Training Course on GDAL/OGR Command-Line Tools Mastery

Professional Development Training Course Outline

Category	GIS	**Duration**	10 Days
Base Fee	$3,000 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

Training Course on GDAL/OGR Command-Line Tools Mastery offers an in-depth exploration of **GDAL (Geospatial Data Abstraction Library)** and **OGR (OpenGIS Simple Features Reference Implementation)** command-line utilities. These powerful, open-source tools are **indispensable** for anyone working with **geospatial data**, enabling efficient **data manipulation**, **format conversion**, **reprojection**, and **automation of complex geoprocessing workflows**. Participants will gain the **practical skills** to expertly handle diverse **raster and vector datasets**, from **satellite imagery** to **GIS shapefiles**, ensuring data integrity and optimizing processing efficiency.

The course emphasizes **hands-on learning** and **real-world case studies**, bridging the gap between theoretical knowledge and practical application. By mastering GDAL/OGR, professionals can significantly enhance their **geospatial analysis capabilities**, streamline data pipelines, and achieve greater productivity in **remote sensing**, **cartography**, **environmental science**, and **urban planning** . This expertise is crucial for tackling large-scale **geospatial big data** challenges and building robust, automated solutions.

Programme Curriculum

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Course Objectives

1. Comprehend the fundamental **data models** and **drivers** for both raster and vector data.
2. Successfully set up and optimize the **command-line environment** on various operating systems.
3. Fluently convert between a multitude of **geospatial formats**
4. Apply commands for **clipping**, **resampling**, **merging**, and **band manipulation** of raster datasets.
5. Utilize OGR for **filtering**, **spatial querying**, **attribute manipulation**, and **reprojection** of vector layers.
6. Accurately define, inspect, and **transform CRS** for diverse datasets using gdalwarp and ogr2ogr.
7. Develop **batch processing scripts** using GDAL/OGR for repetitive tasks, improving efficiency.
8. Generate **DEM derivatives** like hillshades, slopes, and aspects.
9. Apply techniques for **orthorectification**, **pan-sharpening**, and **radiometric correction**.
10. Understand how to leverage GDAL/OGR within **Python** or **Bash scripts** for advanced automation.
11. Align unreferenced imagery to a known coordinate system.
12. Create and manage **virtual raster datasets** for on-the-fly processing and mosaic creation.
13. Effectively identify and resolve common issues encountered with GDAL/OGR commands.

Organizational Benefits

- Eliminate reliance on expensive proprietary GIS software licenses.
- Automate repetitive geospatial tasks, dramatically reducing processing time and manual effort.
- Seamlessly work with diverse geospatial data formats from various sources.
- Process large volumes of geospatial data efficiently, supporting big data initiatives.
- Equip teams with a versatile skillset for complex geospatial challenges.
- Standardize geospatial data processing pipelines across departments.
- Tools for data validation and transformation ensure higher data integrity.
- Develop tailored solutions and integrate with existing systems using open-source flexibility.

Target Audience

1. GIS Analysts & Specialists:
2. Remote Sensing Professionals
3. Data Scientists & Engineers
4. Environmental Scientists
5. Urban Planners & Researchers
6. Software Developers

7. Cartographers.
8. Anyone involved in managing, processing, or analyzing large volumes of geospatial data.

Course Modules

Module 1: Introduction to GDAL/OGR & Command Line Basics

- Overview: Understanding GDAL (raster) and OGR (vector) libraries.
- Installation: Setting up GDAL/OGR on Windows, Linux, and macOS.
- Command Line Fundamentals: Basic syntax, common options, and navigating the terminal.
- Help & Documentation: Effectively using gdalinfo -h and ogrinfo -h for self-help.
- Data Model: Introduction to raster and vector data models and their abstract representation in GDAL/OGR.
- **Case Study**: Inspecting various geospatial files (e.g., GeoTIFF, Shapefile, KML) to understand their structure and metadata using gdalinfo and ogrinfo.

Module 2: Raster Data Basics with GDAL Utilities

- gdalinfo: Extracting metadata, projection, and band information from raster files.
- gdal_translate: Converting raster formats (e.g., TIFF to PNG, JPEG to GeoTIFF).
- gdal_edit.py: Modifying raster metadata, projections, and geotransforms.
- gdaladdo: Creating overviews (pyramids) for faster display and performance.
- gdalwarp: Introduction to raster reprojection and mosaic building.
- **Case Study**: Converting a collection of satellite image tiles from one format to another and generating overviews for web mapping applications.

Module 3: Advanced Raster Processing: Clipping & Resampling

- gdal_translate -projwin: Clipping rasters by geographic coordinates.
- gdalwarp -cutline: Clipping rasters using a vector polygon.
- gdal_translate -outsize: Resampling rasters to a new resolution.
- Interpolation Methods: Understanding different resampling algorithms (e.g., nearest neighbor, bilinear, cubic).
- Nodata Values: Handling and managing nodata values in raster datasets.
- **Case Study**: Extracting a specific region of interest from a large DEM using a shapefile boundary and resampling it for a web-based terrain visualization.

