Automatic Detection for Surface Defects of Industrial Material
Based On Image Processing

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ABSTRACT

Material has periodic defects that are difficult to detect during production even by experienced human inspectors. Therefore, we introduce an image processing method for automatically detecting defects on the surface of the machines. To show visible defect can be optically enhanced to improve manual assessment as well as how descriptor-based image processing and machine learning can be used to allow automated fault detection. Industrial knitting is a complex production process. Of all state-of-the-art industrial knitting procedures, large circular knitting machines allow the highest productivity compared to flat and small circular knitting machines. Product quality is strongly influenced by machine parameters, mainly yarn tension, take-off tension, sinker height and rotation speed. Small mis adjustments of the machine’s components may lead to defects.

Keywords: support vector machines (SVM), Fuzzy c-means (FCM), Peripheral Interface Controller (PIC)

INTRODUCTION

The need for quality control and performance testing has become an integral part of production procedure. Defect identification from images is becoming increasingly significant in a variety of applications since quality control plays a prominent role in manufacturing of virtually every product. Quality ranking and defect detection of textured contrived surfaces is one of the major topics to be investigated. Surface inspection and defect detection is a particular case in texture classification, where the algorithm attempts to inspect a surface for possible defects, to classify the input sample as either normal or abnormal, or to rank its quality. Many vision-based inspection approaches have been developed to detect defects on textured surfaces with wide applications such as biomedical systems, surface inspection of industrial products that include textile, metal surfaces, wood, paper, glass, leather, food products inspection etc. So, we have focused on the machine vision approach to the problem of defect detection of engineered surfaces[1-3]. The machine vision offers accuracy, consistency and low cost solution to the problem of subjectivity, fatigue and high cost associated with the human inspectors, hence the most important sense. Among several vision-based activities, object recognition and classification are basic and immediate acts. It would be useful if we could develop an automatic
visual pattern recognition system to assist or replace human operator in surface inspection of industrial products. It is important to find the most appropriate visual properties or features of an object that make it distinguishable from others. These properties can be color, shape, edges, texture etc. In a typical pattern recognition or object classification process, the first step is the extraction of features or key properties of objects [4-6]. The next step is classification of objects according to their features. To expect a successful classification performance, extracted features of different objects must show adequate separation in the feature space. We propose a simple technique that uses a procedure based on the heuristics used by human inspectors for detecting defects. We compute three features and use support vector machines (SVM) for final classification [7-11].

PROPOSED SYSTEM

The captured (RGB) image is converted into grey scale image. An image enhancement is performed by applying filter and removes all noise objects. Subsequently, we extract image information with different descriptors for pre-processing, FCM segmentation and feature extraction. After the segmentation process, the defected area is calculated. The MATLAB result is given to the controller as an input. If the defects present in that industrial material, the buzzer will be in ON condition and the corresponding information will be sent as a message to mobile via GSM. Results show that the proposed allows training both tested classifiers with good classification rates of up to 98.9% shown in fig 1.

Fig 1: Block diagram of the proposed system

Preprocessing techniques

In character recognition systems most of the applications use gray or binary pictures since process color pictures is computationally high. Such pictures might also contain non-uniform background and/or watermarks creating it tough to extract the document text from the image while not acting some quite preprocessing, therefore; the specified result from preprocessing may be a binary image containing text solely. Thus, to attain this, many steps area unit required, first, some image sweetening techniques to get rid of noise or correct the distinction within the image, second, thresholding to get rid of the background containing any scenes, watermarks and/or noise, third, page segmentation to separate graphics from text, fourth, character segmentation to separate characters from one another and, finally, morphological process to reinforce the characters in cases wherever holding and/or different preprocessing techniques scoured elements of the characters or additional pixels to them. The higher than techniques gift few of these which can be employed in character recognition systems and in some applications; few or a number of these techniques or others could also be used at totally different stages of the
OCR system, the remainder of the chapter can gift a number of the techniques used throughout the preprocessing stage of a personality recognition system.

**FCM Segmentation**

Image segmentation shows a significant role in medical image processing. Fuzzy c-means (FCM) is one of the common clustering algorithms for medical image segmentation. But FCM is extremely exposed to noise due to not considering the spatial information in image segmentation. An improved FCM medical image segmentation algorithm based on MMTD which takes some spatial features into account. Image segmentation is the procedure in which the original image is partitioned into homogeneous regions and plays an important role in medical image processing. As the imaging mechanism and the tissues of medical images are different, medical images are easily affected by noise, field migration effect, and tissue movement. Fuzzy c-means (FCM) is one such soft segmentation technique applicable for medical images. The performance of this method to obtain an optimal solution depends on the initial positions of the centers of the clusters, the measure of membership degree for each data point, and so on. FCM image segmentation approach which only takes the gray feature into account and ignores the other features is very sensitive to noise. This leads to some wrong classifications. For example, some pixels which should belong to the homogeneous region are separated. In order to improve the antinoise and the effect of the segmentation, we introduce the spatial feature and the correlation between the pixel and its neighbors to image segmentation.

