Synthetic Aperture Radar (SAR) Data Analysis Training Course

Professional Development Training Course Outline

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

Course Introduction

Synthetic Aperture Radar (SAR) has revolutionized **remote sensing**, offering an unparalleled ability to acquire high-resolution imagery of Earth's surface regardless of weather conditions or time of day. Unlike traditional optical sensors limited by cloud cover and daylight, SAR systems actively emit microwave signals, enabling **all-weather, day-and-night monitoring**. This unique capability makes SAR an indispensable tool for a vast array of applications, from **disaster management** and **environmental monitoring** to **urban planning** and **defense**. Synthetic Aperture Radar (SAR) Data Analysis Training Course provides participants with the foundational knowledge and practical skills required to effectively process, analyze, and interpret SAR data, transforming raw signals into actionable **geospatial intelligence**.

Navigating the complexities of SAR data, including its unique characteristics like **speckle noise** and **geometric distortions**, demands specialized expertise. This program is meticulously designed to bridge that knowledge gap, equipping professionals with the **cutting-edge techniques** and **software proficiency** necessary to harness the full potential of SAR. Through a blend of theoretical instruction and intensive **hands-on exercises**, participants will gain a deep understanding of SAR principles, **advanced processing workflows**, and **real-world applications**, ensuring they can confidently apply SAR analysis to solve critical challenges across diverse industries and research domains.

Programme Curriculum

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Course Objectives

Upon completion of this training, participants will be able to:

1. Grasp the core principles of **Synthetic Aperture Radar (SAR) technology**, including microwave interaction with Earth's surface and SAR signal acquisition.
2. Distinguish between various **SAR data products**, acquisition modes (e.g., Stripmap, ScanSAR, Spotlight, TOPSAR), and their specific applications.
3. Execute essential **SAR data pre-processing steps**, including **speckle reduction**, radiometric calibration, and geometric correction for accurate analysis.
4. Analyze and interpret **SAR backscatter signatures** to identify different land cover types, surface features, and material properties.
5. Utilize fundamental **SAR analysis techniques** for applications such as **flood mapping**, forest monitoring, and land cover classification.
6. Gain a solid understanding of **Interferometric SAR (InSAR)** concepts, including interferogram generation and coherence, for precise deformation monitoring.
7. Learn the principles of **Polarimetric SAR (PolSAR)** to unlock advanced land cover classification, target decomposition, and biomass estimation.
8. Implement **SAR change detection techniques** to monitor dynamic phenomena like urban expansion, deforestation, and disaster impacts.
9. Effectively integrate **SAR data with GIS platforms** for enhanced spatial analysis and visualization.
10. Develop proficiency in industry-standard **SAR processing software** (e.g., ESA SNAP, ENVI SARscape) for practical data manipulation.
11. Apply SAR techniques for **infrastructure monitoring**, detecting subtle movements and structural integrity changes.
12. Employ SAR data for rapid **disaster assessment**, including earthquake deformation, landslide detection, and oil spill mapping.
13. Perform **SAR time series analysis** to observe subtle changes over time, crucial for environmental and geological studies.

Organizational Benefits

- Equip teams with the ability to derive **critical insights** from SAR data, leading to more informed and timely decisions in various operational areas.
- Streamline **geospatial data analysis workflows** and reduce reliance on weather-dependent optical imagery, ensuring continuity of operations.
- Optimize resource allocation and minimize fieldwork through the effective use of **remote sensing technologies** for monitoring and assessment.
- Proactively identify and monitor potential hazards such as **landslides, subsidence, and infrastructure vulnerabilities**, enhancing safety and reducing potential damages.
- Foster a skilled workforce capable of leveraging **advanced Earth observation techniques**, positioning the organization at the forefront of **geospatial innovation**.
- Facilitate accurate and regular reporting for environmental regulations, land-use planning, and **disaster preparedness** initiatives.
- Enable seamless **integration of SAR data** with other remote sensing datasets, providing a holistic view for complex analyses.

Target Audience

1. GIS Professionals & Analysts
2. Remote Sensing Specialists
3. Environmental Scientists & Ecologists
4. Disaster Management & Humanitarian Aid Personnel
5. Urban Planners & Civil Engineers.
6. Agricultural Scientists & Agronomists
7. Geologists & Hydrologists
8. Defense & Security Analysts

Course Outline

Module 1: Introduction to Synthetic Aperture Radar (SAR)

- SAR Fundamentals
- SAR System Characteristics
- Key SAR Missions
- SAR Data Formats
- **Case Study: Sentinel-1 for Global Monitoring**: Explore how Sentinel-1's systematic acquisitions enable consistent monitoring of Earth's surface across vast areas, including examples of maritime surveillance and ice monitoring.

Module 2: SAR Data Pre-processing

- Radiometric Calibration
- Speckle Noise Reduction
- Geometric Correction & Orthorectification.
- Co-registration of Multi-temporal SAR Data
- **Case Study: Pre-processing for Flood Mapping**: Hands-on exercise using Sentinel-1 GRD data to prepare it for flood extent mapping, demonstrating speckle filtering and radiometric correction over a flood-affected area.

Module 3: SAR Image Interpretation and Visualization

- Understanding SAR Backscatter
- Interpreting Land Cover Types.
- Polarimetric Signatures.
- Visualization Techniques

- **Case Study: Urban Area Mapping**: Analyze a high-resolution SAR image of an urban area to identify buildings, roads, and open spaces, discussing the impact of building orientation on SAR signatures.