Module 4: Raster Merging & Band Manipulation

- gdal_merge.py: Stitching multiple raster tiles into a single mosaic.
- gdal_calc.py: Performing raster algebra (e.g., calculating NDVI from separate bands).
- Band Selection: Extracting or reordering specific bands from a multi-band raster.
- Virtual Rasters (VRT): Creating VRTs for on-the-fly merging without physical file creation.
- Color Relief: Applying color ramps and hillshade effects for visualization.
- **Case Study**: Merging several Landsat scene tiles to create a seamless mosaic of a large area and then calculating NDVI to assess vegetation health.

Module 5: Working with Digital Elevation Models (DEMs)

- gdaldem: Generating hillshade, slope, aspect, and terrain roughness maps.
- Contour Generation: Creating contour lines from a DEM using gdal_contour.
- Viewshed Analysis: Introduction to basic viewshed calculations.
- Data Types: Understanding integer and float data types for DEMs.
- Source Data: Exploring common DEM sources (e.g., SRTM, ASTER, LiDAR).

- **Case Study**: Generating a hillshade map and slope map from a downloaded SRTM DEM to analyze terrain characteristics for a proposed construction site.

Module 6: Vector Data Basics with OGR Utilities

- ogrinfo: Inspecting vector layer metadata, fields, and spatial reference.
- ogr2ogr: Converting vector formats (e.g., Shapefile to GeoJSON, KML to GPKG).
- SQL Queries: Filtering vector features using OGR's SQL dialect.
- Attribute Manipulation: Adding, deleting, or modifying fields.
- Creating New Layers: Defining new vector layers and adding features.
- **Case Study**: Converting a large OpenStreetMap dataset (OSM PBF) to a GeoPackage and filtering out only specific feature types like roads or buildings using SQL.

Module 7: Vector Data Reprojection & Transformation

- ogr2ogr -t_srs: Reprojecting vector data between different Coordinate Reference Systems.
- -s_srs: Specifying the source CRS explicitly.
- Coordinate Transformation: Understanding the implications of different transformations.
- Datum Shifts: Awareness of datum transformations and their importance.
- Proj Strings & EPSG Codes: Working with various CRS definitions.
- **Case Study**: Reprojecting a national administrative boundary shapefile from a geographic CRS (e.g., WGS84) to a local projected CRS for accurate area calculations.

Module 8: Vector Data Manipulation & Geoprocessing

- ogr2ogr -clipsrc: Clipping vector layers using a bounding box or another vector layer.
- ogr2ogr -sql: Advanced spatial queries and attribute joins.
- -overwrite & -append: Managing output file behavior.
- -segmentize: Densifying lines and polygons.
- Dissolving Features: Merging adjacent features based on common attributes.
- **Case Study**: Clipping a road network to a specific municipal boundary and then performing an attribute query to select only primary roads.

Module 9: Geospatial Data Automation with Shell Scripting

- Bash Scripting Basics: Introduction to creating and executing simple shell scripts.
- Looping & Iteration: Processing multiple files automatically using for loops.
- Conditional Statements: Implementing logic for dynamic processing.
- Input/Output Redirection: Managing command output and input from files.
- Error Handling: Basic strategies for managing script errors.
- **Case Study**: Developing a batch script to reproject and convert an entire directory of raster images from different sources to a unified CRS and format.

Module 10: Advanced GDAL Features & Workflows

- gdal_rasterize: Burning vector features into a raster.
- gdal_sieve.py: Removing small, isolated pixel regions from a raster.
- gdal_proximity.py: Calculating proximity to features in a raster.
- gdal_polygonize.py: Converting raster polygons to vector polygons.
- Dataset Options: Exploring driver-specific creation and open options.
- **Case Study**: Creating a raster impact zone from a point dataset (e.g., pollution sources) and then vectorizing the resulting buffer for further analysis.

Module 11: Georeferencing with GDAL

- Ground Control Points (GCPs): Understanding their role in georeferencing.
- gdal_translate -gcp: Adding GCPs to an unreferenced image.
- gdalwarp for Rectification: Using gdalwarp to transform the image based on GCPs.
- Transformation Algorithms: Polynomial and Thin Plate Spline transformations.
- Image Pre-processing: Preparing images for accurate georeferencing.
- **Case Study**: Georeferencing a scanned historical map to a modern coordinate system to allow for overlay with current GIS data.

Module 12: Working with Web Services (WMS, WFS)

- WMS (Web Map Service): Accessing and downloading raster data from WMS servers using GDAL.
- WFS (Web Feature Service): Querying and downloading vector data from WFS servers using OGR.
- Service Capabilities: Inspecting the capabilities of OGC web services.
- Filtering Web Data: Applying spatial and attribute filters to web service requests.
- Performance Considerations: Optimizing requests for large datasets.
- **Case Study**: Downloading current weather radar imagery from a WMS server and overlaying it with local road networks from a WFS for real-time analysis.

Module 13: Interfacing GDAL/OGR with Python

- osgeo Library: Introduction to the Python bindings for GDAL/OGR.
- Reading Data: Accessing raster and vector datasets programmatically.
- Writing Data: Creating new geospatial files with Python.
- Raster & Vector API: Performing operations like reading pixel values, querying features, and creating geometries.
- Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
23 Nov 2026	04 Dec 2026	Online	$2,000
23 Nov 2026	04 Dec 2026	Physical	$3,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$9,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$12,000

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