International Journal of Innovative Research in Technology & Science

Received 5 August 2018, Received in revised form, 19 August 2018, Accepted 24 September 2018, Available online 30 September 2018

ISSN: 2321-1156 *Volume VI Issue V, September 2018*

Image Surface Defect Detection Techniques Based on Image Processing

Chetan Vasant Chaudhari, Dept. of CSE, SRK University, Bhopal, India; chaudharichetanv@gmail.com;
Sapana A Fegade, Dept. of CSE, JTMCOE, Faizpur, MH, India; sapana.fegade4@gmail.com;

ABSTRACT

Image processing using surface defect detection techniques in image detection, form of signal processing for which the input is an image, such as a photograph or video frame. Examination of ceramic tile is finished in conditions like noise, high temperature, and wetness. There are many stages through that we are able to maintain quality of a tile. These stages include examination of color variation during a tile, chip offs during a tile, surface defects during a tile. This paper provides analysis of techniques that are helpful to search out surface defects like crack, blob, hole, variation in color, defect in corners, and pattern pair in tile that has pattern thereon. Glass defects are a significant reason for poor quality and of embarrassment for makers. It's a tedious method to manually examine terribly giant size glasses. The manual examination method is slow, long and vulnerable to human error. Automatic examination systems victimization image process will overcome several of those disadvantages and provide makers a chance to considerably improve quality and reduce prices. During this paper we tend to review varied glass defects and also the potential automatic solutions victimization image process techniques for defect detection. Literature presents totally different techniques to mechanically determine the crack and its depth victimization image process techniques. During this analysis, an in depth survey is conducted to spot the analysis challenges and also the achievements until during this field. Consequently, fifty analysis papers are taken associated with crack detection, and people analysis papers are reviewed. Supported the review, analysis is provided supported the image process techniques, objectives, accuracy level, error level, and also the image information sets. Finally, we tend to gift the varied analysis problems which might be helpful for the analyzers to accomplish additional research on the crack detection.

Keywords: - Edge detection, image processing, Surface Inspection, Defect Detection, Defect detection, computer vision, Crack detection.

I. INTRODUCTION

In tile business, production of tiles is in bulk. If examination of a tile is completed manually, it'll take a lot of your time. Additionally the creating of tiles is really tired automatic plant except quality check. Therefore automation in examination is one in all the ways that to reduce the time for examination in tile business. Examination may be tired printing stage or later stage. whereas inspecting a tile, we might even see bound defects within the surface of a tile like blob, pinhole, variation in color of a tile, crack, and chip offs during a tile, pattern pair, scratches etc. thus once detective work the tile, we will apply some image process steps to search out these defects. The elemental stages comprising a laptop Vision system for digital image process are: Image acquisition, Preprocessing, Segmentation, Feature extraction (representation and description), Recognition interpretation and classification), and content. From above, a number of the stages may be removed according the important time digital image process application. The quality management conception is that the most significant side of the glass producing business. Within the past human vision has compete a primary role in quality examination and verification processes? It is, however, currently thought of a limiting consider the examination of product beginning from trendy industrial production lines, wherever high operating speeds and extremely restricted tolerances are needed, not like traditional defect detection mode that is slow and susceptible to errors.

Figure 1 Surface Inspection, Precise Defect Classification images.

The answer to those issues has been the introduction of artificial vision-based examination system. As a matter of reality, applications of those systems are these days widespread in several industrial sectors [1], particularly the glass business. For this industrial sector, an in-line automatic review system that's ready to discover, and classify the defects present in glass sheets has been developed and analyzed [2]. The standard management of the ultimate product may be a basic a part of the glass production method, and this can be incontestable by the appreciable research that has been dedicated to automatic examination techniques [3]. These studies target victimization totally different approaches for defect detection counting on their specific application as a result of no single technique are often thought-about optimum. As a result, several examination techniques are projected with the aim of accelerating the productivity and rising the ultimate product quality [4, 5]. With relevance the glass business, analyses and methodologies utilized to find the defects within the glass sheets primarily use image process techniques owing to their higher exactness and speed. Variety of techniques that use machine visual impairment detection system are conferred within the past, by varied authors in their analysis on this subject. This paper reviews the categories of glass defects and image process algorithms for defect detection [6].

Received 5 August 2018, Received in revised form, 19 August 2018, Accepted 24 September 2018, Available online 30 September 2018
ISSN: 2321-1156 Volume VI Issue V, September 2018

II. TYPES OF DEFECT

Once the glass sheet is manufactured, it is sent to the defect detection division of the glass production unit for testing and validation of defects. The various types of defects that can be present in the glass are:

Foreign material: This defect has the appearance of a lump. It is an unmelted, opaque material embedded in the glass. Low-

Contrast Defect regions: These defect areas are roughly defined as fairly large, several millimeters in diameter, and relatively dark and/or bright regions that stand out against the background.

Scratches and spots: These are the marks or irregular patches on the surface. These occur mainly during transportation within the factory.

