Training Course on AI for Feature Extraction from Geospatial Data

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 AI for Feature Extraction from Geospatial Data delves into the transformative power of **Artificial Intelligence (AI)** and **Machine Learning (ML)** for **geospatial data analysis** and **feature extraction**. As the volume and complexity of **satellite imagery**, **drone data**, and other **remote sensing datasets** explode, traditional manual methods for extracting meaningful information are becoming obsolete. This program provides participants with cutting-edge knowledge and practical skills to leverage **deep learning architectures**, **computer vision techniques**, and **geospatial AI algorithms** to automate the identification, classification, and quantification of features such as **land cover**, **urban infrastructure**, **environmental changes**, and more. You'll gain hands-on experience with industry-standard **geospatial platforms** and **AI frameworks**, empowering you to unlock unprecedented insights and drive data-driven decision-making across diverse sectors including **environmental monitoring**, **urban planning**, **disaster management**, and **precision agriculture**.

The curriculum focuses on developing a strong foundation in **GeoAI principles**, covering essential topics from **data preprocessing** and **feature engineering** to **model training**, **validation**, and **deployment**. Through practical exercises, **real-world case studies**, and project-based learning, you'll master techniques for **object detection**, **image segmentation**, **change detection**, and **predictive analytics** using **spatial data**. This course is designed to equip professionals with the advanced competencies needed to navigate the rapidly evolving landscape of **geospatial intelligence**, enabling them to solve complex problems, optimize resource allocation, and foster innovation in their respective fields. Prepare to transform raw geospatial data into actionable intelligence with the power of AI.

Programme Curriculum

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Course Objectives

1. Comprehend the core concepts of **Geospatial Artificial Intelligence** (GeoAI) and its intersection with **GIS**, **Remote Sensing**, and **Big Data Analytics**.
2. Acquire proficiency in **preprocessing** and **preparing diverse geospatial datasets** (satellite, aerial, LiDAR, drone imagery) for AI model consumption.
3. Learn advanced **feature engineering techniques** specifically tailored for extracting robust features from **complex spatial data**.
4. Implement **Convolutional Neural Networks (CNNs)** and other **deep learning architectures** for **image classification**, **object detection**, and **semantic segmentation** in geospatial contexts.
5. Apply **Recurrent Neural Networks (RNNs)** and **transformer models** for **time-series analysis** and **change detection** in sequential geospatial data.
6. Explore **unsupervised learning methods** for **feature extraction** and **pattern recognition** in unlabeled geospatial datasets.
7. Gain hands-on experience with **cloud-based geospatial AI platforms** like **Google Earth Engine** and **Microsoft Planetary Computer** for scalable analysis.
8. Develop robust workflows for **training, validating, and evaluating AI models** for geospatial feature extraction, ensuring **model robustness** and **accuracy**.
9. Understand methodologies for enabling **real-time feature extraction** and **predictive analytics** from streaming geospatial data.
10. Address **ethical considerations** and **bias mitigation** in the development and deployment of **AI-powered geospatial solutions**.

11. Design and implement **scalable geospatial AI workflows** for processing **large-volume, high-resolution imagery** efficiently.
12. Apply AI techniques for **environmental monitoring**, **climate change assessment**, **deforestation detection**, and **natural resource management**.
13. Utilize AI for **urban growth analysis**, **infrastructure mapping**, and supporting **smart city initiatives** through geospatial feature extraction.

Organizational Benefits

- Automate tedious and time-consuming manual feature extraction processes, leading to **significant time and cost savings** and increased operational efficiency.
- Achieve higher accuracy in feature identification and classification, enabling **more precise data-driven decisions** and uncovering hidden patterns in vast datasets.
- Equip teams with the skills to process and analyze **massive volumes of geospatial data** efficiently using scalable AI techniques and cloud platforms.
- Develop predictive models for forecasting trends, identifying risks, and optimizing resource allocation across various domains, from **disaster preparedness** to **urban development**.
- Foster an environment of innovation by adopting cutting-edge GeoAI technologies, leading to the development of **new products, services, and solutions**.
- Gain deeper insights into resource distribution and utilization, enabling more effective planning and management in sectors like agriculture, forestry, and infrastructure.
- Enable rapid analysis of real-time geospatial data for critical applications such as **disaster response**, **emergency management**, and **situational awareness**.
- Minimize human subjectivity and error in data interpretation and feature extraction, leading to more consistent and reliable results.

Target Audience

1. GIS Professionals & Analysts.
2. Remote Sensing Specialists.
3. Data Scientists & Machine Learning Engineers.
4. Environmental Scientists & Researchers.
5. Urban Planners & Civil Engineers.
6. Agricultural Scientists & Agronomists.
7. Disaster Management & Humanitarian Aid Professionals.
8. Graduate Students & Academics

Course Outline

Module 1: Introduction to Geospatial AI (GeoAI)

- Defining GeoAI.
- The Geospatial Data Landscape.
- Challenges and Opportunities in Geospatial AI.
- Key AI Paradigms for.
- Ethical Considerations in GeoAI.
- **Case Study**: *Analyzing the ethical implications of using facial recognition on public street-level imagery for urban planning.*

Module 2: Geospatial Data Acquisition & Preprocessing

- Data Formats & Structures
- Data Collection & Sources.

