Introduction to IDRISI

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IDRISI – Getting started

http://www.clarklabs.org/

Introduction to IDRISI

IDRISI Tutorial
IDRISI includes a comprehensive set of tutorial exercises in PDF format, complete with data. If you are new to IDRISI, we strongly suggest that you complete these exercises to familiarize yourself with the system. The first several exercises are especially helpful. The IDRISI Tutorial may be accessed from the Help menu within IDRISI.

IDRISI Manual
The IDRISI software includes a PDF manual which documents theoretical concepts as well as software operation. It is over 300 pages in length and includes material on both basic and advanced topics. The IDRISI Manual may be accessed from the Help menu within IDRISI.

IDRISI Help System
The IDRISI Help System is an instructional component included with the software. The Help provides detailed instructions on how to apply or use each analytical module with your data, as well as pertinent reference information, such as technical notes, data requirements and algorithm details. The Help System may be accessed from the Help menu within IDRISI by selecting the Contents option. Context-specific help may be accessed from within the module by clicking on the Help button.

More information on using Help

System Overview
IDRISI Andes consists of a main interface program (the one with the menu and toolbar system) and a collection of nearly 300 program modules that provide facilities for the input, display and analysis of geographic data. These geographic data are described in the form of map layers – elementary map components that describe a single theme. Examples of map layers might include a roads layer, an elevation layer, a soil type layer, and so on. All analysis acts on map layers. However, for display, a series of map layers may be brought together into a map composition.

Map Layers
The IDRISI Workspace
The IDRISI Menu
The IDRISI Display System

IDRISI Explorer
IDRISI Explorer is a general purpose utility to manage and explore IDRISI files and projects. IDRISI Explorer is used to set your project environment, manage your group files, review metadata, display files, and simply organize your data. IDRISI Explorer is permanently docked to the right of the IDRISI desktop. It can be moved but it can be minimized and horizontally resized.

It is wise to set the project environment before you begin working with IDRISI to facilitate project management. In IDRISI Explorer, you specify a set of data folders to be used as the default for a particular project. While data may be read or written to any location, access is facilitated to the paths specified in the
Concept and functionality

• raster - GIS & Image Processing Software

• research & development project of the Graduate School of Geography at the Clark University, Worcester MA, USA (Prof. Ron Eastman), [www.clarklabs.org](http://www.clarklabs.org)

• objective of the project:
  — professional development of geographic analysis tools,
  — based on „non-profit“ distribution.

• optimal system requirements (WinXP/Vista/7; Intel Pentium IV; 1 GB RAM)

• worldwide known software

• most important advantages: Price ($1250 for full commercial license, $295 for a student one; for comparison, ENVI single-user license costs 7300 EUR), Functionality/Analysis (especially in image processing, geostatistics, decision support, simulation, cost-area calculations), ease-of-use

• most recent version — IDRISI Selva 17.1 released in 2012

• Here, we use the older version, IDRISI Taiga (16.05)
Introduction to IDRISI
GIS and Image Processing functionality

- database query and overlay analysis
- distance and context operations to analyze interactions over space (e.g. shortest path)
- standard and advanced spatial statistics
- surface analysis (slope, aspect, hillshade, curvature, watershed, toposhape) including interpolation and hydrological modeling routines
- change- and time series
- tools for multi-criteria and multi-objective decision making and land suitability analysis
- preprocessing tools for efficient noise and distortion removal, data transformation and full georeferencing
- visual and data enhancement tools, including digital filters, color compositing, pansharpening and others
- unsupervised (e.g. ISODATA) and supervised classification techniques (for both: multispectral and hyperspectral imagery)
GIS and Image Processing functionality – cont’d

• Principal Component Analysis
• soft classifiers
• segment-based classification
• machine learning classifiers including ANNs (e.g. MLP) and decision trees
• Land Change Modeler
• Earth Trends Modeler
• Triangulated Irregular Networks and surface generation
• geostatistics
Functionality - examples

- GIS layers
Functionality - examples

- Overlay analysis

- Interactive digitizing

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<td>Delete Feature</td>
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<tr>
<td><img src="image" alt="Icon" /></td>
<td>Save Digitized Data</td>
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Functionality - examples

- Context operators
  - Elevation Model
  - Slope
  - Aspect
  - Shaded Relief

- Distance operators
  - Target Features
  - Buffers
  - Distance
  - Cost-Distance
Functionality - examples

- Composite generation

- Linear streching
Examples of possible applications

- Land Cover mapping
- Land Use planning
- Natural Resource Management
- environmental modeling
- ecological analysis
- risk and vulnerability analysis
- reducing emissions from deforestation and degradation (REDD)
- etc...
Data models and data structure

Supported data types: raster, vector, thematic (attributes)

Raster data:

• simple row/column structure (no tiling)
• 1 values domain per raster: byte, integer or real
• 1 value per cell
• attribute values are controlled using values files or database tables (e.g. for assigning text attributes of particular cell value)
• presentation control through palettes (LUTs)
• no distinction between surface and point grids (important!)
Data models and data structure — cont’d

Vector data:

- layer-structure, 1 vector object per layer
- data types: point, line, polygon (area)
- presentation control through symbol files
- attribute control through database tables

Data storage:

- file structure: 1 data file (.rst) and 1 documentation file (.rdc) per raster- or vector layer
- relatively simple ASCII formats for data import and export
- binary format for efficient processing
- attribute values files: ASCII, Xbase formats (MS Access and Excel, CSV, ESRI Geodatabase and connection through ODBC to database systems like SQL Server and Oracle)
Data models and data structure – cont’d

Vector

Raster

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Import/Export

- GIS-Formats (e.g. ArcInfo shapefile, ERDAS)
- common raster- (TIFF, GeoTIFF, BMP, HDF, JPG, RADARSAT, Landsat etc.) and vector formats (DXF, ESRI shapefile)

Display (2D) / Map composition

3D Visualizations (3D Fly Through)

Database Workshop (in GIS Module: connection to DBMS features e.g. create queries, create / change table etc.)

Utilities

- conversions: raster -> vector and vector -> raster (limited)
- georeferencing
- resampling
Analysis operations

- Database Queries
  
  For example: Which regions have high radon levels? In which zone lies item X? What is the height range of the study area?

- Mathematical Operations

- Distance Operations

- Context Operations

- Statistics

- Image Processing
  
  Restoration, Enhancement, Transformations, Signature Development, Hard and Soft Classifiers, Hardeners, Accuracy Assessment, Hyperspectral Image Analysis

- Decision Support

- Change/Time Series
Analysis operations cont’d

Query-based functions

Reclassification of raster data (RECLASS): classifies or reclassifies the pixel values into new integer categories (e.g. Aggregation of continuous height values in discrete classes)

Assignment (ASSIGN): generates an output raster basing on separately stored data allocation table (e.g. it is possible to „hide” not interesting ranges of values by putting NODATA or 0 value)

Mathematical Operations

Pairwise combination of raster objects (OVERLAY): calculation of an output raster as a result of cell-wise mathematical operations (addition, subtraction etc.) between the input raster objects (e.g. computing the difference between two height models in large projects, analysis of rock falls, etc.)

Operations on single raster objects (SCALAR, TRANSFORM)
Analysis operations cont’d

Map Algebra Operations (Image Calculator)

- mathematical modeling tool with a calculator-like interface.
- integrates the functionality of the mathematical raster modules (OVERLAY, SCALAR, TRANSFORM) and supports two types of operations: mathematical expressions (+, -, EXP, SIN, ABS, etc.) and logical expressions (AND, OR, NOT, etc.)

Distance Operations

- distance transformation (DISTANCE): calculation of the Euclidian distance of each cell to the nearest target cell (e.g. distance to nearest shopping center)
- cost calculation (COST): calculating a distance while taking a „friction“ into account (e.g. pathfinding considering slopes)
- buffer calculation (BUFFER): calculation of a buffer area around specified spatial objects (points, lines, surfaces) (e.g. identification of influence areas along the railway)
Analysis operations cont’d

Neighborhood Operations

• terrain model analysis (SURFACE): calculation of slope (SLOPE) and site exposure (ASPECT) basing on the raster DTMs as well as the generation of hillshade models
• filtering of raster data (FILTER): e.g removal of very small areas, smoothing of the DTM data with the prior interpolation
• visibility analysis (VIEWSHED): calculation of the visible area of one or more locations

Statistical Operations

• calculation of histograms (HISTO): plots the number of pixels for each pixel value of the raster image; provides means and standard deviations (e.g an average land value in a study area)
• regression analysis (REGRESS): calculation of regression values between two rasters along with the confidence intervals
• trend Analysis (TREND): determination of trend surfaces (linear, quadratic or cubic) of a raster object (e.g propagation direction and speed of an environmental phenomenon)
Analysis operations cont’d

Decision Support

• variety of methods and theories for decision support and risk analysis
• this module specifically supports the multi-objective, multi-criteria and uncertainty (stochastic modelling) aspects

Temporal Analysis (Change/Time Series)

• calculation of time series and statistical analysis of the temporal behavior of certain areas (PROFILE), (TSA – Time Series Analysis) (e.g. analysis of temporal change of average sunshine duration and precipitation values)

Surface Analysis

• interpolation (kriging, distance-weighted average, Thiessen/Voronoï tessellation, TIN, interpolation from isolines, Trend Surface Analysis)
## Evaluation

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
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<tr>
<td>Very versatile and powerful analysis functionality</td>
<td>Relatively limited data management</td>
</tr>
<tr>
<td>Complete Mini-GIS package</td>
<td>Simple data structure (e.g. no tiling); limited object size</td>
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<tr>
<td>On-the-screen digitalization (convenient raster digitalization module)</td>
<td>Restrictive conditions (identical geometrical resolution for all raster objects)</td>
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<tr>
<td>Allows georeferencing and resampling of raster data</td>
<td>Relatively limited support for commercial raster formats</td>
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<tr>
<td>Good price</td>
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<tr>
<td>Practical for small, constrained projects and tasks</td>
<td>Not suitable for very large and complex projects</td>
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Reference