HEXAGON
GEOSPATIAL

RADAR ANALYST WORKSTATION

MODERN, USER-FRIENDLY RADAR TECHNOLOGY IN ERDAS IMAGINE®

White Paper
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Introduction

Over the past two decades, radar software research and development has resulted in a number of algorithms that produce higher-quality versions of the information products that are required by the user community. However, the natural variation in radar images and background-to-target ratios, as well as false positives, preclude the specification of processing parameters and thresholds that are universally applicable. As a result, handling radar images has traditionally been a very hands-on process, much more so than the processing and analysis of optical imagery.

ERDAS IMAGINE®'s radar technology has been specifically designed to minimize the amount of work required from a human operator. With easy-to-use wizards and intelligent default values, ERDAS IMAGINE's radar tools provide the maximum amount of automated pre-processing and information extraction and present you with the results for final refinement.

IMAGINE Radar Mapping Suite™

To launch the Radar Analyst workstation, load a radar image into the viewer. The context-sensitive ERDAS IMAGINE ribbon will then provide a Radar Analyst tab that includes the tools you need to work with the image. Figure 1 shows the Radar Analyst tab inside the ribbon. Additional layers – raster or vector – can be displayed simultaneously to aid analysis.

Figure 1: The Radar Analyst tab is shown in the ERDAS IMAGINE ribbon when radar images are loaded into the viewer.

The Radar Analyst Workstation

The Radar Analyst workstation remains focused on the image in the viewer (the image-of-interest). Additional layers, raster or vector, can be overlain to aid in the analysis, but the information-extraction tools will remain focused on the image itself.

When first displayed, the radar image will commonly be georeferenced (WGS84) from the original format on the fly. There is no need to import or orthocorrect the image beforehand. This saves time and eliminates resampling errors. The radar image is displayed as a magnitude image for initial visual inspection.

If you want, you can create derived layers in either Edge Enhance or Level Slice mode. With these overlays present, an array of tools become active to help you extract information. And the final products, in shapefile format, are ready for distribution.

Real-time Image Analysis

The Radar Analyst workstation is designed to aid visual analysis and interpretation. Because radar is an active, highly directional sensor, the ability to detect features is greatly affected by the direction of the radar beam. The Look Direction Arrow tool in the workstation shows you the look direction relative to the image-of-interest at any time, any resolution, and any orientation of the image.

Real-time brightness and contrast adjustment wheels allow you to optimize the visual display of any image segment. A real-time region growing tool enables you to quickly and accurately define the perimeter of a feature, without time-consuming and error-prone hand editing.

A major advantage of ERDAS IMAGINE's Radar Analyst workstation is its ability to co-display several layers on top of a selected radar image, enabling you to analyze it in a meaningful context. This is shown in Figure 2. Here, we see a RADARSAT-2 image containing an oil slick feature in the center, with a red ship on it. Coastal vectors (green), undersea oil pipelines (blue), and known surface and subsurface oil production infrastructure (red) are co-displayed with the radar image. This allows you to evaluate the oil slick in relation to possible sources.

