Automatic Change Detection Based On Codelength Differences

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SMART AND TO THE POINT

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The Problem

- Detecting changes between two Images.

- The images were taken at different times.

A   B

Assumptions

- The images represent aerial location at two different times.

- The images are registered.

- The changes of interest are due to small objects.

- Shadows and light changes may appear.

- Object's minimum size is known.

Possible Solutions

- Straightforward methods: simple differences.

- Methods of interest: coding lengths comparisons.

Basic Method [Josel'ito et.al, 2004]

- **Natural** threshold detection algorithm:

  - Estimate **P(A)** - The probability distribution of pixel intensities, using histograms for picture A.

  - Estimate **P(A|B)** using conditional histograms.

  - For a given pixel, if **P(A) > P(A|B)**, a change is detected
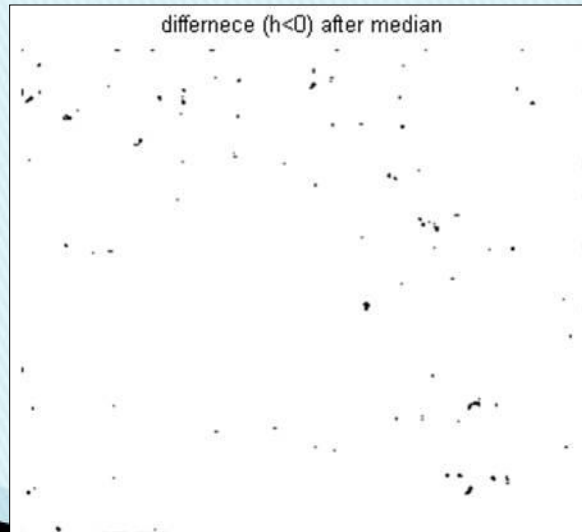
- Post processing with median filter

