Detection and Remove of Defects in Image Based on Multi-Stage Median Filter and Local Binary Patterns

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Abstract - The research describes a method of detecting and eliminate distortions in archival Image documents using texture analysis based on local binary neighborhoods. The proposed approach consists of the following stages: pre-treatment, detection of scratches and remove it. Pre-treatment is used for reduce the effects of noise and small defects in the image by Multi-Stage Median Filter. For recognition of the class defects using a Support Vector Machine. The benefit of the new approach a few examples in the detection and remove noise and scratches. The aim of this work is to reduce the noise and error recovery images based on the detection and reconstruction of defects in the photographs.

Keywords: multi-stage median filter, local binary patterns, defect detection, Support Vector Machine, denoising image.

I. INTRODUCTION

Currently, each family collections have a large number of archive pictures and photo documents. Most of these documents exist only in unique copy. Some of these defects may be present as a result of bad storage or direct physical damage (noise, cracks, stains, scratches, etc.).

Convert all Image archive by digitizing the image data can not only reliably preserve and improve their visual quality using advanced processing technology images.

Methods of the automatic recognition of defects in the images is widely used in practice. Automatic detection occurs in the task of finding defects in the road surface, the textile industry, as well as virtual restoration of archival photo images.

II. MULTI-STAGE MEDIAN FILTER

The best known order-statistics filter is the median filter, which replaces the value of a pixel by the median of the gray levels in the neighborhood of that pixel [1], and multi-Stage Median Filter is developed from Median Filter to get Better detail preservation.
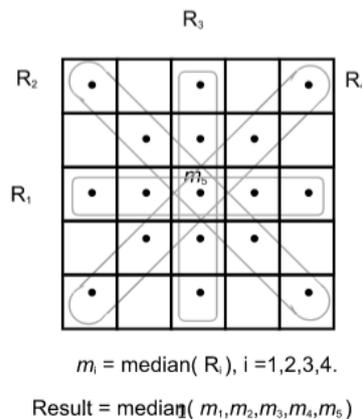

m_i = median(R_i), i =1,2,3,4.

Result = median(m_1, m_2, m_3, m_4, m_5)

Fig. 1 A Display to Choose Best Pixel by Multi-Stage Median Filter to Remove Noise

III. PRPOSED SYSTEM DESIGN

Digital restoration of damaged photos consists of phase detection injuries and eliminate them. In most cases, this process is carried out by manual processing, which requires certain skills and time [2]. Wherein the recovery damaged the image the user must identify the alleged defects for subsequent reconstruction in automatic mode [3].

The image is seen as a simplified mathematical model, which is a two-dimensional discrete sequence $Y_{i,j}$, i= 1, N=1, M, look:

$$Y_{i,j} = (1 - d_{i,j}) \cdot S_{i,j} + d_{i,j} \cdot C_{i,j},$$

Where $Y_{i,j}$The observed image, $S_{i,j}$ original (damaged) image, $d_{i,j}$ binary mask defects, which shows exactly which portion of the image is damaged, $C_{i,j}$ luminance values of the defects.

Figure 2 shows a block diagram of the algorithm for remove noise and detecting defects in the image automatically. The algorithm consists of three stages: apply multi-stage median filter, detection of defects using local binary descriptors and their reconstruction.
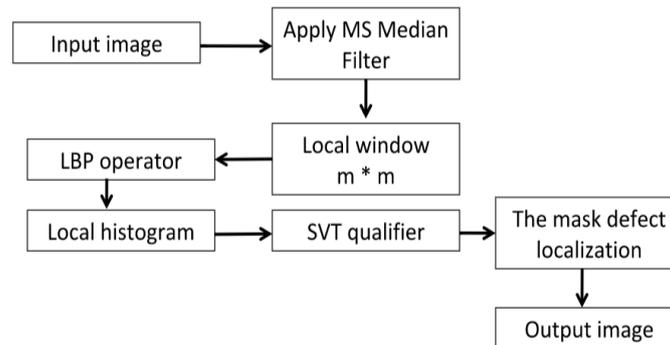

Fig. 2 A Block diagram of the proposed algorithm

Pre-treatment is an important step in the detection of defects, designed to remove noise the noise component, and does not eliminate the large defects. In this paper we used filtering algorithm BM3D [4].

To detect scratches using local binary patterns (LBP) [5] as the texture descriptor of local regions in the image. Using the method of support vector machines (SVM), all parts of the image are classified into two types - an area with defect and without defect region.

The original LBP operator is calculated by comparing each pixel around the center pixel with the center pixel, taken as a threshold value in local area measuring 3 by 3 pixels. In [5], a modification of the method LBP, which is to increase the radius of the pixels are compared with central pixel. Also highlighted 9 homogenous neighborhoods that are most informative about the texture features of the image (Figure 3), and allow to reduce the number of little bin informative. Each of the 9 uniform neighborhoods meet their textural image features, such as ribs, corners and spots.
Modified LBP operator can be written as follows:

$$LBP_{P,K} = \begin{cases} \sum_{p=1}^{P} f(g_p - g_0) & if\ U \le U_T \\ P+1 & otherwise \end{cases}, \quad f(x) = \begin{cases} 1, x \ge 0 \\ 0, x < 0 \end{cases},$$

Where P the number of neighbors; K range; U the number of transitions between 0 and 1; $U_T$threshold by the number of transitions.

Thus, a histogram for the local area, which is the descriptor analysis of local regions in the image for defects.
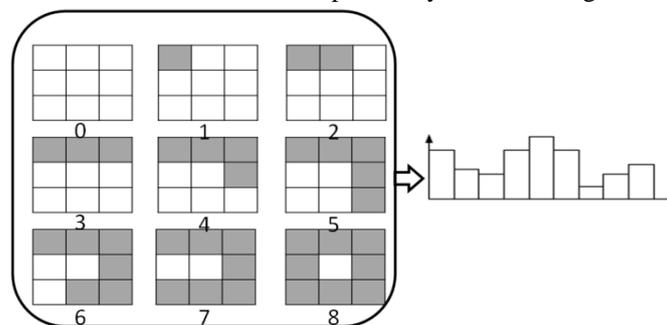

Fig. 3 Construction of the histogram for the uniform LBP

To classify and correlate each pixel to a class of defects or ClassObjects used a support vector machine (SVM) which are two stages:

Training and recognition phase. In the first stage of the plurality of training examplesselected reference vectors, on which is built the dividing plane. Phaserecognition is that the input of the resulting classifier set an exampleX, o social class which is not known. Qualifier allowsto determine which class is the vector X. It should be noted that the method of SVM can be used for both linearly separable images, and for linearly inseparable. In this study, for the construction of the separating hyperplane used radial function:

$$K(x, x') = \exp\left(-y\|x - x'\|^2\right)\ at\ \ y > 0$$

where x - the current vector, x' - the central vector, y - normalizing parameter.

For the reconstruction of the affected areas are encouraged to use the method recovery image pixels, which is based on a search for similar blocks and restore the structure of the image.
Figures 4 present the results of the proposed method of processing.

Fig. 4 - Example of a proposed method

The experimental results show that the noise reduction and detection of scratches clearly, even complex structural and textural characteristics of images. Pretreatment noise reduction helps reduce noise component, as well as to eliminate simple defects. In conclusion we can put the following conclusions.

IV. CONCLUSIONS

This paper presents a good method for remove noise and detection of defects on the basis of modified binary operator of local neighborhoods. For the classification descriptors and the division into classes used a support vector machine. Examples shown in demonstrate the effectiveness of the algorithm when detected scratches on hard texture images.

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