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Contemporary Data Collection and Spatial Information Management Techniques to support Good Land Policies

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Introduction

Great volume of data from various sources
Automatic techniques for data management
→ Time saving
Production of new data

Processed spatial information for decision-making / better monitoring of impacts on the environment, the economy and the society

Today there is an urgent need for several countries to do reforms and reorganize their infrastructure in order to meet the requirements of the globalized environment and achieve a sustainable prosperity for all

The common situation in several countries (e.g., Greece) is:

- Although there is enough know-how
- There is a weak administration & inefficient management, and
- There is an urgent need for adaptation of the administration at all levels

The identification of the 'best use' of modern technology and tools is needed for better and in-time decision-making at all levels of government

A typical example is the management of informal development: from the right estimation of the size of the problem, the detection/localization, up to the regeneration of the areas and the monitoring to minimize the phenomenon in the future

Modern sources of data collection and management of spatial information

During the last 10-15 years new tools have been available and added to the traditional data collection sources:

- Positioning systems
- LIDAR systems
- High resolution satellite optical images

  resolution 0.5m, direct georeferencing, rigorous georeferencing models
- SAR images

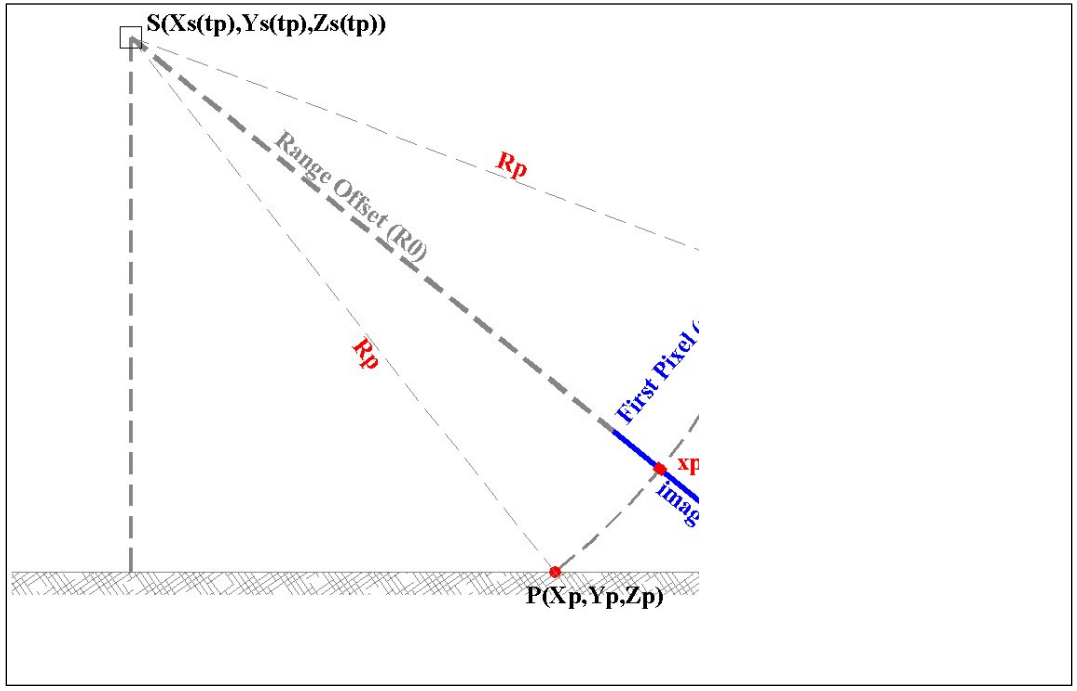
  active microwave imaging sensor, side-looking geometry, 1m resolution

