Virtual Training Center based on eGLE eLearning Platform

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Outline

- enviroGRIDS portal architecture
- eGLE Platform
  - objectives, architecture, implementation scenario, functional levels, data and processing flow
- Lessons
  - visual structure, data types that can be included in eGLE lessons, lessons scenarios, execution (interactive scenario), examples
- Tools
  - pilot tools developed for eGLE, tool instantiation and interaction setup example
- Conclusions
- eGLE related projects
- Acknowledgements
enviroGRIDS portal architecture
eGLE platform objectives

- Allow teachers with non-technical background to create and execute lessons for Earth Observation, based on GRID architecture
- Provide easy-to-use tools for data search and retrieval from remote repositories, data processing description, launch and monitoring over the GRID
- Allow different interaction levels with the students involved in the learning process:
  - modify the input data of a specific processing
  - describe and launch a new processing over the GRID
- Provide tools for online lessons development and visual data presentation
eGLE platform architecture
Functional levels in eGLE architecture

- eGLE Platform
- eLearning Oriented Level
- ESIP and gProcess Platforms
- Grid Infrastructure

- Process description
- Patterns, Templates, Lessons, Teaching materials
- Image and Spatial Data
Data and processing flow

- **Teaching materials, tutorials**
  - Lesson patterns
  - Lesson resources

- **Process description**
  - Lesson description, execution, and management.
  - Workflow based process description.
  - Service description, search, discovery and composition.
  - Services, operations from GISHEO, G-POD, other ESA projects.

- **Grid Infrastructure**
  - EO Data
  - Spatial Data
  - User Data

- **Service**
  - Complex Services

- **Operation**
  - Teaching materials of various topics and subjects.
eGLE: lesson visual structure and data types

- Images
- Videos
- Documents
- 3D Objects
- Sounds
- Other multimedia content
eGLE: lesson scenarios

- **Static**
  - All the content of the lesson is prepared in advance by the teacher, who can use its credentials to access protected information in different repositories.
  - The text, images, videos and all other components are pre-processed on the grid at authoring time and the results are stored into the database.

- **Dynamic**
  - The teacher describes a processing algorithm through a workflow using gProcess and grants to the students the ability to modify the workflow.
  - At runtime the students have the possibility to change the workflow and to execute the modified version over the Grid network.
This lesson exemplifies interactive scenario for teacher and students.

Lesson

ESIP platform

Editor

Scheduler

Manager

Viewer

Executor

Input

Workflow

Output

move data at authoring time

Distributed databases (ex. GENESI-DR)

File repository

eGLE web server

ywesoteca
eGLE pilot tools

Conceptually the water detection algorithm is quite simple and was published by Gond. The algorithm uses SIMR (Short Wave InfraRed), Red and NIR (Near Infrared) spectral bands for detecting water areas. The implemented algorithm uses Landsat images as input and returns a GeoTiff image that highlights the water boundaries. The inputs consist of the band 3, band 4 near-infrared (NIR), and the band 5 mid-infrared (MIR). The MIR frequency is absorbed by water and is very sensitive to moisture. It is used to detect vegetation and soil moisture. In the near infrared band (NIR) the water appears nearly all the bright and that makes the water becomes very very dark in this band. The NIR band may be used to detect the land-water boundary. The NDVI (Normalized Difference Vegetation Index) is used to assist water content. The NDVI index increases with vegetation water content from dry soil to free water. The difference NDWI-JNDI reinforces the perception of free water areas.
eGLE lessons samples

OpenWater symposium and workshops, UNESCO-IHE, Delft, The Netherlands, 18-19 April, 2011

