



Automatic Image Analysis for Gold Exploration

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Acknowledgements

Fugro for the permission to use their data

Warrick Brown for the known deposit locations within the Eastern Goldfields area of WA

Chong Hua Fam for his work on linear feature detection

Prospectivity Analysis

- **MODEL**

- Archaean lode gold mineralisation is known to occur **IN** regions of structural complexity **ADJACENT** to the large-scale shear zones which acted as conduits for mineralising fluids.

- **AIM**

- Seek prospective regions for gold from aeromagnetic data

- **APPROACH**

- Automatically identify significant geological characteristics from aeromagnetic data using image processing

System Overview

Regions of Magnetic Discontinuity Detection

Texture Analysis



Symmetry Detection

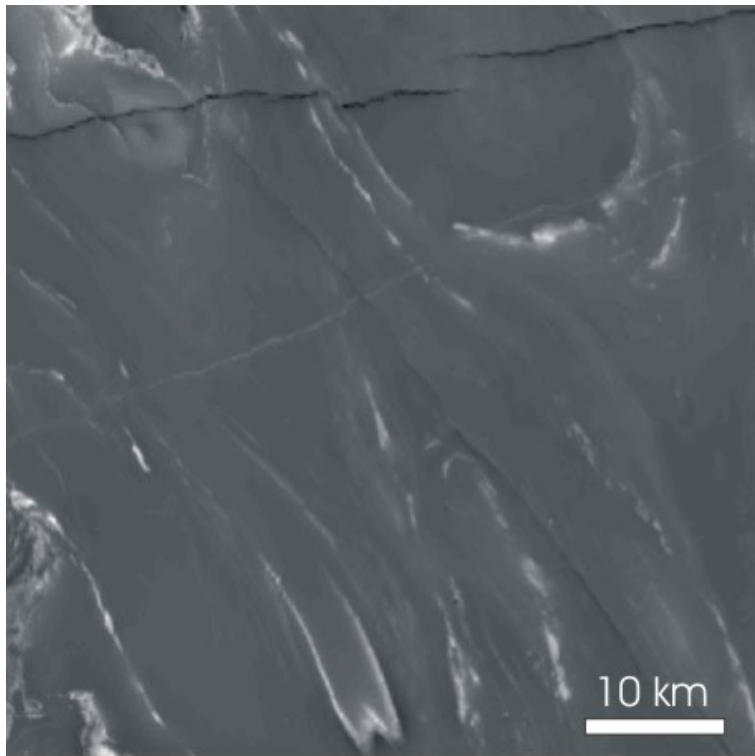


Examination of Nearby Areas for Structural Complexity

Fractal Analysis

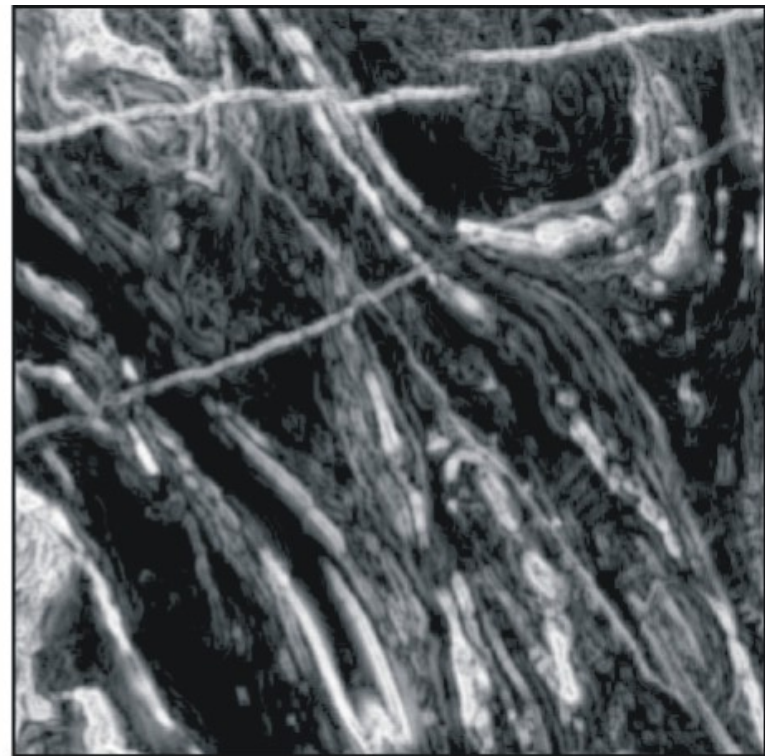
Texture Analysis

- This process characterises local magnetic texture using an entropy measure
 - Representing the randomness of magnetic intensities within the neighbourhood



