A Noise-Robust Method for Crack Segmentation

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1 Introduction

Why we need Crack Detection

Crack detection is important for the inspection, diagnosis, and maintenance of concrete structures

Challenge

Images of the concrete surface contain various types of noise



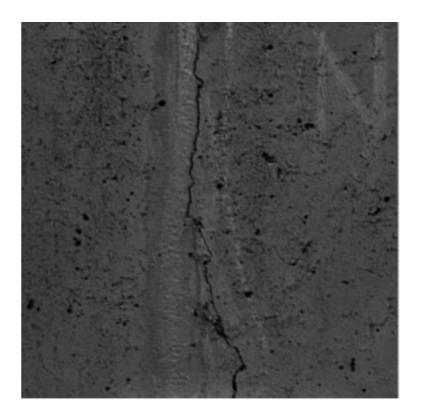


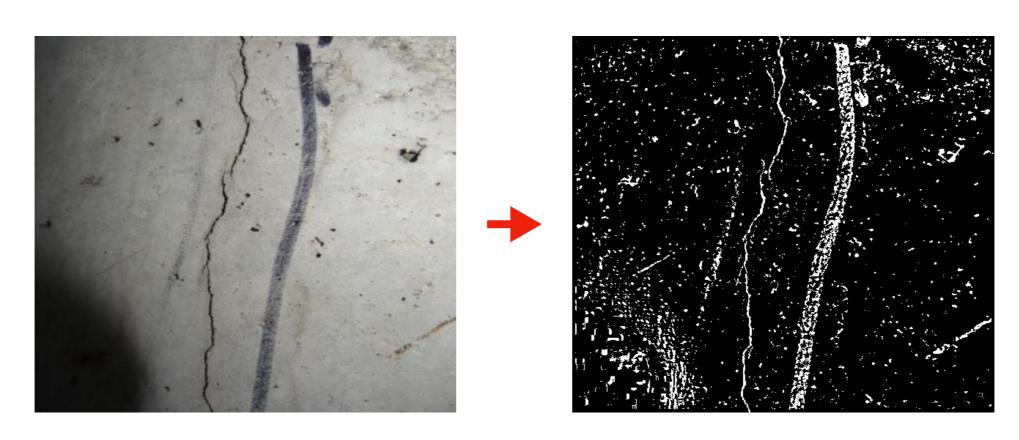
Fig.1 shading, stain and concrete blebs

2 Proposed Method

2.1 Seeds Selection

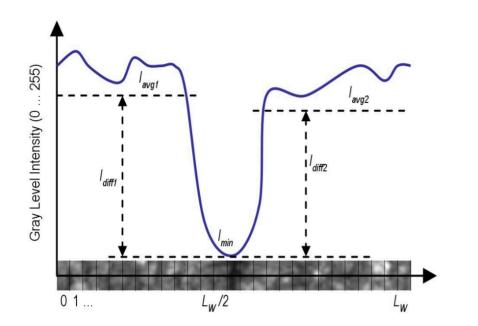
Binarize the image

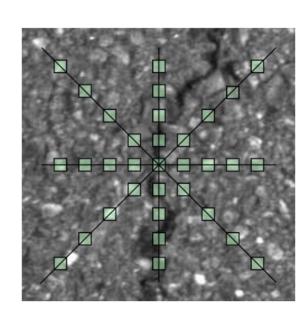
$$I_{avg} = \frac{1}{(2N+1)^2} \sum_{i=-N_{xy}}^{i=N_{xy}} \sum_{j=-N_{xy}}^{j=N_{xy}} I(x+i, y+j)$$
$$K_{ROI} \times I_{avg} - I(x, y) > 0$$



