

# Learning from Semantic Interactions

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# Learning from Semantic Interactions

Relationships help automate the mapping between image data and geo-spatial information

## BACKGROUND & MOTIVATION



**Geospatial Data**

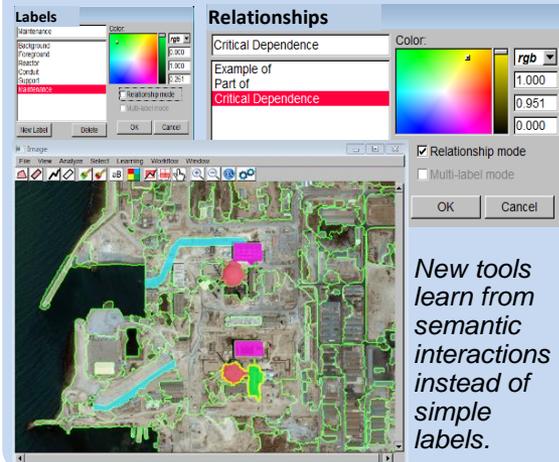
**GIS**

Machine learning tools help turn raw data into maps and other GIS information products but high numbers of false alarms reduce tool effectiveness and analysts patience.

**Most machine learning tools used in geospatial mapping can only learn from labels.**

## INNOVATION

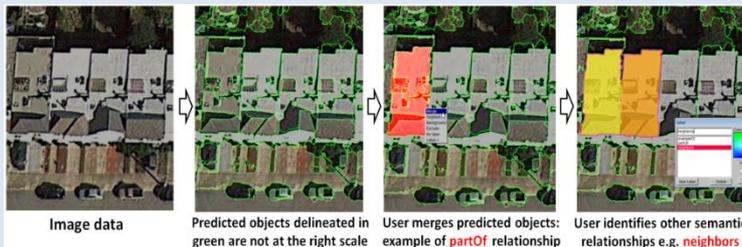
**Learning from examples of Relationships enables tools to capture more information from analysts and produce more accurate data products.**



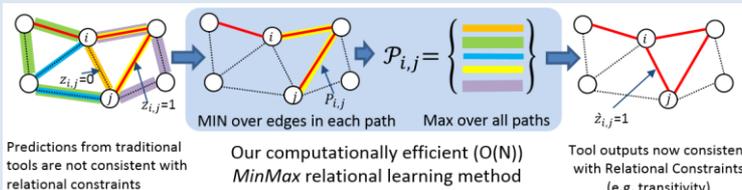
*New tools learn from semantic interactions instead of simple labels.*

## DESCRIPTION

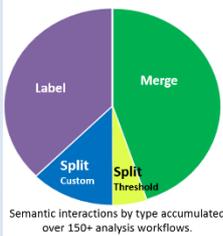
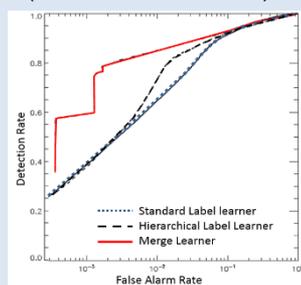
**Our machine learning advances enable tools to learn from examples of geospatial semantics.**



Semantic interactions include visual merging, splitting and labeling and are encoded as nodes and edges within a graph.



With very little training, analysts quickly learn to use merge and split interactions (in addition to labels) to complete image quantification tasks (right). Our relational learning methods exploit the richer Interaction to produce tools that have higher accuracy compared to tools that just use labels, or tools that use merges heuristically (left).

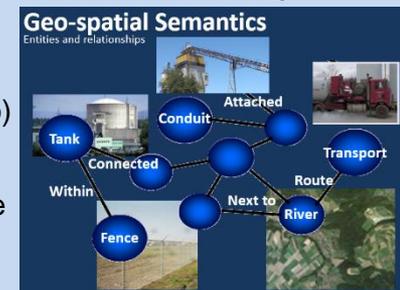


### Current Technology Readiness Level (TRL) 3

- We have used our framework to develop research prototypes in image analysis and data fusion.

## ANTICIPATED IMPACT

LANL's new machine learning tools can learn from semantic user interactions to produce more accurate mappings between geospatial imagery (and video) and semantic knowledge bases (at less cost).



## PATH FORWARD

### Current Phase – LDRD:

- Develop theory and algorithms for tools and demonstrate impact in image analysis applications in materials microscopy.

### Phase 2 – Geospatial Applications:

- Identify collaborators, data and problems in the geospatial domain to advance and generalize our approach.
- Demonstrate and validate our prototype tools in the geospatial domain using large scale problems.

### Phase 3 – Multi-Sensor Semantics:

- Identify use-cases for semantic interactions in multi-sensor / multi-model applications.

**Potential End Users:** Analysts who spend too much time annotating and analyzing unstructured data such as image and video.

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