**Feature extraction**

Feature extraction a kind of spatial property reduction that with efficiency represents attention-grabbing components of a picture as a compact feature vector. This approach is helpful once image sizes are massive and a reduced feature illustration is needed to quickly complete tasks like image matching and retrieval. Feature detection, feature extraction, and matching are typically combined to resolve common pc vision issues like object detection and recognition, content-based image retrieval, face detection and recognition, and texture classification.

**Fig 2: Block diagram of the hardware part**
PIC MICROCONTROLLER

In fig 2, Peripheral Interface Controller (PIC) was originally designed by General Instruments. within the late Seventies, GI introduced PIC 1650 and 1655 – computer architecture with thirty directions. PIC was sold to semiconductor unit Features: affordable, self-contained, 8-bit, Harvard structure, pipelined, RISC, single accumulator, with fastened reset and interrupt vectors shown in fig 3.

Fig 3.PIC Microcontroller

POWER SUPPLY

A regulated power provide primarily consists of a normal power provide and voltage control device, as illustrated within the fig four. The output from a normal power provide is fed to the voltage control device that gives the ultimate output.

Fig 4.Regulated power supply circuit
The ac voltage, generally 230 Vrms is connected to a electrical device that transforms that ac voltage to the amount for the required dc output. A bridge rectifier then provides a full-wave corrected voltage that's ab initio filtered by a \[\Pi\] (or C-L-C) filter to provide a dc voltage. The ensuing dc voltage sometimes has some ripple or ac voltage variation. A control circuit use this dc input to supply a dc voltage that not solely has abundant less ripple voltage however additionally remains constant even though the input dc voltage varies somewhat or the load connected to the output dc voltage changes. The regulated dc offer is on the market across a potential divider.

**EXPERIMENTAL RESULTS**

In detector technology, low-power physics, and low power frequency (RF) style have enabled the event of little, comparatively cheap and low-power sensors, known as small sensors which will be connected via a wireless network. These wireless small detector networks represent a replacement paradigm for extracting knowledge from the atmosphere and modify the reliable observance of a range of environments for applications that embrace police work, machine failure identification, and chemical/biological detection. a vital challenge within the style of those networks is that 2 key resources-communication information measure and energy square measure considerably a lot of restricted than in an exceedingly bound network atmosphere. These constraints need innovative style techniques to use the out there information measure and energy expeditiously.

A true color image is a picture within which every picture element is such as by 3 values one every for the red, blue, and inexperienced parts of the picture element scalar. \(M \times n \times 3\) array of sophistication uint8, uint16, single, or double whose picture element values specify intensity values. For single or double arrays, values vary from \([0, 1]\). For uint8, values vary from \([0, 255]\). For uint16, values vary from \([0, 65535]\). Image formation victimisation detector and different image acquisition instrumentation denote the brightness or intensity I of the sunshine of a picture as 2 dimensional continuous perform \(F(x, y)\) wherever \((x, y)\) denotes the spacial coordinates once solely the brightness of sunshine is taken into account. generally three-dimensional spacial coordinate square measure used. Image involving solely intensity square measure known as grey scale pictures shown in fig 5.
The “automatic detection for surface defects of commercial materials supported image processing” is an improvement in detection of surface defects on industrial materials. Using GSM Technology, the message about defected area is sent to an appropriate mobile shown in fig 6.
CONCLUSION

This work provides the collective survey of the various image process techniques used for the
detection of the cracks, scratches and defects within the engineering structures. The most
intention of this study was near to study and review the defect detection system supported image
process. Here we've taken several analysis papers for the review supported the defect detection.
The analysis of various ways for defect detection and identification is completed. a picture
process primarily based technique for police work defects (hole, crack and imperfectness in
diameter) in industrial materials is projected. In next task the defects are distinguish in keeping
with their size and form and overall system are enforced. it'll additionally provide the thought
concerning major defect and minor defect. Experimental results can demonstrate the system as
effective for addressing the economic materials. Our future work are to focus for implementing
this method in tiny and huge scale industries.

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