Basic Method

image$_A$

image$_B$

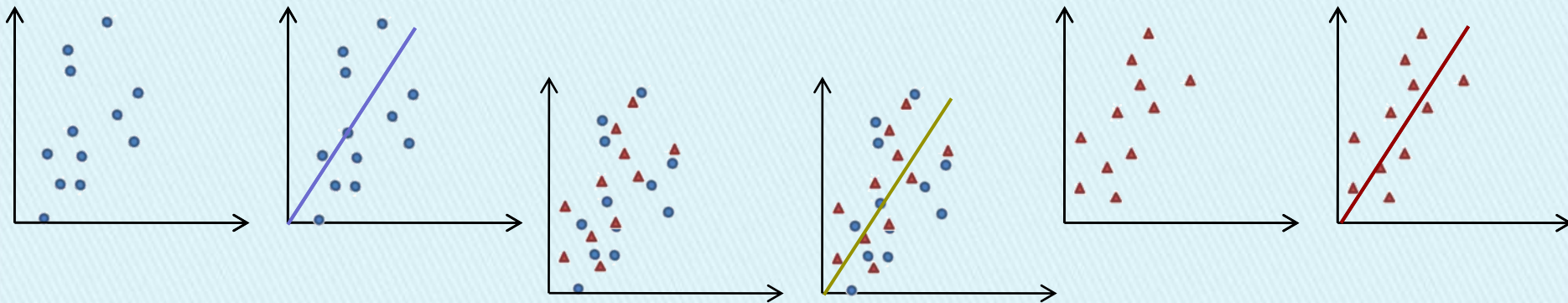differnece (h<0) after median

Codelength

- Represents the information in data.
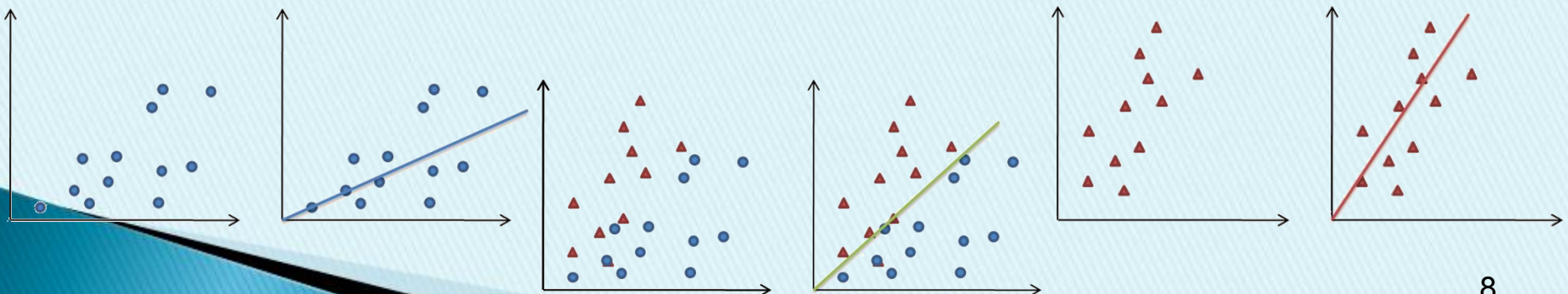
The more information to code

↓

The longer the codelength.

Codelength differences

- Joint coding is preferable for similar datasets


- Separate coding is preferable for different datasets

Proposed Method

- Symmetric detection criterion:

    – Codelength of the first image – **C1**

    – Codelength of the second image – **C2**

    – Joint codelength of both images – **Cd**

    – If **Cd > C1 + C2**, a change is detected

- Improve the estimation using a local model

- Post processing with morphological filter
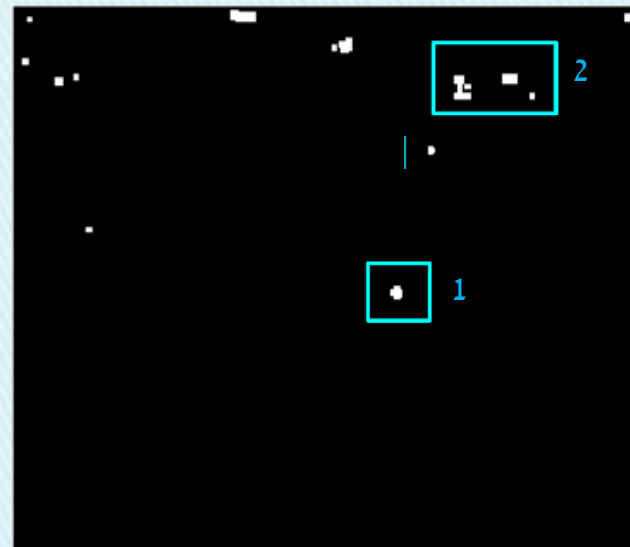
Block Diagram

