

Fusion of geological, geophysical and mine planning data

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Overview

- **Automatic integration of multi-channel geophysical data with geological and mine planning data**
- **Examples from past data fusion work**
- **Future work**



The Input Space

Probabilistic fusion

- Avoid feature extraction from raw sensor data
- Generate fused data representation
- Implicitly combine:
 - Spatial measures
 - Scalar and vector fields
- Data fusion results in probabilistic model
- Rich models of the world



Challenge: Learn (compress) application-specific characteristics



Application Overview

- **Information Gathering**
 - Can the sensors measure the quantities of interest?
- **Representation**
 - Can you model incompleteness or uncertainty?
 - Does the representation have desirable computational characteristics?
 - Is it compact?
- **Reasoning**
 - How does the representation facilitate reasoning?
 - Can one be confident that the *correct* decision will be made?

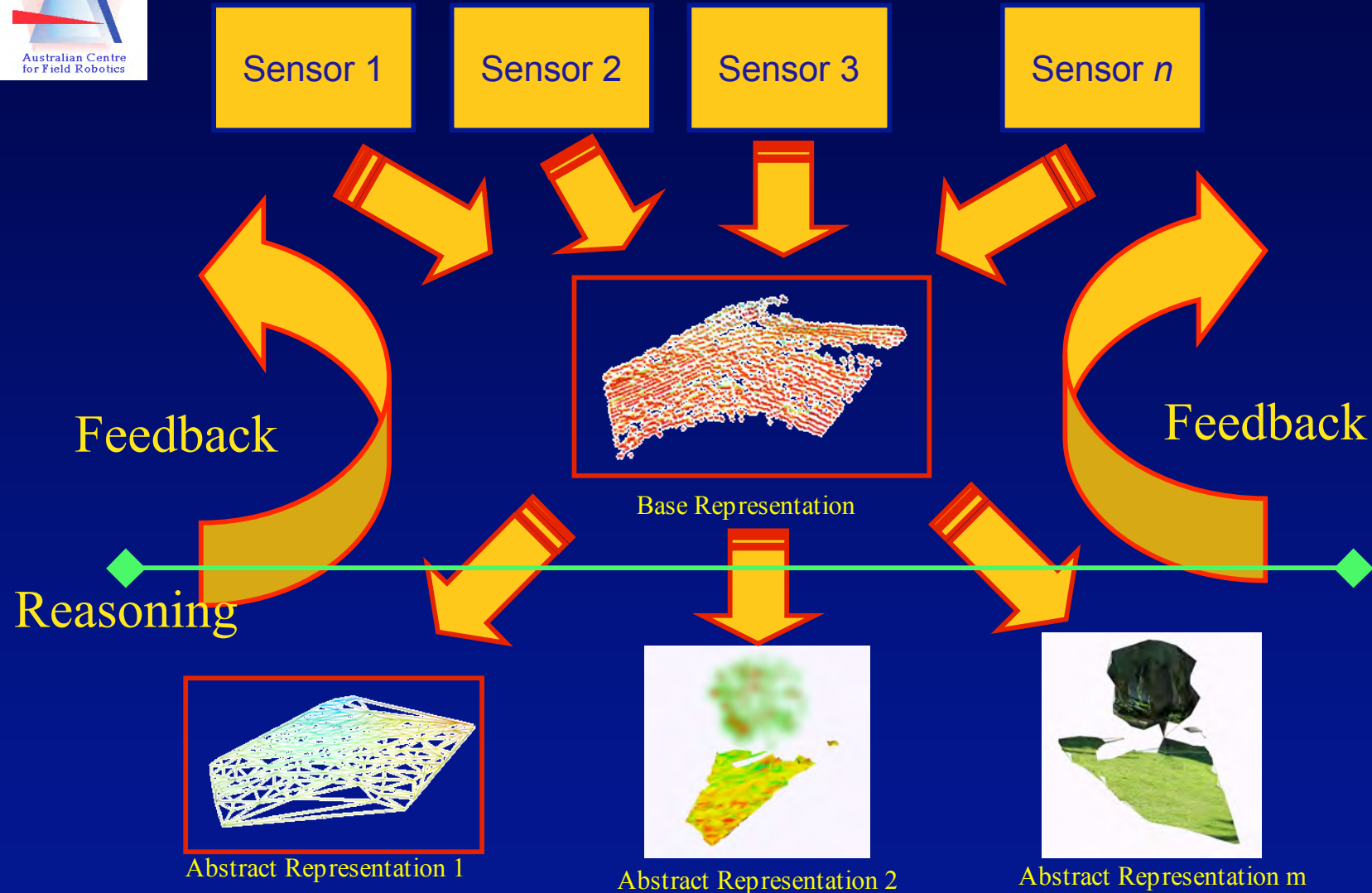


Data Representation

- **Can features in the subsurface reliably be classified into primitives (dykes, sills etc)?**
- **What are the memory requirements?**
