Detection of Roof Holes and Wall Crack using Shape-Based Method

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Abstract

Image processing is a method to perform some operations on an image in order to extract some useful information. The shape-based method will extract the curve signature from every image and then find the similarities between the images. In this Paper, the analysis was based on two different ways Such as detection of roof holes and wall crack. The roof holes are detected in three steps : an input image is pre-processed using RGB to gray color conversion and standard noise removal method, Shape Feature is find based on SIFT Algorithm and finally K-means algorithm is used to clustering the roof holes. Similarly the Wall Crack is detected in two steps: Image is pre-processed using color conversion and suitable edge detection methods and Morphology operations are applied to detect the wall crack. Finally, the range of the wall crack is estimated. Majority of crack occur when the components are the material of which the building is made up of it subjected to forces which are greater than those which it can withstand. Crack may also occur if the material used in the building is of poor quality and the construction is not carried out in accordance with some ideas.

Keywords

Roof Holes, SIFT, K-Means, Wall Crack, Edge Detection, Morphology.

I. INTRODUCTION

Image Processing is the up to date rising technique in the world. Digital image processing refers processing of the image in digital form. Modern cameras may directly take the image in digital form but generally images are originated in optical form. Image Enhancement operations improve the qualities of an image like improving the image's contrast and brightness characteristics, reducing its noise content. It does not add any information to it. Visual inspection

has become increasingly important in civil and construction engineering. It is useful for the non-destructive testing and maintenance of architectural structures. Inspecting such structures in the early stages of their degradation is critical to their maintenance. The degradation of concrete commonly used building material is caused by a variety of factors such as earthquakes, frost damage, salt erosion, rain water, and dry shrinkage. Cracks on the concrete surface are one of the earliest indications of degradation [1]. A crack is the separation of an object or material into more, pieces under the action of stress. Depending on the substance which is cracked, the crack decreases the strength of the materials in most cases, e.g. constructing walls, roads, etc [2]. Crack information (e.g., number of cracks and crack width and length) represents the current structural health, which can be used for the proper maintenance to improve the structural safety. The fundamental way to detect concrete cracks, this method is time consuming and costly, dangerous for specialists, and inappropriate environments can cause estimate errors [3]. The two types of damaged building detection approaches: the post-event image or detect the changes between the pre-event and post-event images. The building damage is occurred through the distribution of edges of buildings [4]. In this Paper proposed method is based on Shape Feature. The shape of object plays an essential role among the different aspects of visual information. Therefore, it is a very powerful feature when used in similarity of images and retrieval. The analysis is a method of discovery the shape of irregular objects. This analysis is used to detect roof holes and wall crack.

II. LITERATURE SURVEY

[5] G.P. Bu, S. Chanda, H. Guan, J. Jo, M. Blumenstein2 & Y.C. Loo1 "Crack Detection using a Texture Analysis-based Technique for Visual Bridge Inspection". In this paper proposed an automatic bridge inspection approach employing wavelet based image feature with SVM classifier.

[6] Hyeong-Gyeong Moon and Jung-Hoon Kim "Intelligent crack detecting algorithm on the Concrete Crack image using Neural Network". In this paper is used to identify the crack based on Gaussian filtering and some morphological processing. Finally an image is classified by using Artificial Neural Network algorithm.

[7] Soji Koshy, Radhakrishnan. B " Detection of Crack using different Techniques".In this paper proposed crack detection based on morphological operation,Thresholding and some filtering techniques.
[8] Saranya vijayan1,Dr S.N Geethalakshmi " A Survey on Crack Detection Technique and Deep Learning Algorithm". In this paper proposed Detection of crack using Ostu's method and deep learning algorithm such as Back-Propagation algorithm and Fuzzy Logic Controlled Deep Neural Network.
[9] Prateek Prasanna, Kristin J. Dana, Nenad Gucunski, Basily B. Basily, Hung M. "Automated Crack Detection on Concrete Bridges". In this paper used an automated crack detection algorithm, STRUM classifier. The machine learning classification is done to classify the segment into crack and not crack images.