Example 1

Size: 327X282

Window: 4X4

Filter: 3X3

15
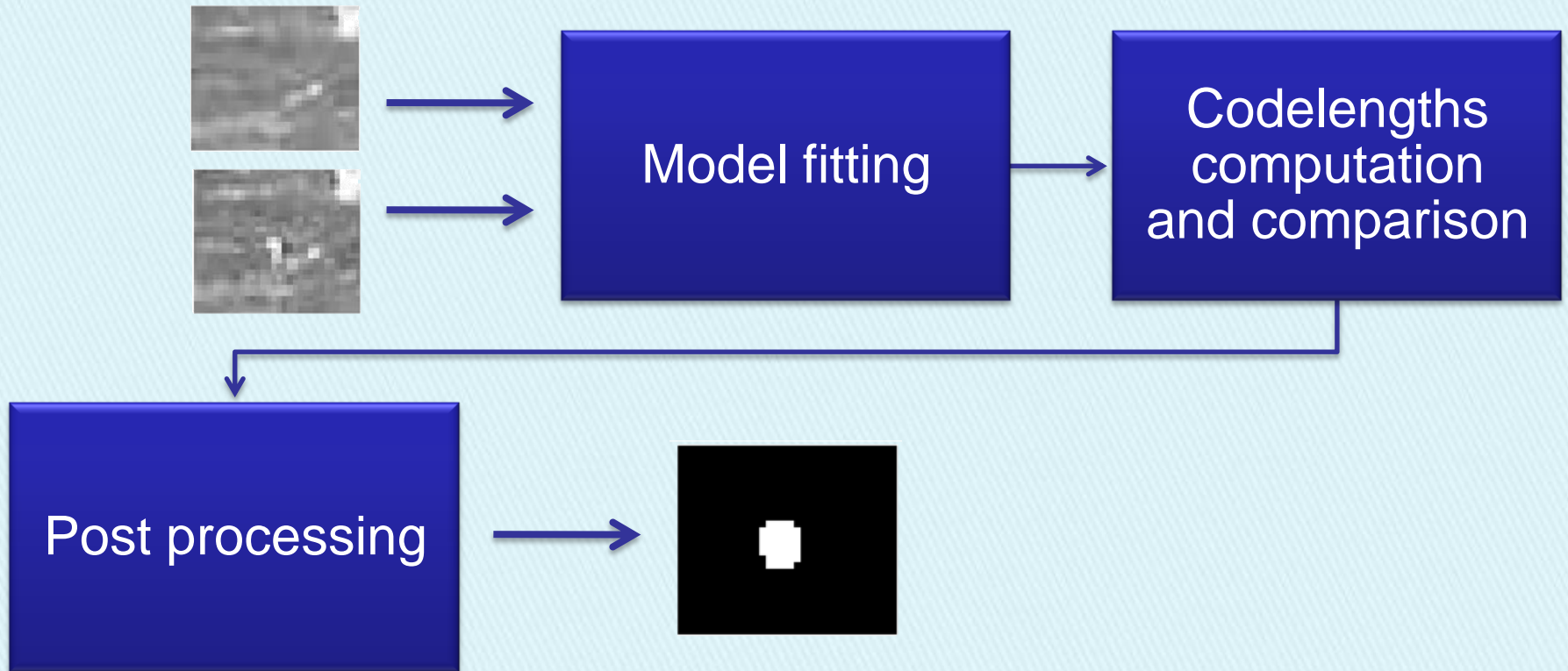
Bigger window run

Image A

Image B

Size: 327X282

Window: 5X5
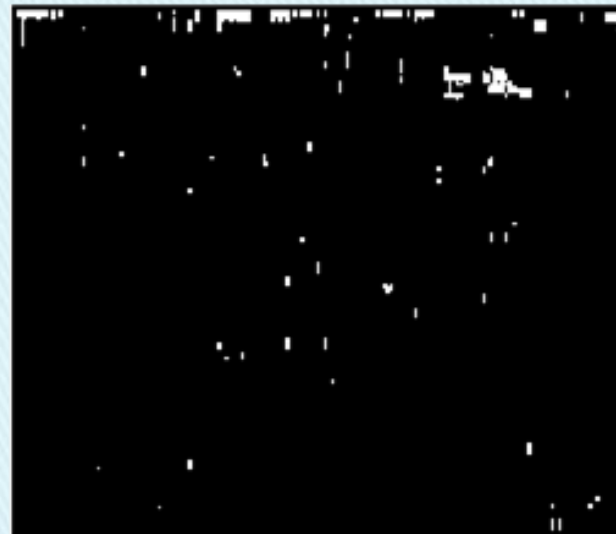
Filter: 5X5

Final Result

Smaller window run

Size: 327X282

Window: 3X3

Filter: 2X2

Image A

Image B

Final Result

Example 2

Size: 1000X1000

Window: 7X7
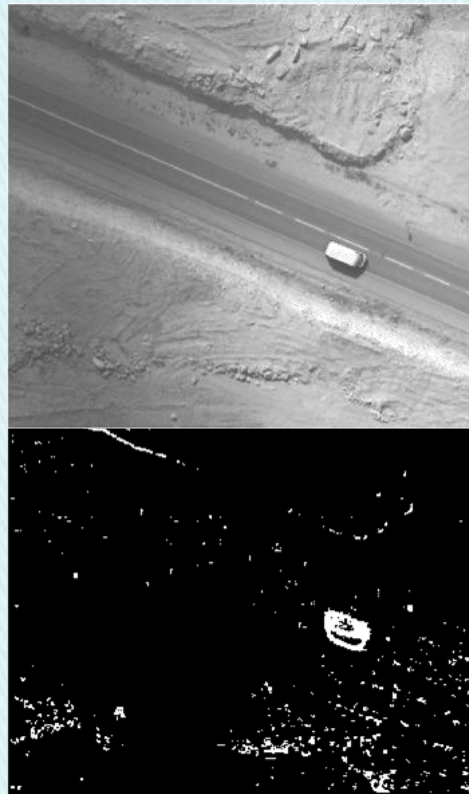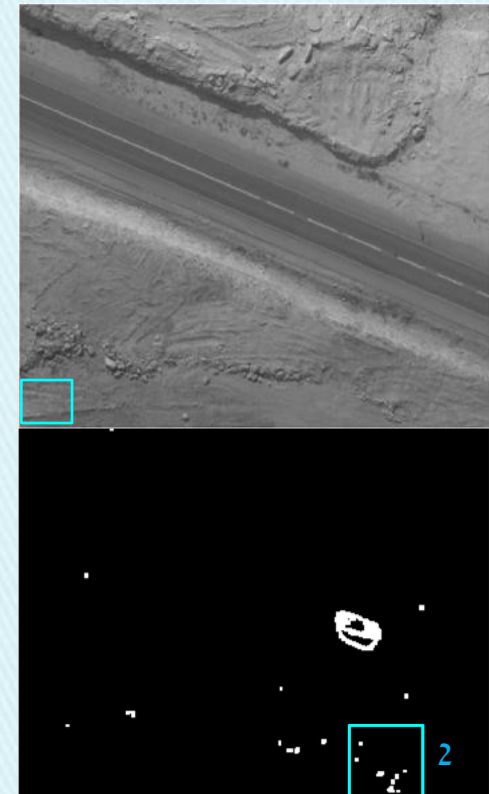
Filter: 7X7

Image A

Image B