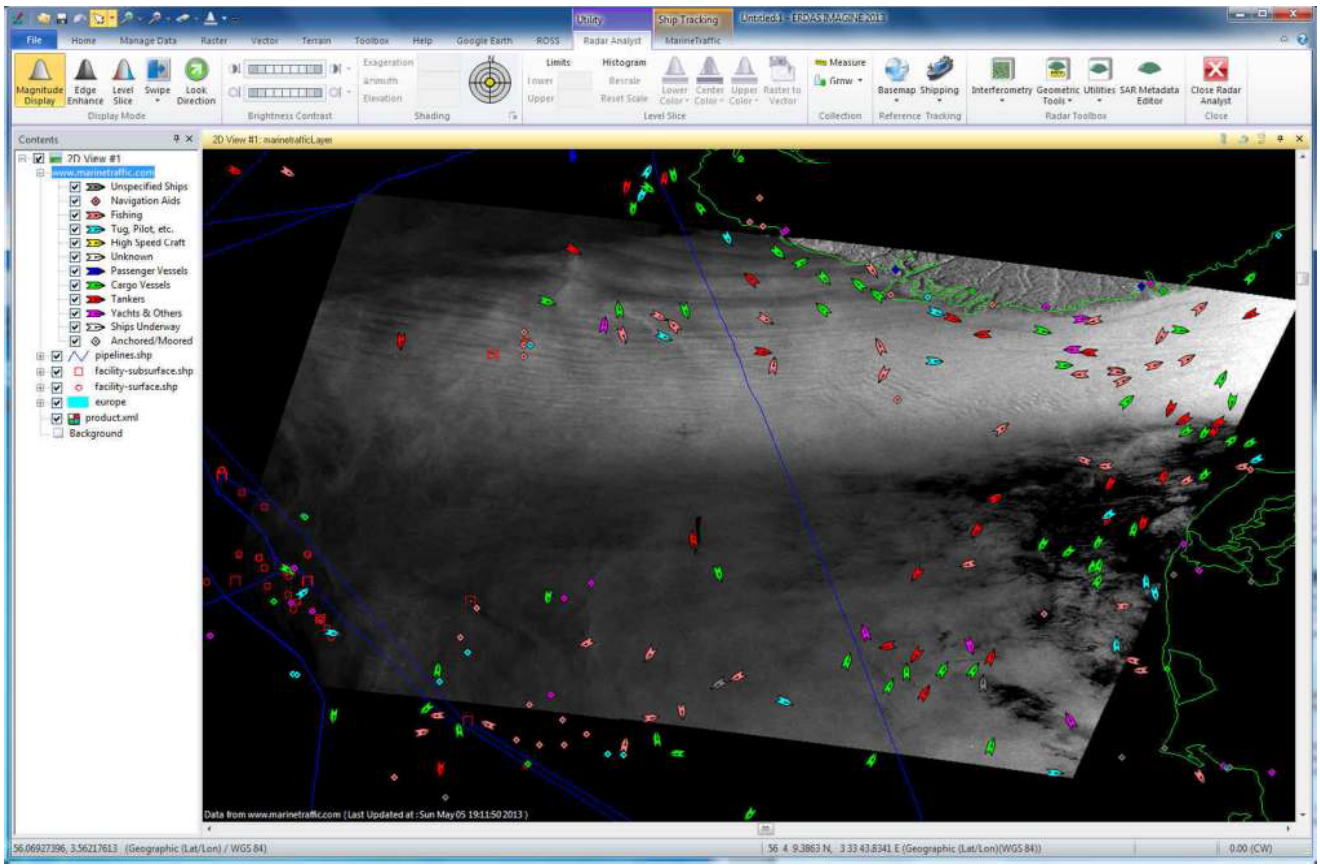

Figure 2. An oil spill (center) is shown in relation to countries, production infrastructure, and ships.

Reference and Tracking Layers

The final co-displayed layer in Figure 2 is real-time Automated Identification System (AIS) data from coastal receivers. This provides information on the ships in the area, which are potential sources of the oil slick. The synergy between radar imagery and ship monitoring is an application of significant and growing interest world-wide, and one that ERDAS IMAGINE's Radar Analyst workstation will be optimized to exploit.

Optionally, you can display reference base maps from Bing™ while analyzing land images. These reference and tracking layers are delivered by partner companies, and you can choose to upgrade the available data through an online licensing protocol. Real-time data, real easy.

Interferometry

IMAGINE Interferometry, an IMAGINE Radar Mapping Suite™ add-on, can also be launched from the Radar Analyst tab. IMAGINE Interferometry presents three analysis techniques - Coherence Change Detection (CCD), Interferometric DEM Extraction (InSAR), and Differential Interferometric Subsidence Mapping (DInSAR) - as user-friendly wizards.

Radar interferometry requires a sequence of extremely precise mathematical operations - some of the most sophisticated in the world of image processing. For this reason, Intergraph has partnered with world-recognized experts to optimize the various steps. In addition, all processing parameters have intelligent default values to eliminate guesswork by the non-expert.

ERDAS IMAGINE's interferometry wizards are all based on processing steps that are either identical, or at least very similar. This reduces the learning curve. Once you are proficient at one analysis, it is easy to start using the others. Indeed, ERDAS IMAGINE makes interferometry so simple that anyone, even a person with no image processing experience, can achieve good results...automatically. This is market-changing technology.

Coherence Change Detection

With CCD, you can look for changes between two radar images based on differences in the phase of the radar waves. This extremely sensitive technique can identify differences as small as a quarter of a wavelength. Thus, for a 2.4-centimeter X-band image, you can detect change at 0.6-centimeter resolution!

InSAR DEM

Instead of looking for the change between two radar images, they can be combined to create an interference image, much as you create a hologram with optical waves. This interferogram can then be manipulated (unwrapped) to yield a detailed digital elevation model (DEM) of the surface. Because you are working at the fractional wavelength scale, the precision of the DEM commonly exceeds what can be achieved with optical stereo pairs.

DInSAR Subsidence

If there already is a DEM of the study area, it is also possible to look for slight differences in the surface elevation of the study area, again at the sub-wavelength scale. Slight elevation changes, such as those induced by resource extraction, volcanic activity, or earthquakes, are quantitatively mapped.

Radar Toolbox

The Radar Toolbox contains all the common radar image processing tools routinely needed to clean up, orthorectify, enhance or reformat the data.

Geometric Tools

In the Radar Analyst workstation, images are georeferenced on-the-fly as they are read into the viewer. This works well for images of water bodies or flat areas, but in areas with significant relief variations, it is preferable to orthocorrect the image using a DEM. Orthoradar automates this process.

Utilities

The Utilities module contains lots of standard radar-image-processing tools. The Speckle Reduction algorithms are significant among these. All of the industry-standard favorites are included, but many have been improved and now allow the user to tune the algorithm to the specific image being processed.

Different display formats are advantageous for different analyses. With the Conversions package, you can convert any format to another.

SAR Metadata Editor

SAR image processing relies heavily on many parameters associated with the image pixels. This metadata is provided by the data suppliers along with the image. When ERDAS IMAGINE ingests a radar image, the necessary metadata parameters are also ingested and attached to the image. These can be viewed at any time using the SAR metadata editor.

21st Century Radar Image Processing

With the most recent versions of ERDAS IMAGINE, radar image processing has advanced into the next generation of image processing software design. No longer is this cutting-edge technology accessible only to remote sensing experts. Instead, the new paradigm is automated information extraction for the larger audience that needs the radar-derived information. Decision makers, and their staff, can now easily utilize extremely sophisticated algorithms.

In addition, the more advanced users now have a dedicated radar analysis environment in the Radar Analyst workstation. Designed along with operational radar facilities world-wide, these real-time tools allow rapid and precise information extraction and creation of industry-standard information products.

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