GIS software

ArcGIS (1981) dominates as industry standardIdrisi (1986) alternative for education / researchQGIS (2002) open source - free download

Others (fewer since 1995) 1994: BC Gov used PAMAP (Victoria) and Terrasoft (Nanaimo)

Remote Sensing software

... Not just one that rules them all like GIS

➤The big three

Less expensive options

Free download options

Remote Sensing software: the big 3

Software

special strength

ERDAS (Atlanta, USA: 1978) - vector integration

PCI (Toronto, Canada: 1982) - orthoimages / breadth



ENVI (Boulder, USA: 1991) - hyperspectral

Earth Resources Data Analysis System (ERDAS) \$\$

The first version of ERDAS was launched in 1978 on <u>Cromemco</u> microcomputers running the <u>CDOS</u> - OS.

>Unix / Windows / Mac

Live link raster-vector 1988

➢Partnered with ESRI 2000



>Owned by Leica (2001) -> Intergraph -> Hexagon

>Current version: Imagine - filetype: .img

PCI Geomatics, Canada 1982

... formed as Perceptron Computing Inc.

(not many people know this)

➤Windows and Linux



\$\$

First versions (FORTRAN) were command line: EASI: 'Engineering Analysis and Scientific Interface' (not many people know this)

Current version: Catalyst (2022) – previously Geomatica Banff

File type .pix (will open in other software)

"PCI Geomatics, is the world leader in geo-imaging products and solutions. PCI Geomatics offers customized solutions to the geomatics community in over 135 countries."

Recognised as the most extensive RS software system

Modules written by leading Canadian researchers

Best for orthorectification .. Orthoengine

► Most support for new sensors e.g.

Toutin's Model

ASTER, AVNIR, CARTOSAT, CBERS, DEIMOS, DMC, DUBAISAT, EOC, EROS, FORMOSAT, GEOEYE, GF GOKTURK, GOSAT, HJ, IKONOS, IRS, KAZEOSAT, KOMPSAT, LANDSAT, MERIS, ORBVIEW, PLEIADES, PRISM QUICKBIRD, RAPIDEYE, RASAT, SJ9, SPOT, SSOT, TH, THAICHOTE, WORLDVIEW, YG, ZY

ENVI: Boulder, CO 1991 \$\$

"ENvironment for Visualizing Images" (with specialty for hyperspectral) http://www.exelisvis.com/ProductsServices/ENVIProducts.aspx





Find and extract specific objects with the ENVI Feature Extraction Module (ENVI FX). User-friendly tools to extract features from geospatial imagery based on the object's spatial, spectral, and texture characteristics and identify them as objects like vehicles, buildings, roads, coastlines, rivers, lakes, and fields.

ArcGIS spatial analyst (formerly GRID) \$

\$\$

Spatial Analyst functional reference E Color Model (Spatial Analyst) E Conditional (Spatial Analyst) E Conversion (Spatial Analyst) Density (Spatial Analyst) Distance (Spatial Analyst) Extraction (Spatial Analyst) Generalization (Spatial Analyst) E Groundwater (Spatial Analyst) Hydrology (Spatial Analyst) Interpolation (Spatial Analyst) E local (Spatial Analyst) Map Algebra (Spatial Analyst) 🗄 🧼 Math General (Spatial Analyst) Math Bitwise (Spatial Analyst) Math Logical (Spatial Analyst) 🗉 🧼 Math Trigonometric (Spatial Analyst) 🗉 🧼 Multivariate (Spatial Analyst) Neighborhood (Spatial Analyst) E Overlay (Spatial Analyst) E Raster Creation (Spatial Analyst) Raster Management (Spatial Analyst) E Reclass (Spatial Analyst) 🗉 🧼 Solar Radiation (Spatial Analyst) E Surface (Spatial Analyst) E Sonal (Spatial Analyst)

Multivariate (Spatial Analyst) An overview of the Multivariate tools Band Collection Statistics Class Probability ClassProb Create Signatures ClassSig Dendrogram Edit Signatures EditSig Iso Cluster Maximum Likelihood Classification MLClassify Principal Components PrinComp StackStats

https://pro.arcgis.com/en/pro-app/latest/help/data/imagery/imagery-and-remote-sensing-in-arcgis.htm