- **What are the computational requirements?**



Representational Hierarchy





Application 1: Mining

- **Terrain imaging for heavy equipment**
 - Application oriented research
 - Real-time terrain imaging in all weather
 - Used for operator aiding and/or equipment automation



Terrain Building Demo

 The screenshot shows a software window titled 'CMTE shovel visualisation'. The main view is a 3D perspective of a terrain model with a yellow shovel. A 'Colours' dialog box is open, allowing users to customize the appearance of various elements:

- Background:** PaleTurquoise1
- Grid:** AntiqueWhite2
- Plane:** grey95
- Point:** yellow
- Text:** User defined...
- Shovel Body:** Shovel Body
- Shovel Tracks:** grey50
- Shovel Dipper:** Shovel Dipper

 On the right side of the interface, there are controls for 'START', 'STOP', a 'Slow' to 'Fast' speed slider, 'view' options (free, Isometric, top), and 'projection' options (perspective, orthogonal). At the bottom left, status information is displayed: 'Position (North): -3.22', 'Position (East): -9.17', and 'Time (GMT Thursday): 00:00:22.39'. A 'Make movie' checkbox and a 'QUIT' button are also present.

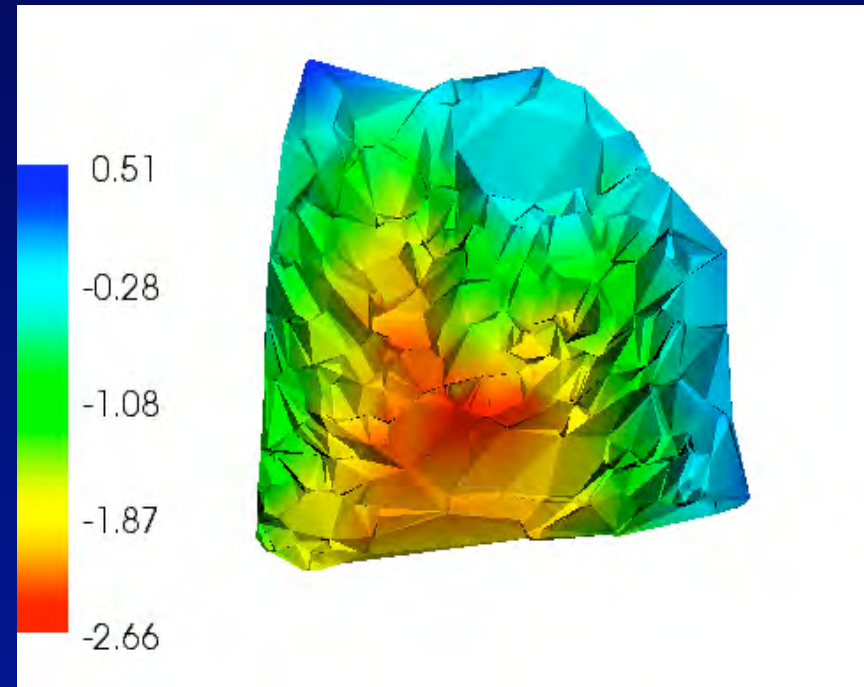
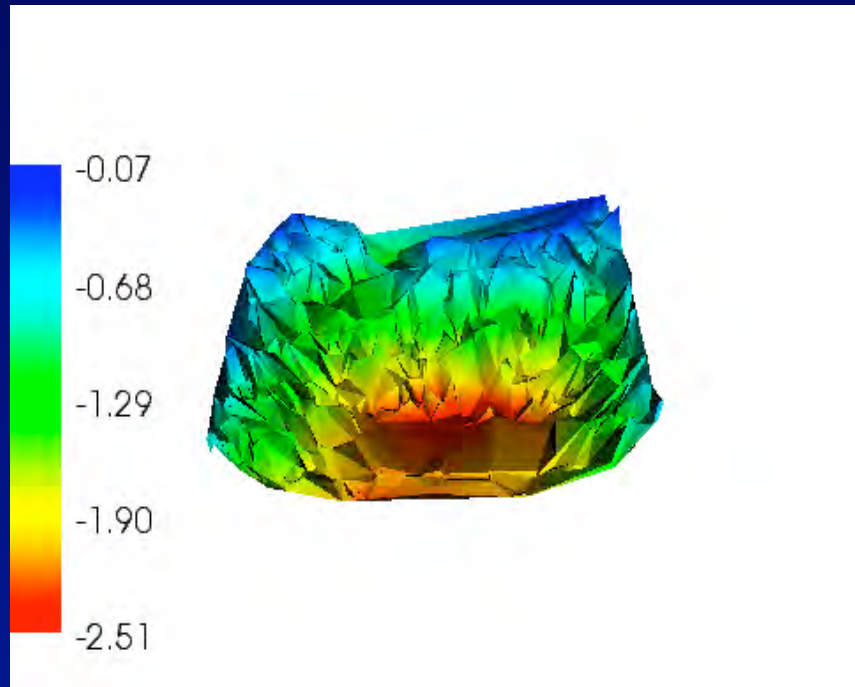