III. METHODOLOGY

Methodology is the systematic, theoretical analysis of the methods applied to a field of study. The implementation process of roof holes detection methods are shown in Fig.1.The implementation process of wall crack detection methods are shown in Fig. 2.

1) ROOF HOLE DETECTION

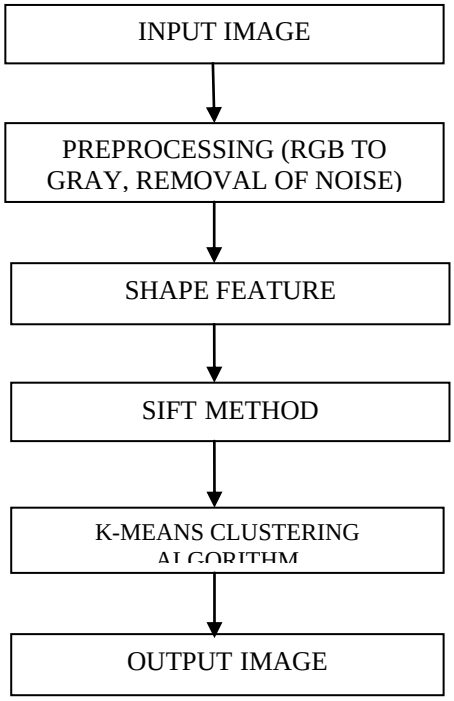


Fig 1: Implementation Process of Roof Hole

A) Preprocessing

The Pre-processing is an improvement of the image data. The main purpose of the RGB color model is for the representation and display of image in computer. RGB is a machine dependent color model different devices identify or reproduce a given RGB value differently. Gray scale digital image is an image which the value of each pixel is a single sample, it carries only intensity information. Gray scale images are also called monochromatic, denoting the presence of only one color. Salt and pepper noise is a form of noise sometimes seen on images. It is also known as impulse noise. The noise can be caused by an unexpected disturbance in the image signal. It presents white and black pixels.

B) Scale invariant feature transform (sift)

The scale-invariant feature transform is an algorithm to identify and give details about local features in images. An image can extracted some important points and provide a "feature description" of the image. The information are extracted from a training image can be used to identify the object in a test image. To perform consistent detection it is important that the features extracted from the training image be detectable even under changes in image scale and noise. Such points frequently lie on high contrast regions of the image such as object edges. Transform an image into large collection of feature vectors, each of which is invariant to image translation, scaling and rotation. SIFT descriptors to local distortion are obtain by the pixels of the key points location and blurring of the images.

C) K-means clustering method

K-means clustering aims to partition n observations into k clusters in which each observation belongs to the cluster with the nearest mean**,** serving as a prototype of the cluster. The objective function can be obtained by assuming that k clusters, where k is known. Each cluster is assumed to have a center; we write the center of the i'th cluster as ci. The j'th element to be clustered is described by a feature vector xj. For example, if we were segmenting scattered points, then x would be the coordinates of the points; if we were segmenting an intensity image, x might be the intensity at a pixel. We now assume that elements are close to the center of their cluster, yielding the objective function.

$$\Phi(\text{clusters, data}) = \sum_{i \in \text{clusters}} \left\{ \sum_{j \in i\text{'th cluster}} (x_j - c_i)^T (x_j - c_i) \right\}$$

Notice that if the allocation of points to clusters is known, it is easy to compute the best center for each cluster. However, there are far too many possible allocations of points to clusters to search this space for a minimum. Instead, we define an algorithm which iterates through two activities:

(i) Assume the cluster centers are known, and allocate each point to the closest cluster center.

(ii) Assume the allocation is known, and choose a new set of cluster centers. Each center is the mean of the points allocated to that cluster.