Home / Courses / Remote Sensing with QGIS

Remote Sensing with QGIS

QGIS Python Plugins Repository <u>Download latest</u> Semi-Automatic Classification Plugin

SAGA Raster GIS, Germany, 2004 System for Automated Geoscientific Analyses

integrated into QGIS



FREE

http://www.saga-gis.org/en/index.html

GRASS raster GIS (1982)

https://grass.osgeo.org/

Started in 1982 by U.S. Army - Construction Engineering Research Laboratory (USA-CERL) in Champaign, Illinois. USA-CERL completed its last release of GRASS in 1992. GRASS development was assumed by academia in 1997, and became an OS project - an international team manages the source code. FREE

Now part of QGIS

Dune Migration at <u>Jockey's Ridge</u> State Park, North Carolina Infrared photo draped on USGS LIDAR data

IDRISI Worcester (Boston)

http://www.clarklabs.org Idrisi Canada: http://www.idrisi.ca

\$

Raster based GIS and remote sensing since 1986

What's New

IDRISI Taiga Now Shipping! Includes Innovative Earth Trends Modeler Application Segment-based Classification! Learn More >

Focus Paper on Segmentation & Segment-Based Classification Now Available! Download >

See all Focus Papers >



Feature / segment classification (instead of per pixel) is now part of all GIS/RS software: or Object-based image analysis (OBIA) ... See Advanced RS (GEOG457)

TNTmips \$



products gallery downloads

news

documentation

support

contact us

about us

Enter search terms ...

C

Datum Workstation Download

TNTgis 2022 **Previous Release** New Feature List Download

Top Links Purchase

News - Jan 2023 Datum Workstation Official Release

Uses

Viewing Geodata Editing Geodata Georeference / Rectify Geodata Formats

Map Design

Publishing Geodata Mix Local & Web Da Publish Web Maps

Image Processing Image Classification Feature Mapping

Datum Workstation Advanced Software for Geospatial Analysis

Price quotes were sent in mid December to all current and recent TNTgis customers about the new release of Datum Workstation. If you did not receive one, please contact us.

purchase

Datum Workstation provides advanced GIS, image processing, and geospatial analysis at an affordable price. Includes scripting language to automate geospatial processing using local and network computing resources. Formerly called TNTgis, it is used in over 120 countries around the world and translated into 24 languages. We stand behind Datum Workstation with responsive free support.

Complete professional package integrating GIS, image processing, terrain analysis and surface Datum Workstation modeling, LIDAR visualization/processing, geodatabase management, desktop cartography, and web map publishing. View and interpret any type of geospatial data (image, vector, CAD, shape, LIDAR, TIN). View Datum GeoView data in 2D, stereo, and 3D perspective, and view/edit associated relational databases.

Datum Workstation runs on both Windows and MacOS.



GIS, Spatial Analysis, and Desktop Cartography

Datum Workstation is an advanced Geographic Information System that integrates display and processing of map data, imagery, and terrain data along with the creation and management of associated relational databases. Datum Workstation provides all the tools needed to create, edit, georeference, interpret, and publish any type of geospatial data. Geospatial analysis processes are provided for geometric (vector, CAD, shape) map data as well as for imagery and terrain

https://www.microimages.com/products/tntmips.htm

Free viewers

Basic viewer & conversion utilities

Windows Macintosh Solaris Linux other

ERDAS Viewfinder					
http://gis.leica-geosystems.com/products /imagine/downloads/viewfinder.asp	Yes				
ENVI FreeLook Viewer http://rsinc.com/pr/detail.asp?PRID=16 http://ftp.rsinc.com/pub/freelook/	Yes	Yes	Yes	Yes	Yes
ER Viewer http://ermapper.com/downloads /download_view.aspx?PRODUCT_VERSION_ID=48	Yes				
PCI Geomatica FreeView http://pcigeomatics.com/product_ind /freeview.html	Yes				
TNTlite - free version of TNTmips. <u>http://microimages.com/tntlite/</u>	Yes	Yes	Yes	Yes	Yes
ESRI ArcExplorer http://esri.com/software/arcexplorer/	Yes		Yes	Yes	Yes