(a)

RTP Image of Yilgarn Craton in Western Australia



(b)

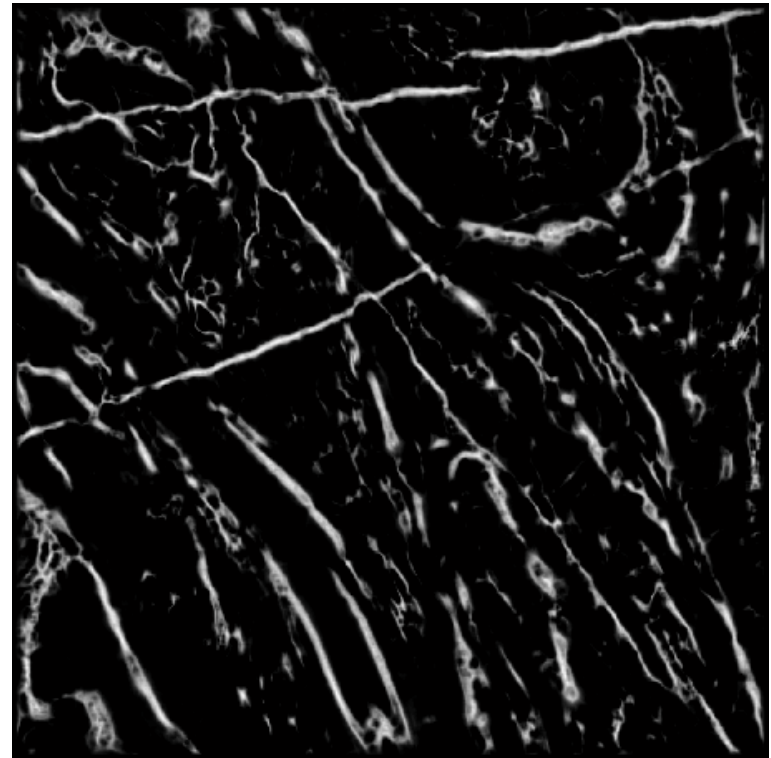
Texture analysis Output of the RTP image

Bilateral Symmetry Detection

- From the texture analysis output, line-like features are detected using a scale- and rotation-invariant symmetric feature detection technique
- Symmetric features contain periodicity within profiles that are sampled along varying orientations
- The symmetry point in the spatial domain corresponds to the point where the local frequency components are at either a minimum or at a maximum in their cycles within the frequency domain.

Bilateral Symmetry Detection

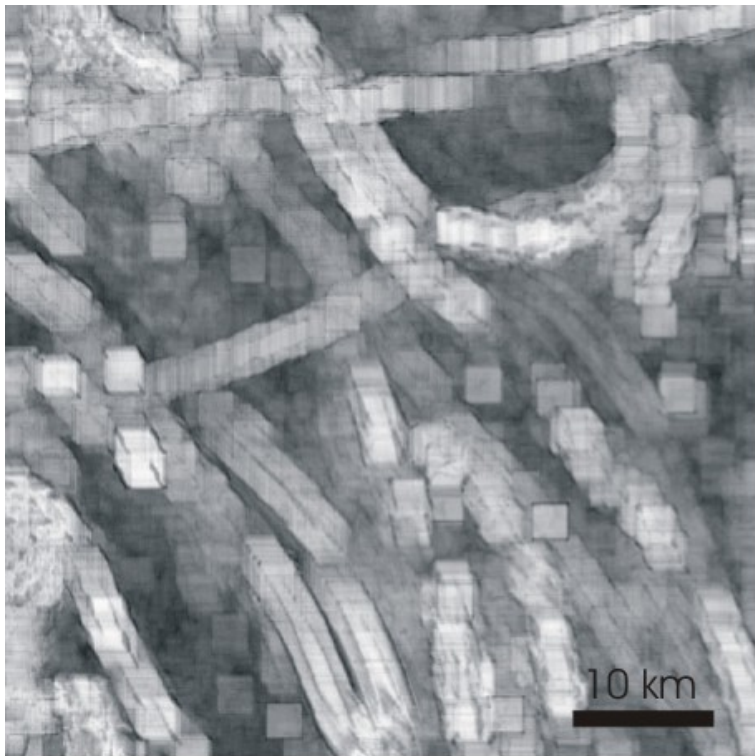
- The symmetry detection process identifies the regions of magnetic discontinuity
 - Lithological boundaries
 - Faults
 - Dykes