2) WALL CRACK DETECTION

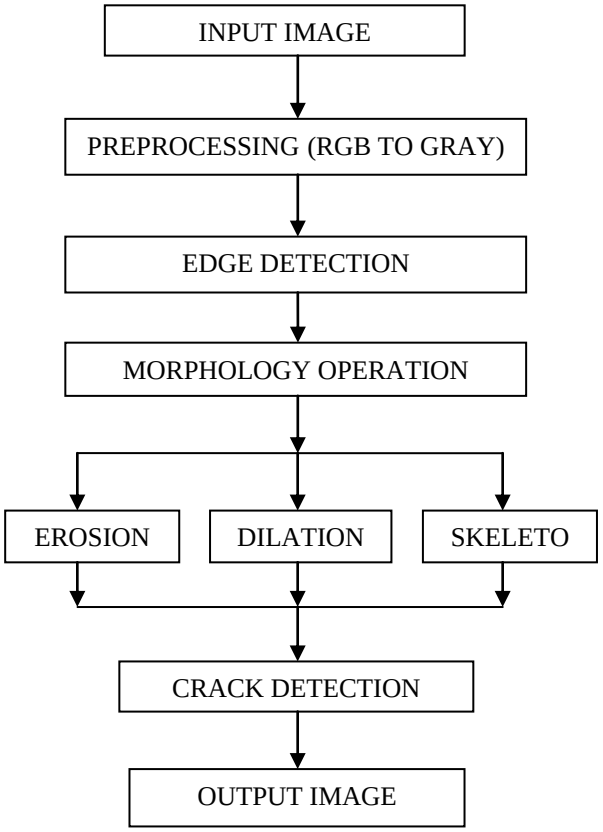


Fig. 2 Implementation Process of Wall Crack

D) Edge Detection

Edge detection is the most common approach for detecting significant discontinuities in intensity values. The Sobel edge detector is also a gradient-based method. It detects edges by searching for maxima and minima in the first derivative of the image. The Sobel edge detector performs a gradient calculation on a gray-scale image; two 3×3 convolution masks are used to calculate gradients, one along the x-direction, and the other along the y-direction. The original image is used to calculate two derivatives: one for horizontal changes and one for vertical.

Gx=

-1	0	1
-2	0	2
-1	0	1

Gy=

-1	-2	-1
0	0	0
1	2	1

$$G=\text{sqrt}(Gx^2+Gy^2)$$

E) Morphology Operation

Morphology is used for extracting some information from the image with the purpose of useful in the representation and description of image shape such as boundaries and skeletons. An image is translated into shape called a Structuring element.

1) Erosion

Erosion "shrinks" or "thins" objects in a binary image. The Shrinking image is controlled by Structuring element. Erosion is performed by toolbox function imerode.

2) Dilation

Dilation "grows" or "thickens" objects in a binary image. The Thickening is controlled by a shape referred to as a Structuring element. Dilation is performed by toolbox function imdilate.

3) Skeletonization

Skeletonization is used to reduce binary image objects to a set of thin strokes that retain important information about the shape of the original objects. Skeletonization is performed by toolbox function bwmorph.

IV. EXPERIMENTAL RESULT

Experimental results showed different types of experiments in roof hole and wall crack detection. Fig. 3 shows Pre-processing of Roof Hole. Fig. 4 shows After Applying Salt and Pepper Noise. Fig. 5 shows After Applying SIFT method. Fig. 6 shows K-means Clustering Algorithm. Fig. 7 shows Detection of Roof Hole. Fig. 8 shows Edge Detection of Wall Crack. Fig. 9 shows Morphology Operation. Fig. 10 shows Detection of Wall Crack Range.

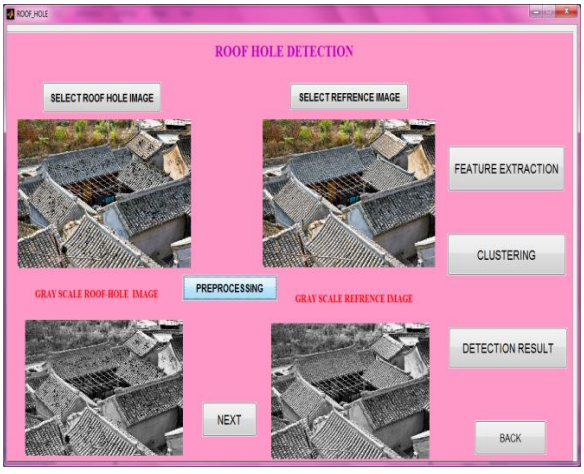


Fig 3: After RGB to GRAY Conversion

Fig 4: After Applying Salt and Pepper Noise.

