Practical teaching of GIS at University of Liège

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Lessons

• Pr. Jean-Paul Donnay:
  – For non-geographers (geologists, urban planners, engineers…)
    ➔ GIS users
    • Master:
      – *Introduction to GIS* (15h theory + 15h practical)
  – For Geographers & Land Surveyors
    ➔ GIS professionals
    • Bach. :
      – *Cartography & GIS* (30h th + 40h pr)
      – *Cartography complement – projections* (15h th + 20h pr)
      – *Spatial analysis & GIS* (30h th + 30h pr)
    • Master :
      – *Project management* (10h th + 10h pr)
      – *GIS* (30h th + 30h pr)
      – *Special questions of geomatics* (20h th + 30h pr)
GIS for users
Introduction to GIS (1)

- Data analysis (QGIS)
  - Data schema
  - Attribute table
  - SQL requests
- Vector data (QGIS, OpenJump)
  - Import / export
  - Topology decomposition
  - Software extensions
- Raster data (Idrisi)
  - Import / export
  - Metadata
  - Color palette
  - Image georeferencing
- Data exchange (QGIS)
  - De facto format standards
  - OpenLayers, Google
  - WMS client
Introduction to GIS (2)

- Coordinate reference systems (QGIS, Google Earth/Maps)
  - SRID (EPSG)
  - « On the fly » transformations
  - WKT CRS definitions
- Spatial requests (QGIS, Open Jump)
  - Simple queries
  - Topologic queries
  - Spatial joints
  - Geometry edition
- DEM (Idrisi, Surfer)
  - Interpolation
  - Slopes, watershed, illumination
  - 3D display
- Raster decision support (Idrisi)
  - Map algebra
  - Multicriteria analysis
GIS prerequisite: cartography

• Map production
  – Geo-referencing
  – Computer graphics (vector & raster)
  – Data pre-treatments (generalization, classifications…)
  – Semiotics application (symbol edition, etc.)
  – Choropleth, flows, continuous maps…
  – Plan design for surveyors

• Different GIS softwares
  – ArcGIS, MapViewer, Idrisi, Q-GIS, Open Jump
  – AutoCad, Covadis
GIS prerequisite: mathematical cartography

- Projections and transformations between coordinate reference systems
  - PHP / SVG programming:
    - CRS transformation interface
  - Tissot Indicators (QGIS, OpenJump)
  - On the fly transformations (QGIS, ArcGIS)
GIS prerequisite: spatial analysis

- **Spatial statistics**
  - Spatial distributions, spatial auto-correlation
- **Graph analysis**
  - Shortest path, flow analysis, propagation (raster)
- **Multivariate analysis**
  - PCA, classifications, regressions, regionalization
- **Geo-statistics & interpolations**
  - TIN, trend surfaces, Kriging, cost surfaces
- **ArcGIS, Idrisi, Surfer, Statistica, MatLab, R, etc.**
GIS prerequisite: spatial analysis: practical example

Horizontal and vertical node calculations:

\[ a_1 = \frac{\text{cost 1} + \text{cost 2}}{2} \]

Practical teacher: Marie Trotta

Raster Calculator

Map Algebra expression

Layers and variables:
- dcrime5
- dcrime1
- dcrime2
- dcrime3
- dcrime4
- resau_float
- resau_liege_1.tif

Expression:

\[ \text{"dcrime1" + "dcrime2" + "dcrime3" + "dcrime4" + "dcrime5"} \]

Output raster:

D:\tp_anop\resultat1
GIS prerequisite: databases

- Theory: Pr. Pierre Wolper
- Database conceptual / logical / physical modeling
  - E/A formalism, SQL language
- Main work:
  - database building (MySQL)
  - PHP interface of the database
GIS

• **Main work** (15h):
  – Conceptual modeling of a spatial database
    • Extended UML language
  – Implementation of the GIS
    • CASE tools
  – Data integration
    • Data conversion, loading, metadata…
  – GIS interface
  – OS software (MosKitt, PostGIS, GeoNetwork, Q-GIS…)
  – Report (1 / pair of students)

• **Other works** (15h):
  – Spatial database applications: spatial index, requests, connectivity, etc.
  – Map algebra: formalism & macro modeler, decision wizard, multicriteria modeling
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GIS main work: UML modeling (MosKitt)
GIS main work: SQL modeling (MosKitt)

/* Code generated for Postgre_8_2_4 with PostGIS extension */

CREATE TABLE bien_immo
PK_bien_immo integer
PK
numero integer
,
rue char
, 
alarme boolean
, 
mitoyen char
);

ALTER TABLE bien_immo
ADD CONSTRAINT PK_bien_immo PRIMARY KEY (PK_bien_immo);

CREATE TABLE commerce(
PK_commerce integer
,
bien_immo integer
,
type_commerce varchar
);

ALTER TABLE commerce
ADD CONSTRAINT PK_commerce PRIMARY KEY (PK_commerce);
GIS main work: Database implementation and management (PostGIS)
GIS main work: data integration (GeoKettle)
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GIS main work: exploitation (OpenJump, PGAdmin)
GIS other works: raster decision support (Idrisi)
Special questions of GIS

- **Distributed GIS**: 3-tiers GIS architecture, GML (XML), Web services.
- **Project driven exercise:**
  - Prototype solution to meet an external demand (SPI, Charleroi, SEGEFA…)
  - All students participate in the solution, in total autonomy.
  - Project planning (PERT) and distribution of tasks (Gantt) under the responsibility of a team (pair) of project managers *(cf. Project management course)*.
  - Still incorporates the implementation of a data server, a Web server, an application server; and building Web services and customized interfaces.
- **PostGIS, Apache, MapServer, Q-GIS, Python, PHP** (or other OS software)
- Oral presentation + report for the customer
Thank you for listening!

Questions?