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**Hydrothermal Alteration**

One of the main goals of the research reported by this paper is to analyze an approach for searching economic ore minerals. An economic deposit might in fact have a very low percentage of the mineral we are looking for. For example, gold may be economically mined at great depth at 5 ppm (5 parts per million) gold content in the ground rock. A typical geological exploration approach is therefore to build a model of associated minerals or environments where the economic mineral might be. We shall use the association of hydrothermal alteration with economic minerals in order to find target exploration areas. Hydrothermal alteration occurs when hot fluids invade the host rocks, interact chemically with it and alter the mineral composition. The hydrothermally altered host rocks contain distinctive assemblages of secondary minerals, called alteration minerals that replace original minerals. Actually, not all alterations are associated with mineral deposits and so we need to identify the types of altered rocks, which have been changed by the hot fluids. In this paper, we try to identify the types of altered rocks, which have been changed by the hot fluids that often also carry economic minerals, according to the type of alteration that they have undergone.

**Ratio Technique Using Landsat Data**

Band ratio is a technique that has been used for many years in remote sensing to effectively display spectral variations. A ratio is created by dividing brightness values at specific bands by another. The primary purpose of such ratios is to enhance the contrast between materials by dividing brightness values at peaks and troughs in a spectral reflectance curve. This tends to enhance spectral differences and suppress illumination differences. Ratios can be used to differentiate minerals if those minerals have different characteristic spectra. The band ratios of Landsat TM data
eGLE lessons samples

Authoring (WYSIWYG editor)

Runtime
Lesson sample – GRID oriented tools

The Normalized Difference Vegetation Index (NDVI) is a simple numerical indicator that can be used to analyze remote sensing measurements, typically but not necessarily from a space platform, and assess whether the target being observed contains live green vegetation or not.

Live green plants absorb solar radiation in the photosynthetically active radiation (PAR) spectral region, which they use as a source of energy in the process of photosynthesis. Leaf cells have also evolved to scatter it, reflect it, and absorb it in the PAR spectral region. The NDVI is a measure of the difference in the reflectance of a target in the red and near-infrared wavelengths. A strong absorption at these wavelengths would result in overheating the plant and possibly damaging the leaves. Hence, live green plants appear relatively dark in the PAR and relatively bright in the near infrared. By contrast, clouds and snow tend to be rather bright in the red (as well as other visible wavelengths) and quite dark in the near-infrared.

Since early sensors of Earth Observation, such as NASA’s ERTS and NOAA’s AVHRR, acquired data in the red and near-infrared, it was natural to exploit the strong differences in plant reflectance to determine their spatial distribution in these satellite images. The NDVI is calculated from these individual measurements as follows:

\[
\text{NDVI} = \frac{\text{NIR} - \text{RED}}{\text{NIR} + \text{RED}}
\]
eGLE: Tools instantiation and student interaction setup

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Conclusions

- Using eGLE platform the teachers are able to create complex lessons in EO domain without having knowledge on Grid technologies or distributed data repositories.

- eGLE provides the development tools needed to create teaching materials in Earth Observation for schools, high schools, universities and companies, for training purposes.

- Through its Tools, eGLE Application can incorporate the necessary functionalities for automated data search and retrieval from already existing distributed repositories (such as GENESI-DR).

- The teachers and even the students can visualize and launch large scale computing operations on satellite images, using transparently the Grid processing resources and facilities.

- eGLE uses Grid and can be extended very easy to any complex processing based on Web services or Cloud Computing (for example integrating already developed Geospatial Web Services like WMS, WCS, WFS, WPS etc.).

- The modular structure of eGLE application allows the integration of new Tools which could encapsulate any new functionalities, implemented in various technologies.
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- eGLE has explored in the development and testing phases the use of spatial data repositories and services provided by the GENESI-DR Project: Ground European Network for Earth Science Interoperations – Data Repository, co-funded by the European Commission (Contract no. 212073, 2008 – 2009).

- To test the Grid based processing eGLE has used the SEE-GRID Infrastructure by collaboration with the SEE-GRID-SCI Project: SEE-GRID eInfrastructure for regional eScience, co-funded by the European Commission (Contract no. 211338, 2008 - 2010).
Thank you!

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