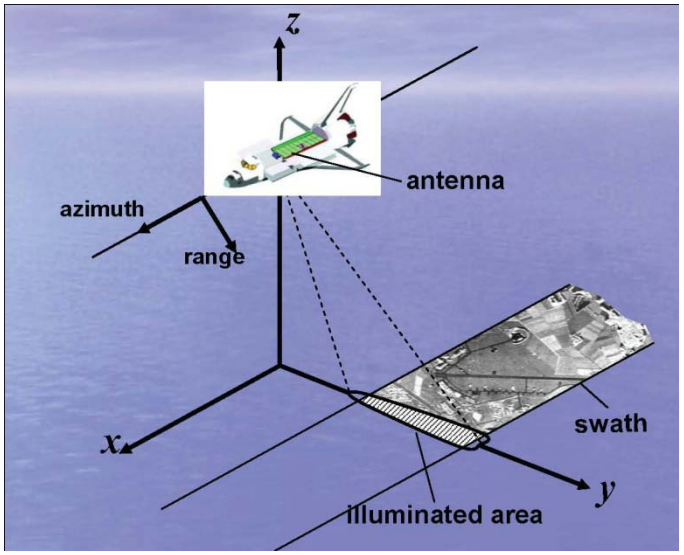
Combined use: advantages, variety of applications

SAR geometry

SAR image is distorted both geometrically and radiometrically, through

foreshortening, range and azimuth shift, layover, radiometric modulation associated with slope, shadowing

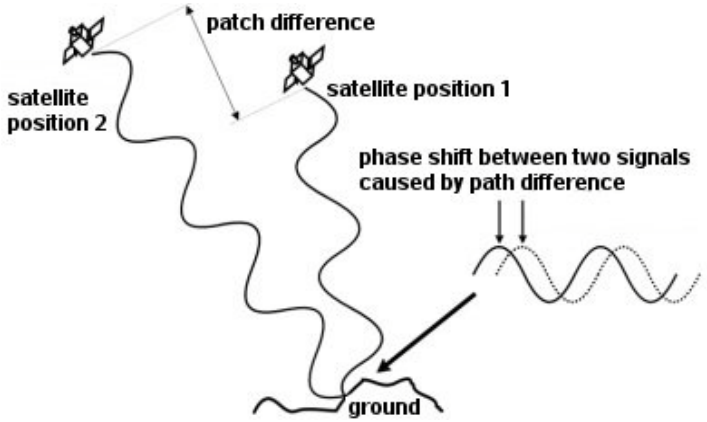




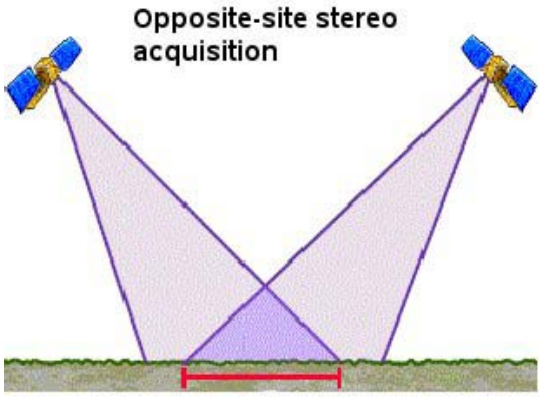
SAR Imaging geometry in range

Methods for SAR processing

- Interferometry (InSAR / IfSAR)