Fig 7: Detection of Roof Hole

Fig 5: After Applying SIFT method

Fig 8: Edge Detection of Wall Crack.

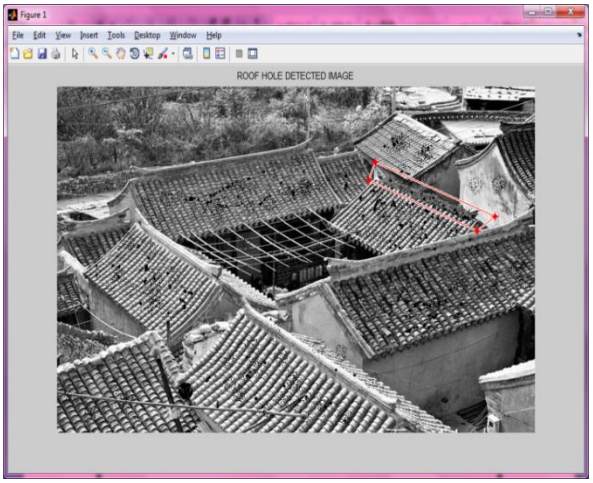


Fig 6: K-means Clustering Algorithm.

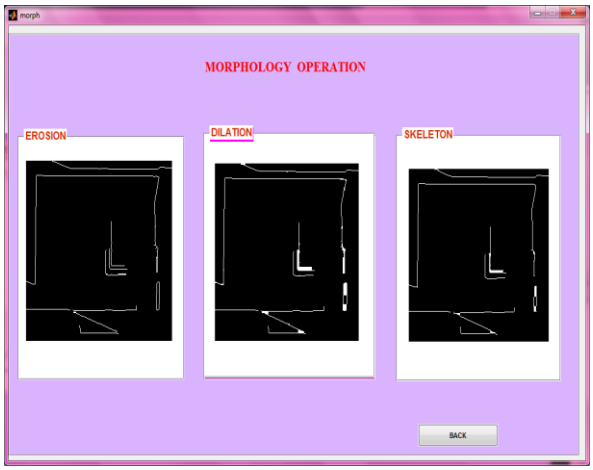
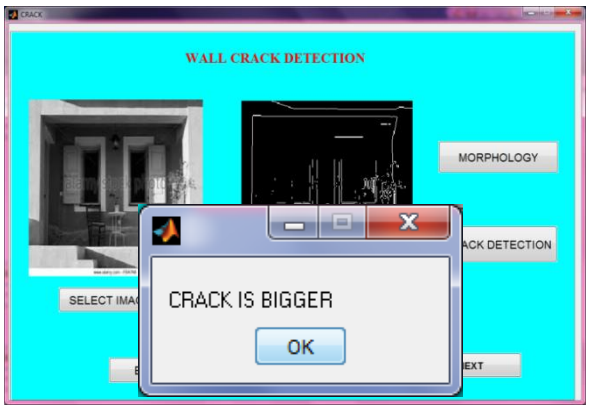


Fig 9: Morphology Operation

Fig 10: Detection of Wall Crack



V. CONCLUSION

Now a day, the roof hole and wall cracks are occurred in many building even in the new buildings. There is a need to identify the hidden and minute cracks in the building. In this paper, the roof hole and wall crack were measured by using feature extraction method such as SIFT, K-means clustering Algorithm and Morphology operation such as Dilation, Erosion and Skeleton. This analysis will be helpful to the engineer to identify the roof-hole and estimate the range of wall crack in an efficient manner. Also it is useful to identify the wall cracks range easily and accurately. In Future work, analysis used large amount of dataset and then implement various Shape method and algorithm.

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