UNB Image Processing Technologies

1. Moving Target Detection
2. Image Matching
3. Image Segmentation

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1. Moving Target Detection
Parallax \[ p = \text{hae} \cdot \frac{d}{f} \times \frac{1}{\cos \theta} \]

P -> parallax  
Hae -> ellipsoidal height  
D -> focal plane distance  
F -> focal length  
\( \theta \) -> off nadir angle

Moving targets
Moving targets
Table 5: Coordinates, speed, and azimuth angle of moving targets

<table>
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<tr>
<th>No</th>
<th>X(m)</th>
<th>Y(m)</th>
<th>H(m)</th>
<th>Speed(km/h)</th>
<th>Azimuth(degree)</th>
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Speed and direction of moving target:
Speed and direction of moving target:
2. Image Matching
Problem with the Existing Solutions

Ambiguity in smooth (low texture) areas, such as forest, grass, water, highway surfaces, building roofs, etc.

QuickBird Image Pair
UNB Image Matching

QuickBird Image Pair
Right image rotates 315
UNB Image Matching
3. Image Segmentation
3.1. Problem in object-oriented classification

- Segmentation in eCognition™

The operator must use his/her experience and a trial-and-error method to find the appropriate segmentation parameters:
  - Scale = ?
  - Shape weight (factor) = ?
  - Smoothness = ?
3.2. Existing object-oriented classification (eCognition)

Step 1:
Segmentation at various scales

Step 2:
Classification of image objects
3.3. UNB Supervised Segmentation

- Perform Preliminary Segmentation

- Parameters used:
  Scale = 25
  Shape weight = 0.1
  Smoothness = 0.1
  weight

(1) Initial Segmentation
3.3. UNB Supervised Segmentation

- Train the system by selecting appropriate sub-objects that comprise the object of interest
- Start iterative process to determine appropriate segmentation parameters
3.3. UNB Supervised Segmentation

- Convergence in 4 iterations
- Solution parameters:
  - Scale = 120
  - Shape weight = 0.410
  - Smoothness = 0.868

(3) Automatically finding optimal segmentation parameters
Re-segmentation Results and Comparison

Trial and error approach  
(State-of-the-art)

UNB approach  
(UNB solution)
Re-segmentation Results and Comparison

Trial and error approach

UNB approach
Re-segmentation Results

(UNB result)
Some examples of international research awards:

• John I. Davidson President’s Award for Practical Paper of ASPRS, 2009, with my PhD student Zhen Xiong

• One of 9 Canadian successful research achievements for the "Technology Transfer Works: 100 Cases from Research to Realization", by the Association of University Technology Managers 2006 (an international association)

• Talbert Abrams Grand Award of ASPRS, 2005, Yun Zhang, C. Vincent Tao, and J. Bryan Mercer
CRC-AGIP

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(Azienda Generale Italiana Petroli) established in 1926.

(CRC-Laboratory in Advanced Geomatics Image Processing)
Questions?