2.1 Seeds Selection

Denoise — Multiple Directional Non-Minimum Suppression





(a) The profile of crack region

(b) The profile of non-crack region

(c) The four linear windows at 0°, 45°, 90° and 135°

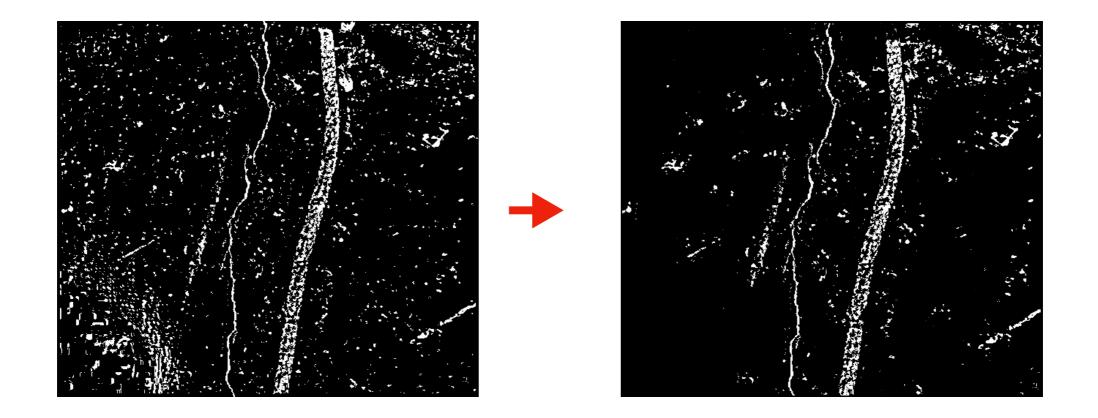
$$I_{avg1} = \frac{1}{L_w} \sum_{i=0}^{L_{min}} I(i); I_{avg2} = \frac{1}{L_w} \sum_{i=L_{min}}^{L_w} I(i)$$

$$I_{diff1} = I_{avg1} - I_{min}; I_{diff2} = I_{avg2} - I_{min}$$

Sun. Changming and Vallotton. Pascal. Fast linear feature detection using multiple directional non-maximum suppression. In International Conference on Pattern Recognition, 2006.

2.1 Seeds Selection

Denoise — Multiple Directional Non-Minimum Suppression



Sun. Changming and Vallotton. Pascal. Fast linear feature detection using multiple directional non-maximum suppression. In International Conference on Pattern Recognition, 2006.

2.2 Seeds Connection No Input a seed p as region R $R_{shape} < T_s$ Initialize T,w,I,L,Ts Increase the window size d The neighborhood pixel is percolated using threshold T and w No I>L Update T and w by using pixels in No the regions R Output region R Delete seed p $d_R > l$