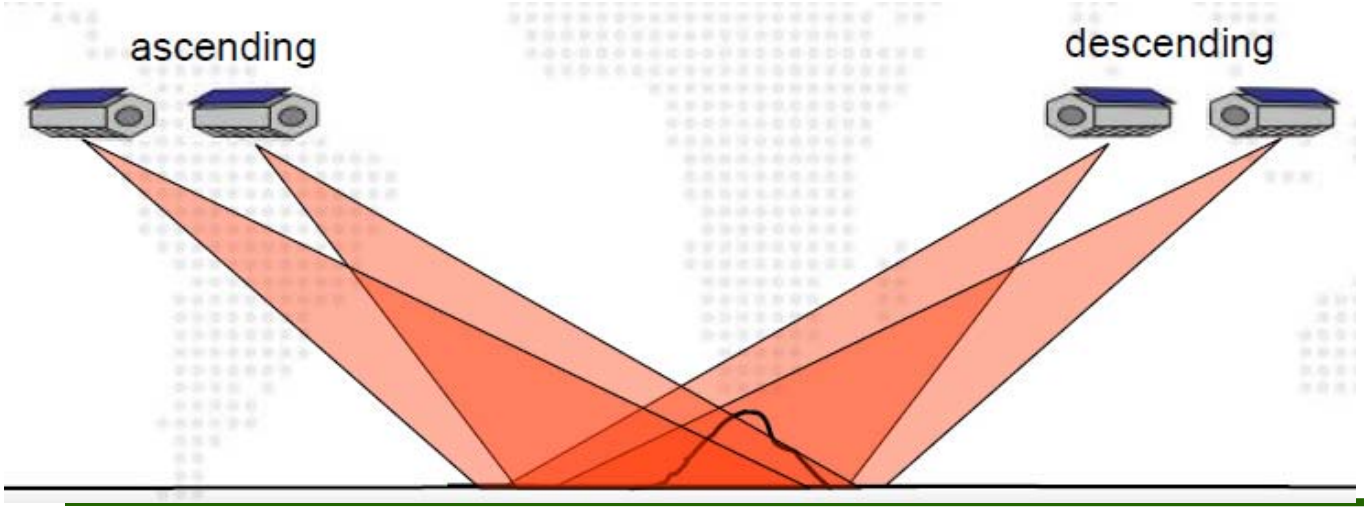
- Radargrammetry

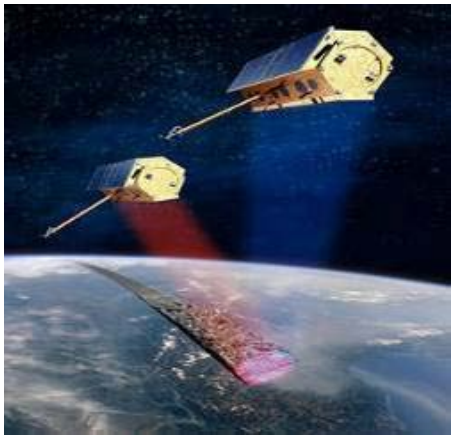


- Polarimetry

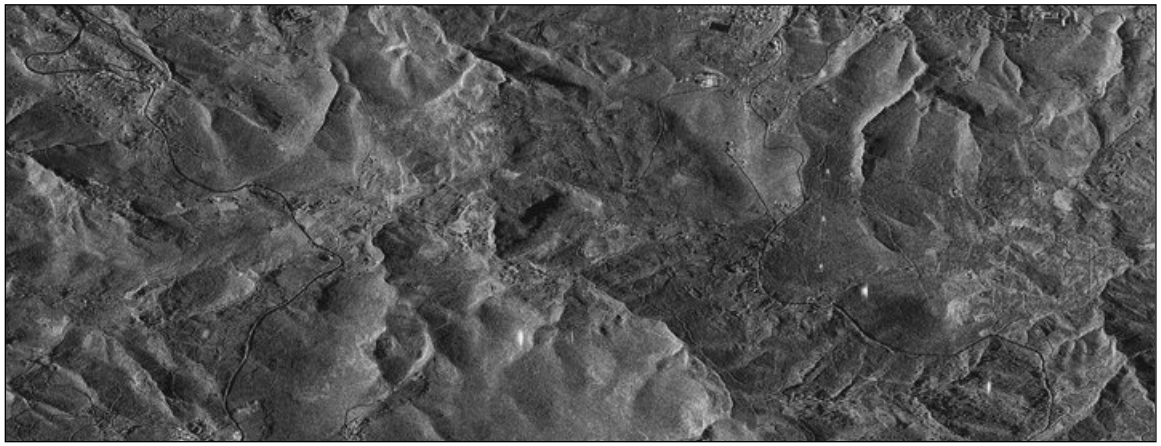
DSM extraction from SAR images

- SAR clinometry (shape from shading) — single image method
- Multi-polarimetric SAR — single (multi-polarimetric) image
- SAR interferometry (InSAR) — two SAR images
- Stereo-radargrammetry — two or four SAR images