Bubbles and inclusions: It is an air bubble like material trapped inside glass as a defect during its production.

Holes and dirt: These are the surface defects which cause major problems for manufacturers, particularly when the production process includes a surface treatment stage. Different image processing algorithms are required for the detection of different types of defects which have been reviewed in the next section.

Blob: This type of defect can be found in tile due to existence of water in tile or proper humidity is not there.

Pinhole: This type of defect is very small. There are small holes in the surface of a tile, which are often undetectable by normal eyesight.

Cracks: This type of defect can be occurred during transmission of tiles or if high pressure is applied on a tile while manufacturing.

Mismatch of pattern: In printing phase, different pattern (other than mentioned pattern) was printed on a tile or placement of a tile is not correct then this type of defect can be found.

III. RELATED WORK

In the section of related we mentioned the work that has done in the field of surface detect in image processing

Rashmi Mishra et al [7] Probabilistic neural network (PNN) can be applied. Different weights are given to the edges of this network and network is divided into four stages. Training set is given to the input stage and this set is passing through the pattern and summation layer followed by output layer. Set of tile images is taken as training set. This set is trained by passing through various stages like applying mean filter, resize the image, make histogram of R,G,B value, calculation of average contrast, detection of edges, form feature vectors, make feature classes based on feature vector class and train the classifier for detecting various defects on surface. Apply these feature vectors to PNN and take output as a defect.

Jie Zhao et al. [8] proposed a method for detection of bubbles and inclusions. First, the defect region is located by the method of canny edge detection, and thus the smallest connected region (rectangle) can be found. The defect region occupies very small part of the image, in comparison to the whole glass material. Segmenting the foreground region beforehand and performing the processing algorithms directly to the foreground can greatly increase the efficiency of the whole algorithm. Then, the binary information of the core region can be obtained based on an OSTU [4] and an adaptive algorithm. After noises are removed, a Binary Feature Histogram (BFH) is proposed to describe the characteristic of the glass defect. Finally, the AdaBoost method is adopted for classification. The classifiers are designed based on BFH. Experiments with 800 bubble images and 240 non-bubble images prove that the proposed method is effective and efficient for recognition of glass defects, such as bubbles and inclusions.

Zhang Yiyang et al. [9] have proposed a crack detection algorithm based on digital image processing technology. By preprocessing, image segmentation and feature extraction, they have obtained the information about the crack image. In Threshold method of segmentation was used after the smoothening of the accepted input image. To judge their image, they have calculated the area and perimeter of the roundness index. Then by the comparison, they have evaluated the presence of the crack in the image. Even though many of the commercial camera based image processing techniques dictate only upon the pre-processing, some techniques concentrate on the integration algorithm were the feature extraction would be made.

Sunpreet Singh et al. [10] Cracks, Spot, bumps, holes can be identified using various techniques. For that noise removal followed by binarization of image is done. Cracks can be identified based on figure aspect ratio and center of gravity equation. Spots can be identified using standard deviation using center of gravity, bumps and holes can be identified using edge detection techniques like Sobel, Prewitt, and Canny. Histogram equalization is used for setting contrast of the image.

S.Y. Alam et al. [11] have proposed a detection technique by the combination of the digital image correlation and acoustic emission. The former method gives a very precise measurement of surface displacements, thus crack openings and crack spacing were determined. In order to complement that method and to investigate damage mechanisms, acoustic emissions resulting from internal damage were also analyzed. A manual grouping method (similar to K-means method) was used to identify different classes of AE energy released from the Beams of three different sizes. In their methodology, they have used three different beam proportionalities for the effectiveness of the output.

Sinha et al. [12] have investigated the cracks by using the two-step approach. They have developed a statistical filter design for the crack detection. After the filtering, they have got to the two-step approach at which the crack feature extraction was done locally at the first step of the pre-processing and then they have fused the images. The second step is to define the crack among the image segment by the process of cleaning and linking. They have overcome their previous work disadvantage where the morphological approach was used

Received 5 August 2018, Received in revised form, 19 August 2018, Accepted 24 September 2018, Available online 30 September 2018
ISSN: 2321-1156 Volume VI Issue V, September 2018

Garcia-Alcaraz et al. [13] for finding defects, various techniques can be applied on an image of a tile. Like thresholding, segmentation, subtraction of two images, clustering etc. In automatic inspection of apple quality, an image of a good apple is considered as a reference image, characteristic of the apple is obtained in terms of rules and image processing criteria by human expert. Then according to these evidences, other apples are examined and apple is classified in one of the predefined three categories.

Oliveira et al. [14] have designed a system for the automatic crack detection. Here the crack detection was based on the sample paradigm. In the sample paradigm, a subset of the available image database was automatically selected and used for unsupervised training of the system images. They have characterized operations based on the classification of the non-overlapping image blocks. Then based on the crack block based detection, the width of the crack was estimated. They have proposed their system following the guidelines offered by the Portuguese Distress Catalogue.