Symmetry Detection Output

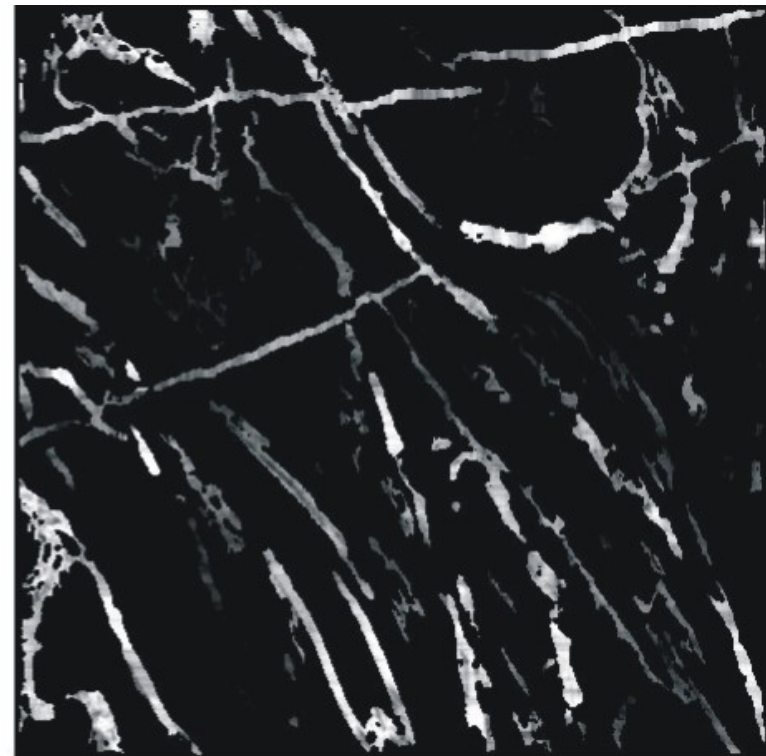
Prospective Regions

- Fractal analysis on areas adjacent to the regions of magnetic discontinuity to determine prospectivity



(a)

Fractal Analysis on local neighbourhood

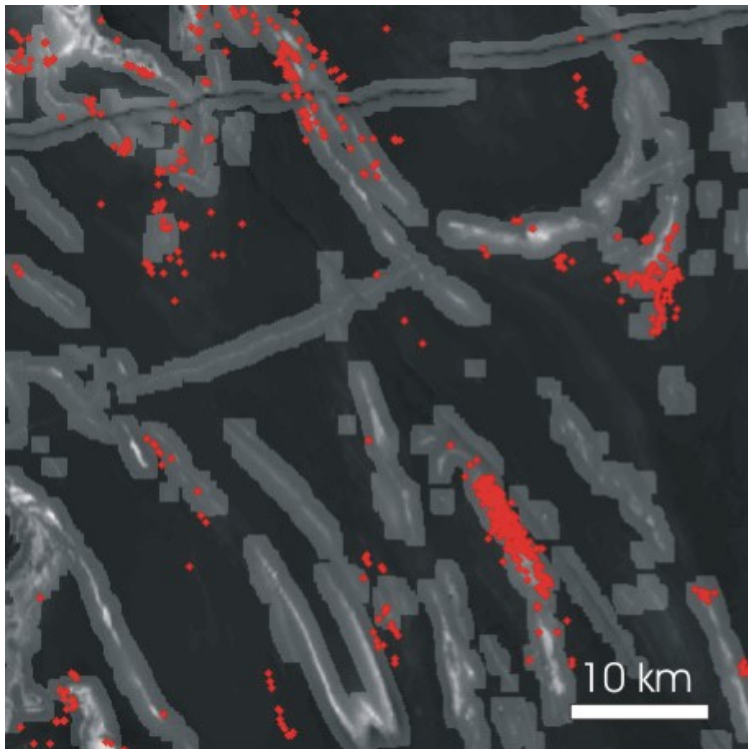


(b)