Combined use of SAR & optical images



SAR image

Fused image
in slant range geometry

Simple techniques

Crowd-sourcing for the collection of both qualitative & quantitative information

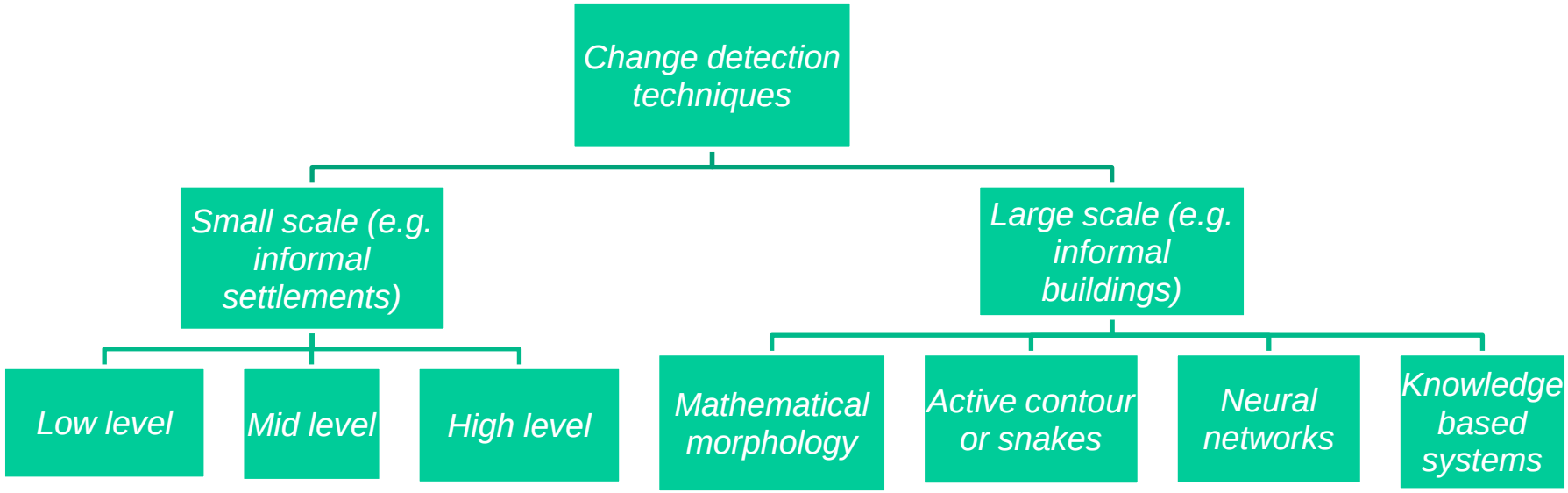
New instruments and tools:

- Maps on the internet
- PDAs, cell-phones
- Web-GIS / Distributed systems

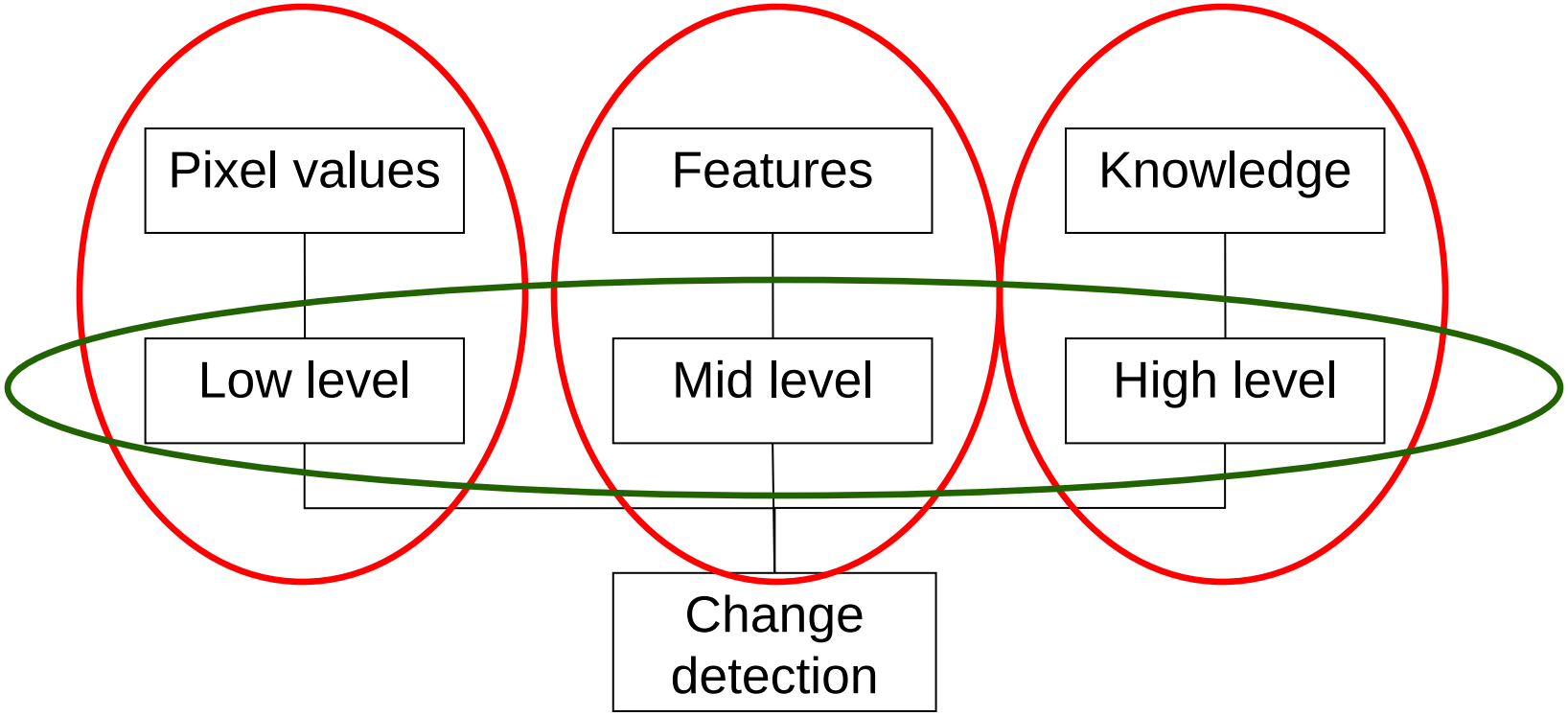
- Development of Positioning systems
  GPS / Glonass / Compass / Galileo
  High accuracy using cheep & user-friendly handheld instruments