Dragline Experiment



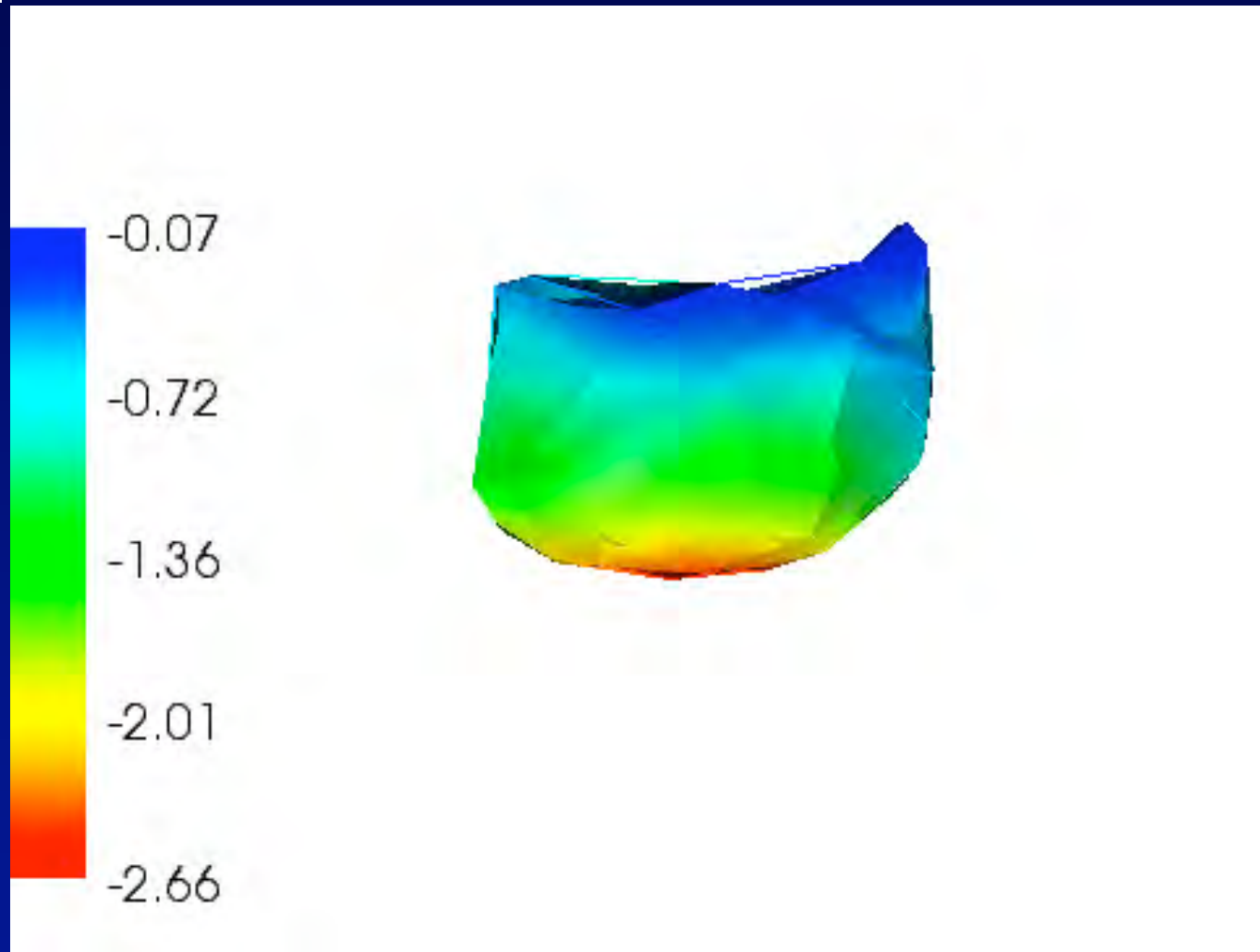


Example



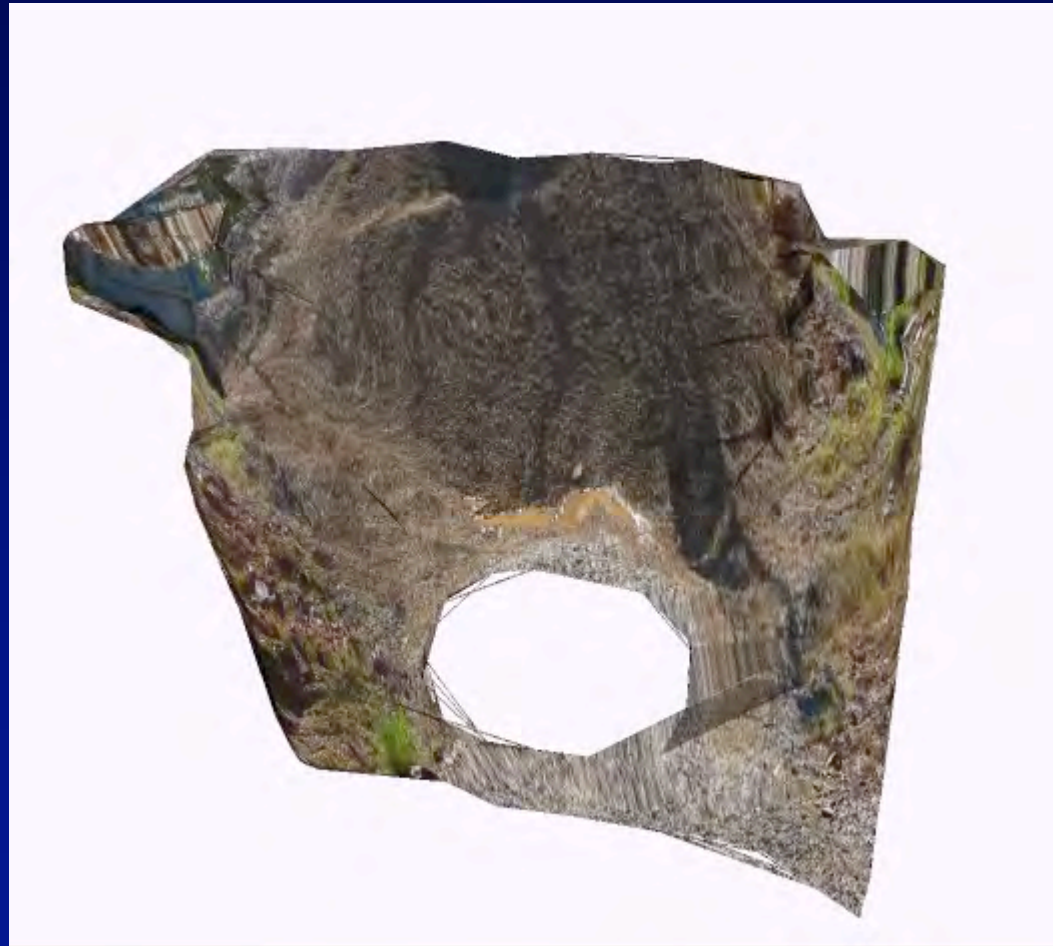


Example





Multi-sensor Data Fusion



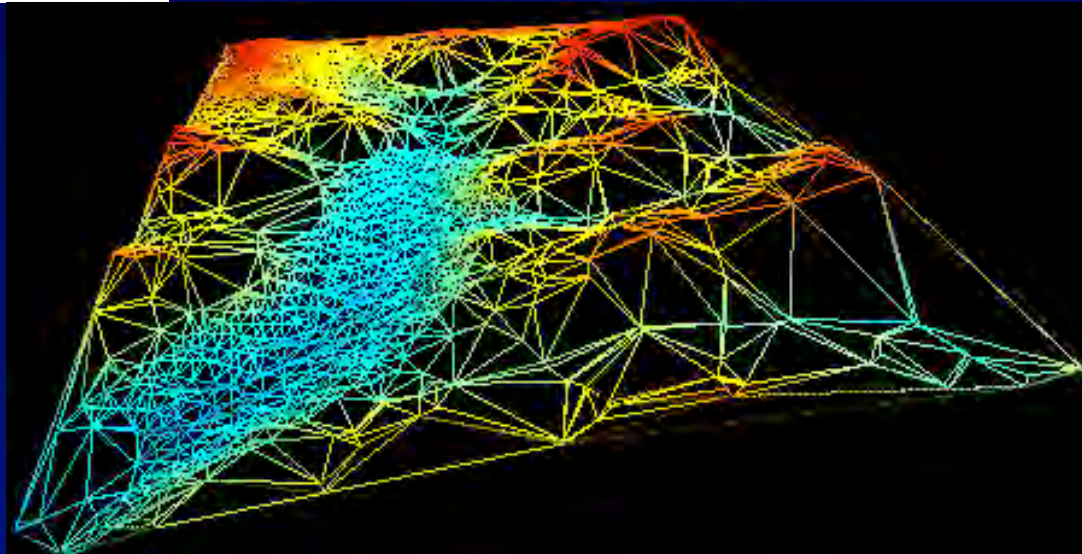


Environmental data fusion

