

Towards Corrosion Detection System

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Abstract

Corrosion is a natural process that seeks to reduce the binding energy in metals. The end result of corrosion involves a metal atom being oxidized. Surface corrosion on aluminum aircraft skins, near joints and around fasteners, is often an indicator of buried structural corrosion and cracking. In this paper we proposed a new method on which we are moving towards designing a method to detect the corrosion within the metals, the new method has defined texture analysis as the main method for this approach, the proposed enhancement shows less false positive and less false negative. The main functions used in this approach beside texture analysis are Edge detection, structure element and image dilation. The new approach has designed to detect a part of the image that has been affected by the corrosion, the tested images has showed a good result lying on detecting the corrosion part from the image.

Keyword - Corrosion, Object Detection, Texture Analysis, Edge Detection

1. Introduction

Corrosion is a physicochemical interaction between a metal and its environment which results in changes in the properties of the metal and which may often lead to impairment of the function of the metal, the environment [12], [5], [4]. The corrosion resistance of metals and alloys is a basic property related to the easiness with which these materials react with a given environment. Today, aircraft paints are routinely removed to reveal corrosion on metal surfaces, and the aircraft must be repainted following repairs. Both expensive and time-consuming, that process can also generate air pollution and waste resources. A method is therefore needed to detect the early onset of corrosion on metal substrates covered by protective

coatings, so that aircraft primers and need not be stripped [13]. Concrete and structural steel. Both materials decay in predictable ways, and bridges and over-passes made from them deteriorate to a level where the structures must be rehabilitated or replaced the cost of rehabilitating these bridges or replacing them with new ones is staggering, approximately \$90 billion a year. Texture analysis is important in many applications of computer image analysis for classification [7], [8].

In new simple methodology for the assessment of the crown corrosion in concrete sewer pipes was developed based upon the principle that the surface roughness increases when concrete corrodes [9]. The roughness was quantified by correlating the depths of the surface pits to the lengths of shadows produced in a single source of incident light. A computer program was used to reconstruct a pseudo three-dimensional concrete exterior and obtain the averaged corrosion rate [2]. In this paper that the use of non-parametric classifiers based on learning algorithm enables the proposed approach to be used in small robots and portable devices for corrosion diagnosis. As the neural network classifiers store the knowledge in the neurons weights, there is no need to store all data as in the parametric methods

2. Why Texture Analysis

Texture analysis methods have been utilized in a variety of application domains. In some of the mature domains (such as remote sensing) texture already has played a major role, while in other disciplines (such as surface inspection) new applications of texture are being found [14]. Texture analysis will play an important role in detecting this isolated data and reducing the error and improving the

classification results [1]. Segmentation can be done by finding the pixels that lie on a region boundary. These pixels, called edges, can be found by looking at neighbouring pixels. Since edge pixels are on the boundary and regions on either side of the boundary may have different gray values, a region boundary may be found by measuring the difference between neighbouring pixels. Most of edge detectors (local operators) use only intensity characteristics as the basis for edge detection. Such methods take advantage of gray level discontinuities that are considered relevant features of the image [6].

And thus texture analysis with edge detection may use to retrieve the objects that have a different texture characteristic from the image. In this paper we are moving towards implementing an accurate method to detect the corrosion, in fact, edge detection, texture analysis and other factors has been embedded on this paper for the purpose of tuning the system to have better result.

3. Methodology

In this approach we will design and implement a method to detect the corrosion within the metals, the new method will define texture analysis as the main method for this approach, texture analysis normally implement to segment a special objects, however texture analysis can not stand alone without enhancing the images, whereby, the object will be easy to detect. The main assistance functions will be edge detection, create structure elements and finally dilate the edge of the structured objects. The expected result will be a system can detect the corrosion.. This texture filter has been invented originally to calculate the local range of an image. These statistics can characterize the texture of an image because they provide information about the local variability of the intensity values of pixels in an image. For example, in areas with smooth texture, the range of values in the neighborhood around a pixel will be a small value; in areas of rough texture, the range will be larger, The stdfilt and entropyfilt functions operate similarly, defining a neighborhood around the pixel of interest and calculating the statistic for the neighborhood to determine the pixel value in the output image. The stdfilt function calculates the standard deviation of all the values in the neighborhood. The entropyfilt function calculates the entropy of the neighborhood and assigns that value to the output pixel. Note that, by default, the entropyfilt function defines a 9-by-9 neighborhood around the pixel of interest. To calculate the entropy of an entire image, use the entropy function.

Edge detection is the process of finding sharp contrasts in intensities in an image [10]. This process significantly reduces the amount of data in the image, while preserving the most important structural features of that image. Canny edge detection operator was developed by John F. Canny in 1986 and uses a multi-stage algorithm to detect a wide range of edges in images, Edge detection methods such as the canny detector [3] were widely applied for this task.

Edge detection methods utilize intensity gradients to detect the boundaries of objects [11].

