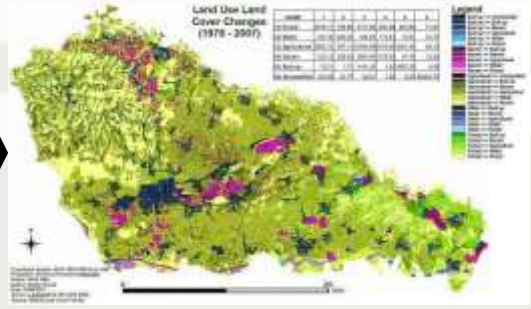
Claster Analysis for Grids
Unsupervised Classification
Classification Scheme



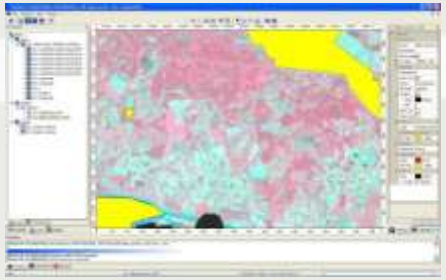
Land Use Land Cover Maps



Land Use Land Cover Changes

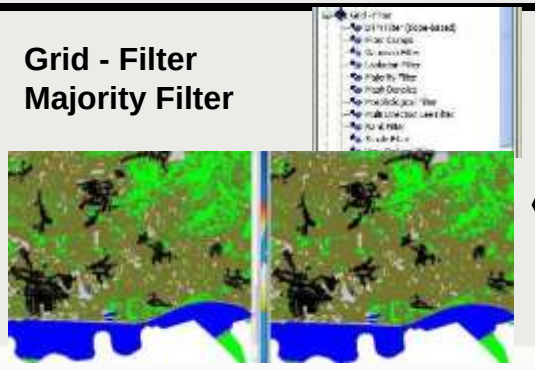


Training Sites, Supervised Classification

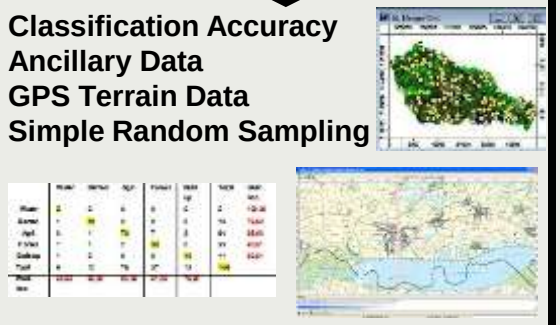


Post-Classification, Visualization and Change Detection

Grid - Filter
Majority Filter



Classification Accuracy
Ancillary Data
GPS Terrain Data
Simple Random Sampling



SAGA – Modules and Functions

Geostatistics Analysis

- Spatial and Geostatistics - Grids
  - Directional Statistics for Single Grid
  - Fast Representativeness
  - Global Moran's I for Grids
  - Inverse Principle Components Rotation
  - Multi-Band Variation
  - Principle Components Analysis
  - Radius of Variance (Grid)
  - Representativeness (Grid)
  - Residual Analysis (Grid)
  - Statistics for Grids
  - Zonal Grid Statistics
- Spatial and Geostatistics - Kriging
  - Ordinary Kriging
  - Ordinary Kriging (Global)
  - Ordinary Kriging (VF)
  - Ordinary Kriging (VF, Global)
  - Universal Kriging
  - Universal Kriging (Global)
  - Universal Kriging (VF)
  - Universal Kriging (VF, Global)
  - Variogram (Dialog))
- Spatial and Geostatistics - Points
  - Minimum Distance Analysis
  - Spatial Point Pattern Analysis
  - Variogram
  - Variogram Cloud
  - Variogram Surface
- Spatial and Geostatistics - Regression
  - Geographically Weighted Multiple Regression
  - Geographically Weighted Multiple Regression (Point
  - Geographically Weighted Multiple Regression (Point
  - Geographically Weighted Regression
  - Geographically Weighted Regression (Points/Grid)
  - Multiple Regression Analysis (Grid/Grids)
  - Multiple Regression Analysis (Points/Grids)
  - Polynomial Regression
  - Regression Analysis (Points/Grid)

Terrain Analysis

Grid Analysis, Filters, Calculs...

Imagery Classification, Tools...

- Grid - Visualisation
- Imagery - Classification
  - Change Detection
  - Cluster Analysis for Grids
  - Decision Tree
  - Supervised Classification
  - Supervised Classification for Polygons
- Imagery - Fast Region Growing Algorithm
  - Fast Region Growing Algorithm
- Imagery - OpenCV
  - OpenCV - Basic Morphological Operations
  - OpenCV - Fourier Transformation
  - OpenCV - Single Value Decomposition
- Imagery - Segmentation
  - Grid Skeletonization
  - Seed Generation
  - Simple Region Growing
  - Watershed Segmentation
- Imagery - Tools
  - Colour Normalized Brovey Sharpening
  - Colour Normalized Spectral Sharpening
  - Enhanced Vegetation Index
  - IHS Sharpening
  - Principle Components Based Image Sharpening
  - Tasseled Cap Transformation
  - Vegetation Index (Distance Based)
  - Vegetation Index (Slope Based)
- Imagery - ViGrA
  - ViGrA - Basic Morphological Operations
  - ViGrA - Distance
  - ViGrA - Edge Detection
  - ViGrA - Fourier Filter
  - ViGrA - Fourier Transform
  - ViGrA - Fourier Transform (Real)
  - ViGrA - Fourier Transform Inverse
  - ViGrA - Smoothing
  - ViGrA - Watershed Segmentation

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Summary, Conclusion, Recommendation

Over the last decade there has been an explosion in the numbers of users and developers of FOSS for Geoinformatics.

FOSS4G is increasingly gaining in importance, and has become a kind of alternative to the proprietary (closed) software.

SAGA is fast growing “child” of the FOSS4G family.

SAGA offers a comprehensive set of free geoscientific modules and libraries, some of them represents the state of the art in their field of analysis, and such functions are difficult to find in other FOSS programs.

Try FOSS4G (any), use them, make changes to the software, share your new knowledge with OSS community, solve your GIS tasks, make money with FOSS.

Thank you for your attention!

zlatko.horvat@live.unigis.net

http://www.zlatkohorvat.com