Remote Sensing for Cultural Heritage: from site detection and documentation, to risk monitoring and mitigation Workshop
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Sensing patterns:

unveiling archaeological landscapes through Pattern Recognition in Remote Sensing

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Backdrop

Threats:

- Contemporary socio-economic pressure (including over-exploitation and/or urbanisation of rural areas)
- environmental processes (including climate change, coastal erosion etc)

Loss of cultural landscapes all over the world.

Need of improved methodologies to study the processes that have shaped the landscapes:

- to understand and record historical components of landscapes before these are irremediably lost or damaged
- to develop resilience
- to define risk mitigation strategies.

Challenge

Systematically and rapidly identifying landscape features determined by anthropogenic processes and land engineering ❯ **Remote sensing**

- application to archaeological and cultural landscapes of automated and semi-automated procedures for feature extraction [enabling for large swathe of landscapes to be simultaneously investigated] is still in its infancy
- limited development often determined by an uneasiness in surrendering the interpretation process to machine-based judgment.

Approach

Adoption of classification methods to identify potential land division elements based on the automatic learning of patterns and regularities in aerial and satellite datasets.

Pattern matching

machine learning of patterns ❯ use of learned patterns for classification

Advantages:

- overcome the limitations of previous methods based on simple automated pattern recognition
- enable recognising landscape patterns produced by a variety of diverse natural or artificial elements.

Engineered landscapes

- Land surveying and division: first forms of landscape engineering performed by pre-industrial societies.
- Centuriation [the Roman system of land subdivision into large square plots assigned to settlers]:
  - most complex example of landscape engineering in antiquity
  - continues to have a significant influence on present-day agrarian organisation in many locations across Europe.

Case study area:

landscape surrounding the UNESCO Heritage site of Aquileia (Italy).

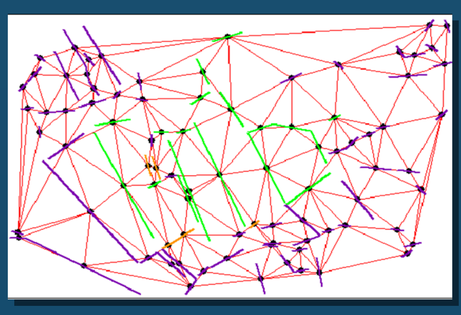
Representing landscapes

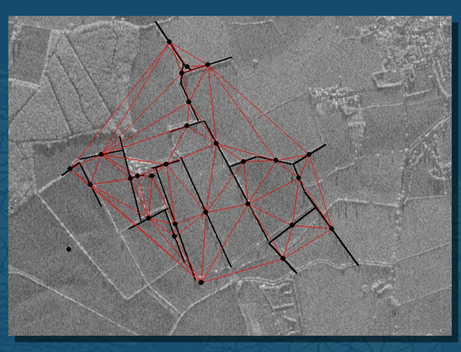
Relational representations needed when:

- 'object' to be recognised is naturally defined in terms of multiple atomic observable entities
- no single observable entity or pre-fixed group is capable of fully characterising the object
- number of observable entities is not fixed
- identity of the entity is not deducible by the observation alone.

Graph-based representations:

- Capture relational arrangements and contextual information needed to disambiguate part-identification
- Allow a coherent representation for the invariants of the object representation (rotation, change in viewpoint etc).





The use of structural representations force to cast the detection/ recognition problem into one estimating structural similarity (graph matching/ structural kernels).

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