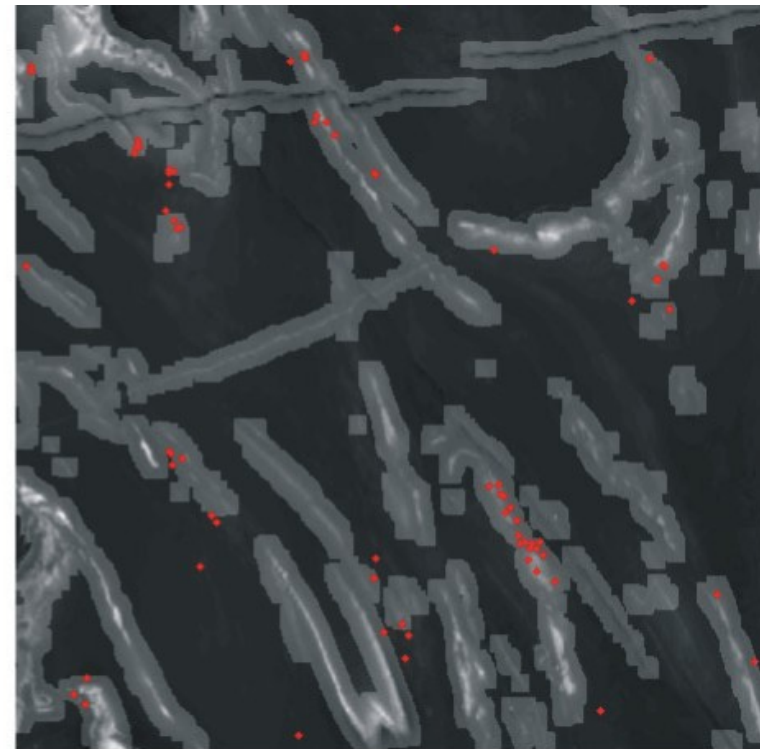
Regions of magnetic discontinuity highlighted according to the fractal analysis result

Experimental Result

- The detected prospective areas are compared with the known deposit locations



(a)

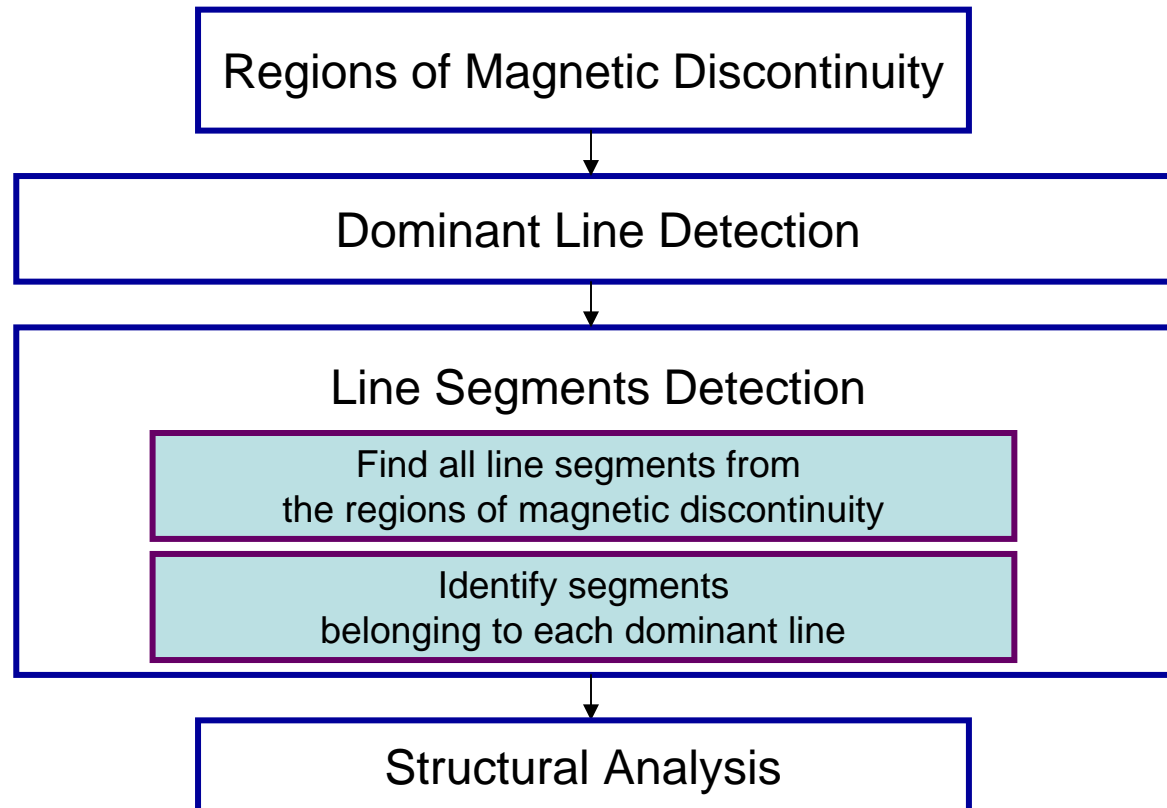


(b)

