

Progetto Sistemi Informativi Geografici per la gestione e la modellazione di dati territoriali
10th Edition – 2012

Introduction to GIScience

Principles and techniques for application development, visualisation and spatial analysis

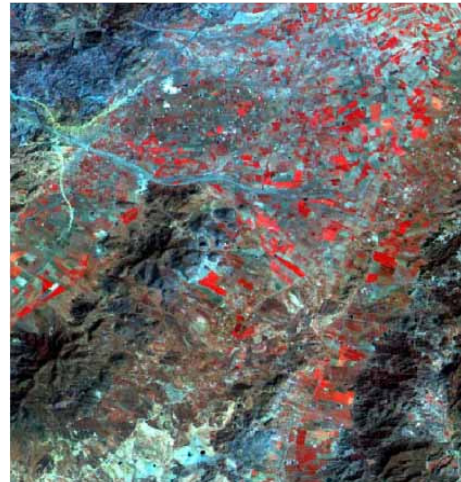
Scope

GIS are gradually imposing as management, editing, query and visualisation tools in different fields of research involving quantitative analysis. Relevant applications can be found in urban planning, environmental sciences and risk management. The wide diffusion of GIS pushes the demand of high skilled professionals in either private and public sector. The introductory GIScience course aims to give the fundamentals of GIScience theory supported by practical examples and laboratory exercises using ESRI ArcGIS 8/9™ and MsAccess™ in relational databases development (**ORDBMSs** – **Object Relational DataBase Management Systems**).

Program

The course, adopting a theoretical/practical approach, will cover the following topics:

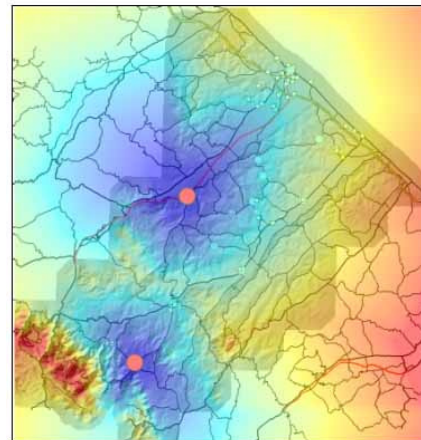
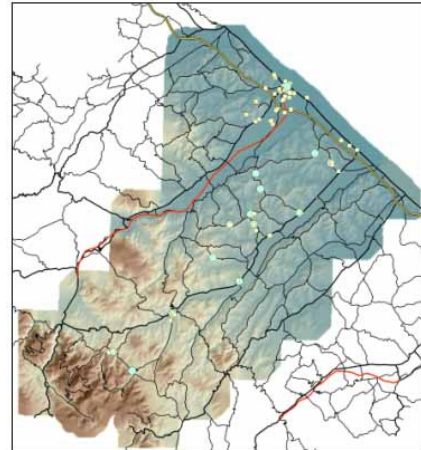
- **Fundamentals:** GIS definition, GIS components (hardware, software, spatial data, human resources, project management), reference bibliography and web resources. The history of GIS with an emphasis on technology and geographical diffusion. Cartography principles: geodesy basics, geographic and plane coordinates, projections and reference systems. Map classification. Application development principles in environmental and social sciences.
- **Spatial data and modelling:** types, scale, spatial features (points, lines, polygons), attribute data, generalization. Topological concepts and their implementation in the ArcInfo™ Coverage model and ArcView™ Shapefile model. Spatial data sources characteristics: scale, costs, availability, time and space resolution. Remote sensing data, aerial photographs, national geographic databases and themes (elevation data, hydrography, administrative boundaries), National statistics. International data sources. **GPS** data acquisition, integration and harmonisation. Vector and raster data models: implementation, strengths and weaknesses. Alternative surface modelling with the **TIN** (**Triangulated Irregular Network**) data model, network data model (road networks, utilities, hydrography).
- **ArcGIS 10™ introduction** ESRI products architecture, from ArcView 3.x™ and ArcInfo™, to the current ArcGIS 8/9™ platform with its components (ArcCatalog, ArcMap ed ArcToolBox). Technical analysis of vector data model implementation in the ArcInfo™ coverage, shape file and geodatabase (feature, object



Valle di Guadalentín (Spagna) - Composite Landsat 421

e relationship classes). Basic functions in ArcMap™: **TOC (Table Of Contents)** and layers, symbology, access to attribute table, graphs and reports, spatial and attribute queries, layout. Introduction to the most used extensions: Spatial Analyst™ and 3D Analyst™, for cartographic modelling, map algebra and 3D visualisation, Geostatistical Analyst™ for **ESDA (Exploratory Spatial Data Analysis)**, variography analysis and regionalization through *Kriging*. Customization: Avenue language and migration to VBA/ArcObjects™ for ArcGIS 8/9™.