- Image Rectification & Georeferencing.
- Radiometric & Atmospheric Correction.
- Data Resampling & Reprojection.
- **Case Study**: *Preprocessing a time-series of Sentinel-2 images to monitor deforestation, including cloud masking and atmospheric correction.*

Module 3: Fundamentals of Machine Learning for Geospatial Data

- Supervised Learning for Geospatial Classification.
- Unsupervised Learning for Spatial Clustering.
- Regression Models for Spatial Prediction
- Feature Engineering for ML
- Model Evaluation Metrics.
- **Case Study**: *Using Random Forest to classify land cover types (forest, water, urban) from multispectral satellite imagery in a specific region.*

Module 4: Introduction to Deep Learning for Imagery

- Neural Network Basics.
- Convolutional Neural Networks (CNNs).
- Transfer Learning & Pre-trained Models.
- Image Augmentation Techniques.
- Setting up Deep Learning Environments.
- **Case Study**: *Applying a pre-trained ResNet model with fine-tuning to classify different crop types from high-resolution drone imagery.*

Module 5: Object Detection in Geospatial Imagery

- Object Detection Architectures
- Bounding Box Regression & Non-Maximum Suppression.
- Training Custom Object Detectors.
- Evaluation Metrics for Object Detection.
- Applications of Object Detection in Geospatial.
- **Case Study**: *Developing a custom YOLO model to detect and count specific types of vehicles (cars, trucks) in high-resolution aerial imagery for traffic analysis.*

Module 6: Semantic Segmentation for Land Cover Mapping

- Semantic Segmentation Concepts
- Encoder-Decoder Architectures
- Preparing Pixel-Level Labels.
- Loss Functions for Segmentation.
- Post-processing Segmentation Outputs.
- **Case Study**: *Using a U-Net model to create a detailed land cover map from multispectral satellite imagery, distinguishing between different vegetation types and impervious surfaces.*

Module 7: Change Detection with AI

- Traditional Change Detection Methods.
- AI-Driven Change Detection.
- Unsupervised Change Detection.
- Supervised Change Detection.
- Time-Series Analysis for Change Monitoring.

- **Case Study**: *Implementing a siamese neural network to detect urban growth and deforestation from multi-temporal satellite images of a rapidly developing area.*

Module 8: Geospatial Feature Extraction with LiDAR Data

- Introduction to LiDAR Data.
- Point Cloud Preprocessing data.
- Deep Learning for Point Clouds.
- Feature Extraction from LiDAR.
- Integrating LiDAR with Imagery.
- **Case Study**: *Using a deep learning model to automatically extract building footprints and tree canopy height from raw LiDAR point cloud data in an urban environment.*

Module 9: Geospatial AI on Cloud Platforms

- Introduction to Cloud Geospatial Platforms.
- Accessing & Managing Big Geospatial Data.
- Scaling AI Workflows.
- GEE API & Python Integration
- Containerization (Docker) for GeoAI.
- **Case Study**: *Performing a regional-scale land cover classification using a custom deep learning model trained and executed on Google Earth Engine.*

Module 10: Advanced Feature Engineering & Representation Learning

- Beyond Pixel Values.
- Spatial Graph Neural Networks (GNNs).
- Self-Supervised Learning for Geospatial Data.
- Generative Adversarial Networks (GANs) for Geospatial.
- Interpretable AI in Geospatial.
- **Case Study**: *Utilizing self-supervised learning techniques to extract robust features from unlabeled drone imagery for anomaly detection in agricultural fields.*

Module 11: AI for Environmental Monitoring & Conservation

- Deforestation & Forest Cover Change Detection.
- Water Quality & Hydrological Monitoring.
- Biodiversity & Wildlife Tracking modeling.
- Pollution Mapping & Air Quality Monitoring.
- Climate Change Impact Assessment.
- **Case Study**: *Monitoring the health and extent of coral reefs using AI-driven image segmentation on underwater drone imagery.*

Module 12: AI in Urban Planning & Smart Cities

- Urban Growth & Sprawl Analysis.
- Infrastructure Mapping & Asset Management.
- Traffic Flow & Congestion Prediction.
- Land Use Optimization.
- Disaster Resilience & Risk Assessment.
- **Case Study**: *Employing object detection and segmentation to create a comprehensi*

Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
21 Sep 2026	02 Oct 2026	Online	$2,000
21 Sep 2026	02 Oct 2026	Physical	$3,000
21 Sep 2026	02 Oct 2026	Physical	$0
21 Sep 2026	02 Oct 2026	Physical	$0
21 Sep 2026	02 Oct 2026	Physical	$0
21 Sep 2026	02 Oct 2026	Physical	$0
21 Sep 2026	02 Oct 2026	Physical	$0
21 Sep 2026	02 Oct 2026	Physical	$0

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