Yadraj Meena et al. [15] for contrast enhancement, adaptive histogram technique is used. Adaptive histogram technique will give better result than histogram equalization. Median filter and wiener filter can be used for noise removal. After detecting object using Sobel operator and region of interest using segmentation, by defining different threshold values cracks and blob type defects can be found. For removing unwanted lines, erosion and erode like morphological operations can be applied.

Martı´n et al. [16] this section shows the IR image based processing technique, which is used in the process of crack detection have proposed an Infrared (IR) thermography method based on IR image rectification with the extraction of Isotherms which allows the detection of cracks as well as the geometric characterization and orientation of the crack to assist the prediction of the direction of propagation of the crack through the material. It allows the fast and simple assessment of the morphology of different cracks (toe crack and longitudinal crack). The application of analysis with IR camera and subsequent image rectification which was used in their proposal allows the geometric characterization of the defects facilitating their classification according to the standards [59, 60]. The detection of the crack using the notches in the irregularities was proposed. Here using the IR thermography image rectification technique, they have detected based on notches which will differ depending on the temperature.

IV CONCLUSION

To discover object from the image, specific edge detection technique is utilized by considering impact of external surroundings. Preprocessing step wants distinction stretching that's fulfilled by bar chart exploit. Some ways for detection of object provide higher results but consume longer that won't acceptable in real time surroundings. Whereas practice morphology operation, smoothing, noise reduction, detection of object is tired less time. For detection defect(s) in corner, further effort is required as compared to detection different defects. Therefore we'll conclude that no such rule has planned through that we'll understand all the defects at a time. In future, one generalized rule is prepared to search out each variety of defects.

REFERENCES

[1]. Chang-Hwan Oh, Hyonam Joo and Keun-Ho Rew," Detecting Low-Contrast Defect Regions on Glasses Using Highly Robust Model-Fitting Estimator," International Conference on Control, Automation and Systems, 2007, pp. 2138 – 2141.
[2].] F. Adamo, F. Attivissimo, A. Di Nisio, M. Savino, an automated visual inspection system for the glass industry, In: Proc. of 16th IMEKO TC4 Symposium, Florence, Italy, Sept. 22–24, 2008.
[3]. M. A. Coulthard, "Image Processing for Automatic Surface Defect Detection," Surface Inspection Ltd, UK, pp. 192- 196.
[4]. M. Leconte, Laser glass inspection system, International Society for Optical Engineering, 1997, 878–882.
[5]. Zhang Yepeng, Tao Yuezhen, Fan Zhiyong," Application of Digital Image Process Technology to the Mouth of Beer Bottle Defect Inspection," 2007, pp. 2-905- 2-908
[6]. Garcia-Alcaraz, Jorge Luis, Maldonado-Macias, Aide Aracely, Cortes-Robles, Guillermo, Latin America Springer. "Lean Manufacturing in the Developing World_ Methodology, Case Studies and Trends", 2014.
[7]. Rashmi Mishra, Dolly Shukla, International Journal of Emerging Technology and Advanced Engineering, Volume 4, March 2014. "An Automated Ceramic Tiles Defect Detection and Classification System Based on Artificial Neural Network".
[8]. Jie Zhao, Xu Zhao and Yuncai Liu, "A Method for Detection and Classification of Glass Defects in Low Resolution Images," Sixth International Conference on Image and Graphics, 2011,.
[9]. Zhang Yiyang. The design of glass crack detection system based on image pre-processing technology, in: Proceedings of Information Technology and Artificial Intelligence Conference, 2014, pp. 39–42.
[10]. Sunpreet Singh, Maninder Kaur, IOSR Journal of Engineering, Volume 2(3), pp 429-32, March 2012. "Machine Vision System for Automated Visual Inspection of Tile's Surface Quality.
[11]. S.Y. Alam, A. Loukili, F. Grondin, E. Rozie`re, Use of the digital image correlation and acoustic emission technique to study the effect of structural size on cracking of reinforced concrete, Eng. Fract. Mech. 143 (2015) 17–31.
[12]. Sunil K. Sinha, Paul W. Fieguth, Automated detection of cracks in buried concrete pipe images, Autom. Constr. 15 (1) (2006) 58– 72.
[13]. Garcia-Alcaraz, Jorge Luis, Maldonado-Macias, Aide Aracely, Cortes-Robles, Guillermo, Latin America Springer, 2014. "Lean Manufacturing in the Developing World_ Methodology, Case Studies and Trends"
[14]. Henrique Oliveira, Paulo Lobato Correia, Automatic road crack detection and characterization, IEEE Trans. Intell. Transp. Syst. 14 (1) (2012) 155–168.
[15]. Yadraj Meena, Dr. Ajay Mittal, International Journal of Advanced Research in Computer Science and Software Engineering, Volume 3, July 2013. "Blob.
[16]. M. Rodrı´guez-Martı´na, S. Lagu¨elaa, D. Gonza´lez-Aguileraa, J. Martı´nezb, Thermo graphic test for the geometric characterization of cracks in welding using IR image rectification, Autom. Constr. 61 (2016) 58–65.