Summary

- We designed a novel algorithm for detecting changes between two images.

- We used codelength differences and local models for detection.

- Proposed technique outperforms the state-of-the-art.

Future work

- Make the algorithm indifferent to target size.

- Combine with other change detectors.

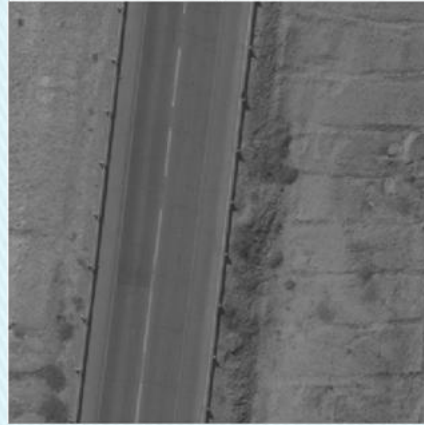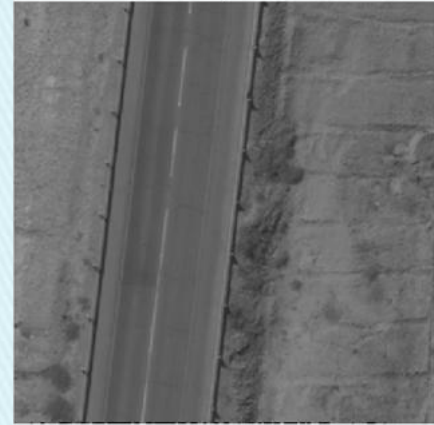- Reject false alarms induced by shadows.

The end

Image A

Image B

Final Result