See also for more remote sensing software: http://archeologiamedievale.unisi.it/NewPages/REMOTESENS/REMOTE11.html



https://gisgeography.com/best-remote-sensing-software/

Cloud-based imagery and Scripting e.g. using R, Python, GDAL

See GEOG457

https://www.researchgate.net/publication/362909213_Cloud-based_storage_and_computing_for_remote_sensing_big_data_a_technical_review

Google Earth Engine is a cloud computing platform for processing satellite imagery and other Earth observation data. It provides access to a large warehouse of satellite imagery and the computational power to analyze those images.

https://earthenginepartners.appspot.com/science-2013-global-forest



Updated site: https://glad.earthengine.app/view/global-forest-change

Statistics as of August 31, 2009



Since 2009

Impact of free data on applications and use including open source analysis.





Canada's remote sensing satellite platform/sensor

This RADARSAT-2 image of Vancouver was acquired May 16, 2011 using the Fine Quad-Pol beam mode (8m resolution). This image represents volume scattering of various surface types:

unruffled = blue, double bounce = red and diffuse = green.

http://www.asccsa.gc.ca/eng/satellites/ radarsat2

My favourite satellite image

Mapping Penguins from space – using penguin poop



https://www.asc-csa.gc.ca/eng/satellites/cubesat/what-is-a-cubesat.asp



Major trends in remote sensing

More and more satellites especially nano and cubesat

More airborne platforms – planes and drones

Data clouds – online processing

Scripting data processing: Gdal, Google Earth Engine, Python

Recent and future EOS launches

https://www.n2yo.com/satellites/?c=latest-launches

https://en.wikipedia.org/wiki/2023_in_spaceflight

Course summary / review

In this course, you should have gained a sense of:

- > Understanding of imagery and wavelengths
- Potential of digital imaging to extract features
- > The potential power of multispectral sensing
- Contribution of remote sensing to Geomatics / GIS
- > Public education and media e.g. Google Earth
- > Data availability purchase and online
- > Many possible applications

GEOG357 wrap-up

Tuesday 10.30 (now): RS software and course Summary

Wednesday 15:00: project data processing ...

Thursday 10.30: 2nd exam in lecture time

Tuesday 10.30: 'project demos' – a few slides / 5 minutes each: e.g.

- 1: goal type of application, study area, image data used and year(s)
- 2: colour composite image(s) of area (clipped) with date(s)
- 3-4: processing: e.g. classification, ratios, bitmaps, feature vectors etc.
- 5: summary results
- Could be extra slide showing any challenging issues

Please: <u>no first slide</u> with just your name and student ID ©

Lecture topics for second exam

10-13	Feature extraction / Mid-Term Exam (15%)	Lab 5: Feature extraction		
16-20	Environmental Change / Thermal RS	Lab 6: Environmental Change		
23-27	Glaciers / Env. Change class demos	Lab 7: Glaciers		
November				
(Oct)30-3	Change detection / DEMs	Lab 8: Change detection		

(Oct)30-3	Change detection / DEMs	Lab 8: Change detection
6-9	Microwave-RADAR / LiDAR	Lab 9: DEMs
13-17	Projects / High resolution sensors	Lab 10: Projects-data
20-24	Hyperspectral & correction / Planetary RS	Lab 11: Data processing
27-Dec 1	RS Software-course review / Exam2 (10%)	Lab 12: project write-up
Dec 5	Project demos – 5 minutes each	

Evaluation 100%

- Exams: Oct 12, Nov 30 + 5% take-home Quiz
- Environmental Change exercise, Oct 25 ٠
- Article review Nov 17
- Lab exercises 5 x 5%
- Final project, Dec 7

30% Exam 2: Nov 30 (10%) 10% lecture topics since midterm; 10 questions, 25% 1 mark each

10%

25%

Sample exam question (previous): Solar radiation peaks in the visible (green) wavelengths, while terrestrial radiation (emitted by Earth) peaks in the thermal infra-red wavelengths. Can you explain why this difference occurs?