$$T = \max(\max_{p \in D_p} (I(p)), T) + w$$

$$w = R_{shape} \cdot w$$

$$R_{shape} = \frac{4S}{\pi d^2} \in [0, 1]$$

Calculate the region shape R_{shape}

2.2 Seeds Connection

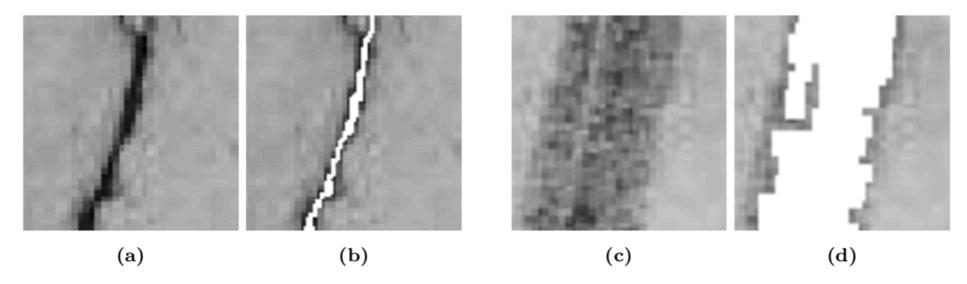
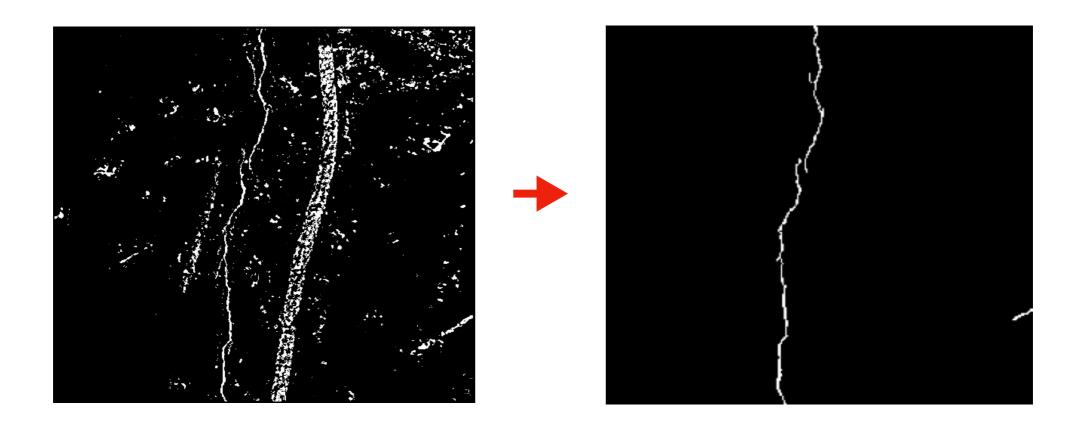
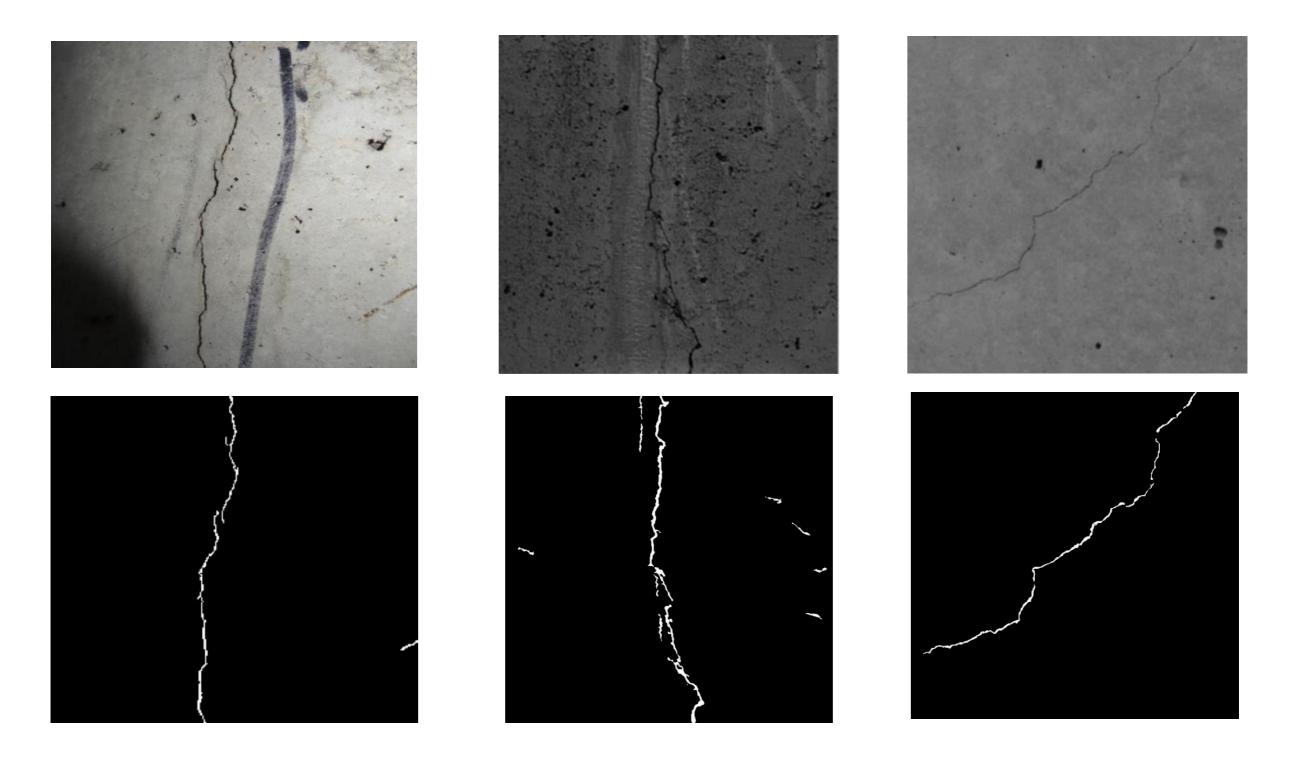


Fig.1 The shape parameter R_{shape} of (b) is 0.04, and R_{shape} of (d) is 0.58,



2.3 Results



Thank you!