ASSIMIV (Part 1)
Artefact detection using image to map comparison

Namur, 12 February 2008

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ASSIMilation of Image in Vector

Update
Upgrade

For assimilation of VHR images into planimetrically accurate vector DB

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Screening then exploiting discrepancies
3 types of discrepancies...

- **Update & upgrade**
  - Objects

- **Artefacts**
  - Objects

- **Planimetric errors**
  - Edges
First step : boundary artefacts
Consistent vector boundaries?

- Adjust GIS database to pseudo ortho-image
  - Trigonometric model
- Transfer GIS labels to image-objects
  - Zonal majority filter
- Measure planimetric errors along edges
  - Accuracy and precision
- Detect potential artefacts
  - Statistical approach
Trigonometric model

- **Residual x-parallax shift**
  - Proportional to object height
  - Function of the viewing zenith angle
  - In the direction of the viewing azimuth angle
  - Shift = H * tan(VZA)

- **Apparent shift**
  - Vertical sides can be similar to the object top
    - E.g. hedges, but rarely buildings
  - Vertical sides are part of the same object
    → No apparent shift when facing the satellite
Automated edge adjustment and shadow candidate detection
Original vector database
Shade and parallax added
Quickbird image \rightarrow over-segmentation
Edge quality assessment

- Indicators for accuracy and precision
  - Edge based bias and standard deviation
  - Parallax error
    - Rough height estimate (checked with shadows)
- Mislabelled polygons
  - Processed in object conflict detection (part 2)
- Other conflicts
  - Error above RMS and class uncertainty: update needed (GIS-based bias removal)
  - Errors below RMS or class uncertainty: tolerated
Normalised bias: systematic errors

- Difference between invasion and recession
- Normalised by reference interface length
- Affected by
  - Edge definition (Database bias)
  - Image acquisition (Image bias)
Sampling for STD estimation

- Some edges are more reliable than others
  - Ecotones
  - Fuzzy edges
  - Simplified objects
E.g.: forest/crop fields boundaries
Second part: Object conflicts
Are « brother » sub-object similar?

- Per field and per class assessment
  - Depends on the intra field heterogeneity
- Characteristic selection
  - Still to do...
  - Only spectral values used at this point
- Bi-modal iterative trimming
  - Use EM algorithm for bi-modal parameters
  - Likelihood threshold
**Iterative trimming**

Assumes that outliers in the distribution are discrepancies

1. Evaluate distribution parameters
   1. Bi-modal distribution (EM algorithm)
   2. Multinominal Gaussian

2. Log-likelihood test for the best distribution

3. Run until no more outliers

4. Calculate likelihood with final parameters
Application example: forest change
Conclusion and perspectives

- Good complementarity between the 2 parts
- Method detects thematic and planimetric discrepancies, but...

1. Overdetection
   - Need to classify discrepancies (hope to see you in 2009)

2. Not appropriate for linear objects
   - Use other methods (snakes, filters...)

3. Validation is a real issue
   - Change, artefacts, fuzzy boundaries, semantic...
Pansharpening tool for OTB

- Bayesian data fusion
  - Fasbender, Radoux and Bogaert
- Works with any optical image
  - Particularly good with VHR
- Adaptable
  - Tuning between « color » and « details »
    - Optimized for the application
    - Optimized for the study area
Urban and rural examples
Thank you for your attention