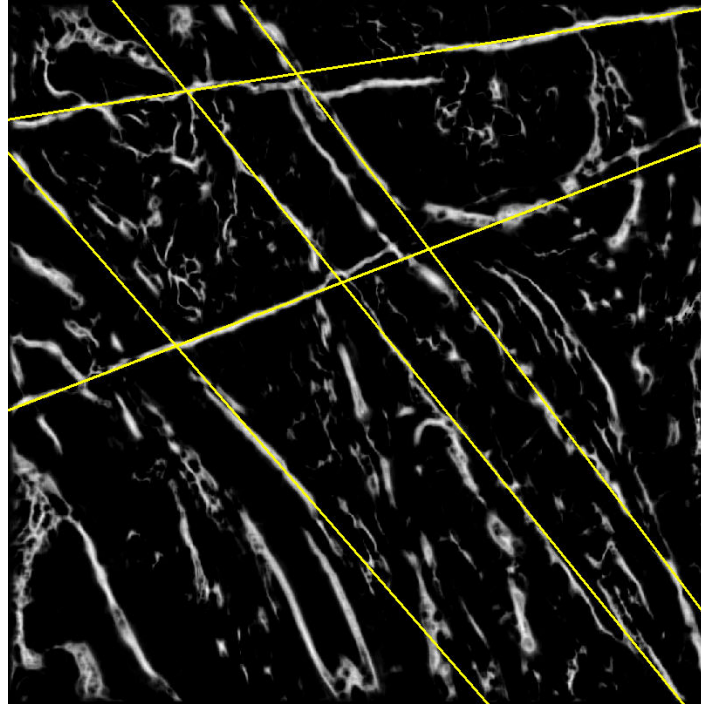
Known deposits overlaid on the regions of interest. In (a), all known gold deposits are marked in red, and in (b), only large deposits that contained greater than 1 tonne of gold are marked

On-going Research

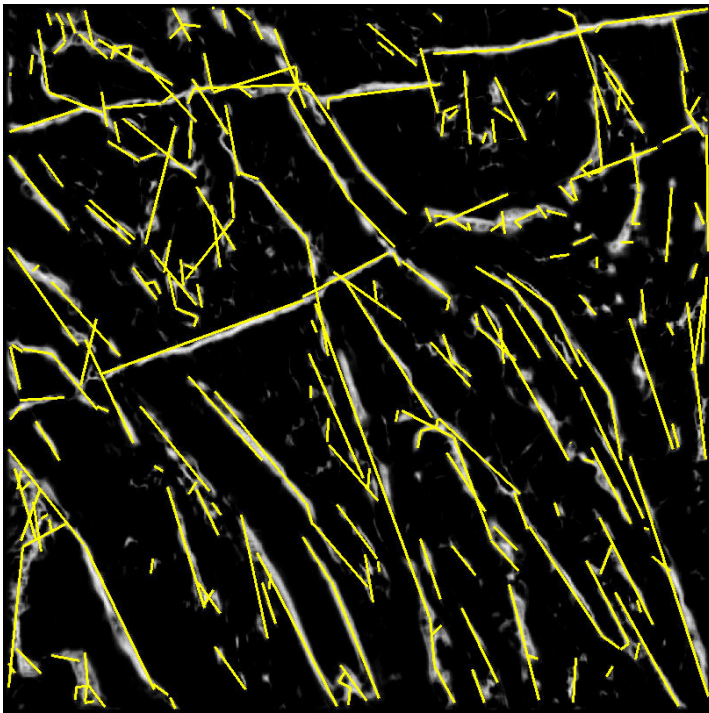
- Detection of shear zones to examine their characteristics important for mineralisation such as breakages, changes of orientation



Dominant
line detection
from the
regions of
magnetic
discontinuity



All Line Segments



Line Segments belonging
to each dominant line