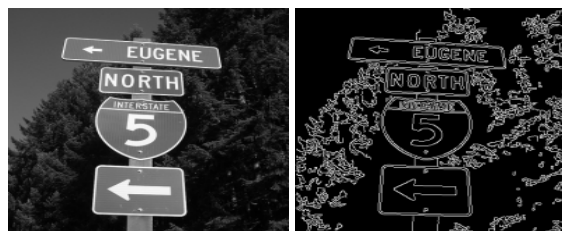


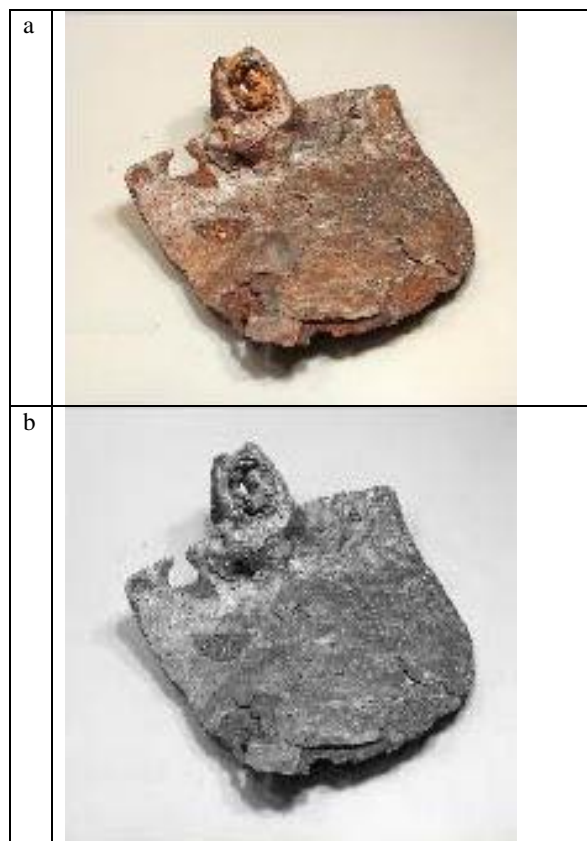
Figure 1. Example of Canny Edge Detection.

4. Testing Result

Below the output figures include a tables, these table has five fields, sequentially, a, b, c, d and e, where (a) is the original image, (b) is the gray level image, (c) is the texture filter, (d) is the Edge detection, and finally (e) is the final enhanced image.

Other test in figure 2 shows more complex corrosion, in figure 2. The caption was for image that has two parts, one part affected by corrosion and other part was not.

The output shows a good accuracy of using the new approach to detect the corrosion on the image



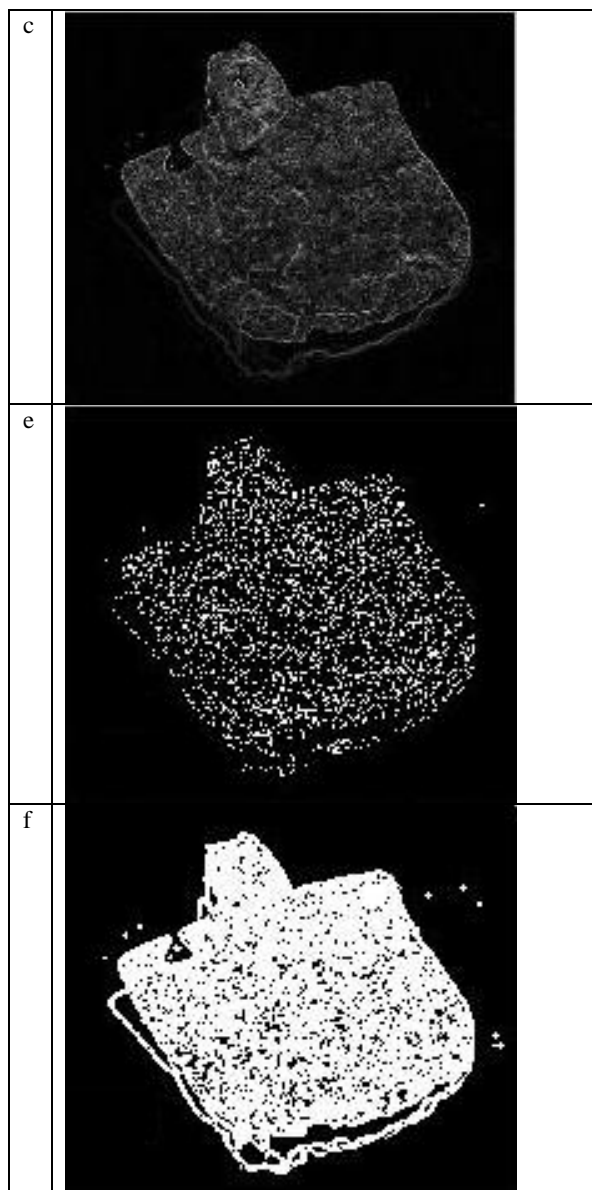


Figure 2. Other Corrosion Detect by the System

5. Conclusions

Texture segmentation is a significant and primary issue in texture analysis. It is concerned with automatically determining the boundaries between various textured regions in an image detection approaches has been widely used in the image processing. It has represented less time consuming and inexpensive alternative. Many techniques and functions were involve on the image processing to achieve an accurate methods on detect, recognize and classify the target, the most popular methods on these area are, texture analysis, image segmentation and many other functions. Texture analysis is one of the most important

characteristics in the image processing; in this paper texture analysis through stdfilt filter has been proposed to detect the corrosion within the plates. The proposed solution has focused on the rough texture of the corrosion areas, and identifies the simple texture as non-corrosion area. The test has shows a good result in term of detecting visible corrosion, as well, we assumed the new approach may do the job successfully with the under-paint corrosion.

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