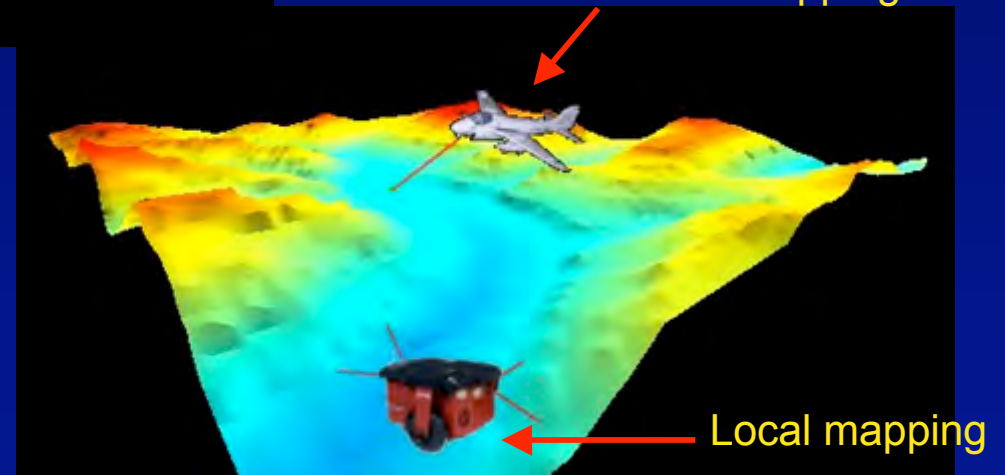
- **Terrain imaging utilising all available information**
 - Many platforms simultaneously gathering data
 - Application dependant visualisation strategy



Example



Global mapping



Local mapping



Movie Clip





Future Work

- **Probabilistic representation of high dimensional airborne radiometric data**
- **Data fusion of airborne radiometric with borehole radar and surface geophysical data in a coal mining application**