Module 4: Introduction to Interferometric SAR (InSAR)

- InSAR Principles
- InSAR Processing Steps.
- Applications of InSAR
- Coherence as a Change Indicator
- **Case Study: Monitoring Land Subsidence**: Analyze InSAR data to detect and quantify land subsidence in a coastal city, illustrating the impact on infrastructure.

Module 5: Polarimetric SAR (PolSAR) Data Analysis

- Polarization States & Scattering Mechanisms
- Polarimetric Decomposition Techniques
- PolSAR Classification
- Biomass Estimation
- **Case Study: Forest Type Classification**: Apply PolSAR decomposition to classify different forest types (e.g., deciduous, coniferous) in a complex forest environment, highlighting the advantages over dual-pol data.

Module 6: SAR for Environmental Monitoring

- Water Resources Management
- Forestry Applications
- Coastal Zone Monitoring
- Glacier and Ice Sheet Dynamics
- **Case Study: Deforestation Detection in Rainforests**: Use multi-temporal SAR data to identify areas of recent deforestation in a cloud-prone rainforest region, demonstrating SAR's ability to "see through" clouds.

Module 7: SAR for Disaster Management

- Flood Extent Mapping
- Earthquake Damage Assessment
- Landslide Detection and Monitoring
- Volcanic Activity Monitoring:.
- **Case Study: Post-Earthquake Damage Assessment**: Analyze high-resolution SAR images acquired before and after an earthquake to identify damaged buildings and infrastructure in an urban area.

Module 8: SAR for Agriculture and Food Security

- Crop Type Classification
- Soil Moisture Monitoring
- Crop Health Assessment.
- Yield Prediction
- **Case Study: Crop Monitoring for Precision Agriculture**: Utilize time series SAR data to monitor the growth stages and health of different crops in an agricultural landscape, informing precision farming practices.

Module 9: SAR for Infrastructure and Urban Monitoring

- Urban Growth Analysis
- Infrastructure Deformation Monitoring
- Underground Pipeline Monitoring
- Building Footprint Extraction
- **Case Study: Monitoring Bridge Stability with InSAR**: Apply InSAR to monitor the long-term stability of a large bridge, identifying potential areas of deformation or settlement.

Module 10: Advanced SAR Techniques

- Differential InSAR (DInSAR)
- Persistent Scatterer InSAR (PSInSAR)
- Small Baseline Subset (SBAS) InSAR
- SAR Tomography
- **Case Study: Measuring Glacier Movement with DInSAR**: Analyze DInSAR data to precisely measure the velocity and direction of glacier movement, contributing to climate change studies.

Module 11: SAR Data Fusion with Other Remote Sensing Data

- Principles of Data Fusion
- Benefits of Multi-Sensor Integration
- Fusion Techniques.
- Applications of Data Fusion
- **Case Study: Land Cover Mapping with SAR and Optical Data**: Perform a fused classification of land cover using both Sentinel-1 SAR and Sentinel-2 optical data, demonstrating the synergistic benefits.

Module 12: SAR Processing Software & Workflows

- Introduction to SNAP
- Key Processing Modules in SNAP.
- Introduction to Commercial Software
- Scripting for Automation
- **Case Study: Automated Flood Mapping Workflow**: Develop and execute an automated workflow in SNAP or a similar tool to process multiple SAR images for rapid flood extent mapping.

Module 13: Advanced SAR Applications & Future Trends

- Maritime Surveillance
- Cryosphere Monitoring
- SAR for Geological Mapping
- Emerging SAR Technologies
- **Case Study: Ship Detection and Tracking**: Use SAR data to detect and track vessels in a busy shipping lane, highlighting the importance of SAR for maritime domain awareness.

Module 14: Practical Project & Advanced Problem Solving

- Project Design & Data Selection
- Applying Learned Techniques.
- Troubleshooting & Quality Control.
- Results Interpretation & Reporting.
- **Case Study: Independent Research Project**: Participants work on a self-selected project (e.g., monitoring a specific land-use change, assessing a local hazard) and present their

methodology and results.

Module 15: Ethics, Data Policy, and Career Opportunities in SAR

- Ethical Considerations in SAR Use
- Open SAR Data Policies
- Career Paths in Remote Sensing/SAR
- Networking & Professional Development
- **Case Study: Leveraging Open SAR Data for Humanitarian Aid**: Explore how organizations use freely available SAR data for rapid disaster response in areas with limited ground access, highlighting data accessibility and ethical considerations.

Training Methodology

- Interactive Lectures & Discussions.
- Practical Demonstrations
- Hands-on Exercises & Labs.
- Case Study-Driven Learning
- Problem-Solving Scenarios
- Software Proficiency Development
- Q&A and Peer Learning.
- Project-Based Learning

Register as a group from 3 participants for a Discount

Send us an email: info@fineskilltrainingcenter.org or call *+254769199797*

Certification

Upon successful completion of this training, participants will be issued with a globally- recognized certificate.

Tailor-Made Course

We also offer tailor-made courses based on your needs.

Key Notes

a. The participant must be conversant with English.

b. Upon completion of training the participant will be issued with an Authorized Training Certificate

c. Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
23 Nov 2026	04 Dec 2026	Online	$2,000

Start Date	End Date	Location	Price
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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