- ❑ **Relational and geographic databases:** migration from traditional file oriented platforms (Idrisi 32™), through class relational databases and modern geodatabases, based on Object Oriented technology. Relational databases principles (Codd model), normalization rules and forms, referential integrity and **SQL (Structured Query Language)** commands. ESRI personal geodatabase and Spatial Oracle.
- ❑ **Data acquisition, editing and data quality (metadata):** digitalization and rasterization, georeferencing, data import, format conversion, link to external data sources (spreadsheet, database), reprojection, transformation, generalization, *edge matching* and *rubber sheeting*, design and implementation of relational databases and Personal Geodatabase (*feature dataset, feature, object and relationship classes* creation). Lineage and *metadata* (FGDC - Federal Geographic Data Committee models). Print layout: cartographic design; best representation model selection criteria and data analysis following project's scopes, visualisation theory and techniques.
- ❑ **Spatial analysis:** measuring geographic features (length, perimeter and area), attribute data query and spatial query, reclassification, buffering and neighbourhood functions, overlaying. Geoprocessing with vector data and raster data manipulation with map algebra. Spatial interpolation techniques and surface analysis (*slope, aspect and hillshading*). GIS as **SDSSs (Spatial Decision Support Systems)**: conceptual design and numeric modelling. Regionalization algorithms: **IDW (Inverse Distance Weight)**, variography and Kriging, application to environmental sciences. Principles of spatial statistics in social sciences and Moran's I analysis in *spatial clusters* detection.
- ❑ **Further issues in GIScience: education and project management:** the debate on GIS, GI System or GIScience? From a technical to an epistemological approach. GIScience education in the private and public sector, the role of distance learning and part-time graduate studies of international institutions (UNIGIS, City University, Birkbeck College, della Penn State University). GIScience role in the organisations, integration with the traditional information systems, prototyping techniques, cost/benefits analysis (*SWOT, Boston matrix*). Foundation of distributed client-server architectures: from Desktop GIS to Internet GIS.



DTM e viabilità nella ubicazione di nuovi servizi

GIScience project

The course is part of a wider learning project in GIScience and GIS, applications and geographic mashup development, environmental applications. Supported by high-level professional and academic profiles, the project includes following courses:

- ❑ **Introduction to GIScience:** principle and techniques for application development, visualisation and spatial analysis
- ❑ **Design and development of GIS software applications:** software engineering, OO and components models, programming in VBA/ArcObjects for ArcGIS 8.x/9
- ❑ **Design and development of GIS software applications:** object oriented model, software engineering, Python programming
 - and its role in in ArcGIS.
- ❑ **Design and development of Web mapping applications:** a course on theory and practice in GeoWeb 2.0 mashups design and development, integrating Google Maps and OpenLayer web services and spatio-temporal PostgreSQL/PostGIS database
- ❑ **Object Oriented JAVA programming for GIS applications development:** a Open Source perspective to stand-alone and Web solutions
- ❑ **A hands-on introduction to databases and geodatabases:** A two-modules foundation course with examples in MySql, PostgreSQL/PostGIS, Oracle XE and ArcGIS/MsAccess for the design and development of Relational (I) and Spatial Databases (II)
- ❑ **Business Geographics & Geodemographics**
- ❑ **Google Maps Mashups**
- ❑ **Environmental project management**
- ❑ **Applied groundwater flow and transport modeling:** groundwater management at regional scale for water supply policies assessment and at local scale for environmental remediation of contaminated sites.

Following a complex and coherent learning path, after traditional part-time and distance learning philosophy, the course has been based, since its first edition in 2003, on both formal classes and self-learning periods, making course accessibility easier and learning objectives realistic

Software

Office Automation MsOffice™, RDBMS MsAccess™, GIS ArcGIS 10.

Who is it for?

Professional working for both private and public sector interested in planning and environment issues, graduate and post-graduate students in similar disciplines. No formal GIS knowledge is required, but it is required experience in using a PC and MsOffice™.

Location & dates

The course will take place at the Environmental Education Centre Casa Archilei, located in Fano (PU) and easily accessible from major transport links. The course will have a duration of 40 hours, with 8 hours lessons, on **29-30-31 march and 13-14 april 2012**.

Registration and payment options

Course fees are **900 € + VAT (21%)**, to be paid in a unique instalment before starting date. Fees are reduced to **850 € + VAT (21%)** for participants with their own notebook. Further fees reduction is applicable, based on conditions stated below.

Fees reduction

Registration before February 29th, 2012	5%
Participants in previous GIScience courses promoted by www.GIScience.it Students regularly enrolled in degree, post-degree and Phd courses at italian or foreign universities at the moment of registration Education Institutions, public and private companies enrolling more than one person	10%

Registration modules is available for download in PDF format or they can be requested at info@giscience.it.

Certificate

At the end of the course, participants attending at least 70% of the lessons will be awarded a Completion certificate.

Didactic material

Participants will be provided with full documentation about relevant course issues. The course adopts the following textbook, included in registration fees:

Ormsbby R., Napoleon E. e Burke R., 2005. *Getting to know ArcGIS Desktop: the basics of ArcView, ArcEditor and ArcInfo*. ESRI Press, coming with a time-limited copy of ArcGIS software.

Following textbook is highly recommended as well:

Longley P.A., Goodchild M.F., Maguire D.J. e Rhind D.W., 2005. *Geographic Information Systems and Science*. 2nd Edition. John Wiley & Sons, UK

Info

For further information, please refer to info@giscience.it Email address or refer to contact references at Contacts section of web site www.giscience.it .