Automatic techniques for processing

- Object extraction
- Building detection
- Change detection in urban environment (building scale)



Change detection approaches



Commercial change detection software

- e-Cognition™, Defiens
  - object oriented classification
  - image segmentation
  - a priori knowledge
  - fuzzy logic
- Feature Analyst™, Visual Learning Systems Inc.
  - machine learning
  - training, correction, iteration

Custom made

- case dependent
- accurate

Problem: i.e. the management of the informal settlements (Greece)

The main causes for the creation of informal development during the last decades are:

- Lack of spatial planning policy
- Lack of cadastre
- Bureaucracy – corruption
- Difficulty to locate quickly the under construction informal buildings in a cost-effective way

Areas with informal constructions

Identification of the Problem

It is a complicated situation that needs to be solved for a number of reasons: social impact, environmental impact, and administrative and economic impact

Need for special legislation and land-use regulations

Lack of reliable statistical data means inability to estimate the size of the problem and the size of its impacts. However, that way we may adopt the wrong policies. Result: bad for the prosperity of the people and bad for the national economy

We need to make the 'best use' in terms of time and cost saving of the available sources for spatial data collection

Contribution of modern techniques and tools for the design of an automated and objective procedure for the detection of informal constructions

Spatial data collection and creation of the needed spatial data infrastructure

Use of existing information

- Cadastral maps
- Orthophotomaps
- National-wide DSM / DTM
- Urban plans
- Forest maps / Coastal maps
- GIS applications
- ...

Complementary use of other means

- Low cost techniques
- Contemporary data sources and tools (satellite images & LIDAR)

Best use of the available information in support of good Land Policy

- Reliable estimation of the size of the problem (total number of informal buildings, and estimation of the impacts)
- Tools to support and speed up the declaration procedure
- Detection of the non-declared informal buildings
- Management of the collected information through the declarations
- Support the regeneration projects and infrastructure improvements in the areas
- Monitoring / inspection of new informal constructions

Conclusions

- Today surveyors need to be aware of what data they can get from the various sources and how useful and reliable these data are in order to deal with specific problems
  to understand the quality of the information (need for metadata)
- Working Group 3.2 members are encouraged to coordinate their work and provide their experience on dealing with specific problems efficiently, i.e.
  - Cadastre and land administration,
  - Risk management,
  - Land management reforms, etc

  by using the 'best' combination of data and tools within a prescribed time and cost framework