Measuring Dimensions and Flatness of Tiles using Digital Image Processing

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Abstract

Quality control in ceramic tile industry is the crucial step of manufacturing process to insure that the tiles will maintain their structural integrity and its visual flatness and its processing. The tile image is taken with the help of camera and stored into the source. This also introduces the random changes in the pixels. In this process the digitalized image is obtained from real world source. This will ensure that the end product i.e tile is corrected and analyzed.

This project aims to create a visual system that is capable of detecting the surface defects for the tiles.

2. METHODOLOGY

This project aims to create a visual system that is capable of detecting the surface for tiles. This will ensure that the end product i.e tile is free from the defects .This process will be effective , efficient and cost effective.

2.2 Image capturing:

The tile image is taken with the help of camera and stored into the computer, then Image processing and morphological operation are done on the image.

2.3 Image Enhancement

Actually, image enhancement technique is to make the image clearer so that various operations can be performed easily on the image. For
this, at first the captured image is converted to the gray level image.

2.4 Edge Detection

An edge may be regarded as a boundary between two dissimilar regions in an image. These may be different surfaces of the object, or perhaps a boundary between light and shadow falling on a single surface. In principle, an edge is easy to find since differences in pixel values between regions are relatively easy to calculate by considering gradients. Many edge extraction techniques can be broken up into two distinct phases:
- Finding pixels in the image where edges are likely to occur by looking for discontinuities in gradients.
- Linking these edge points in some way to produce descriptions of edges in terms of lines curves etc.

2.5 DEFECT CLASSIFICATION

There are various defect that we come across when we inspect the tile some of the defects are:

3. Algorithms

Algorithms to detect the defects

3.1 FONT OF THE MANUSCRIPT

Algorithm to Determine Crack

Defects Let c_length as the range of crack.
Step 1. Check every pixel coordinate (i, j) from left to right up the last pixel element.
Step 2. If any (i, j) has value 1 then
   (a) Consider its adjacent eight pixels and find which are 1.
   (b) If any adjacent pixel has value 1 then Current pixel coordinate will be updated to it.
   (c) Apply the backtracking process to find out all connected pixels and count the length.
Step 3. Apply step 2 to all pixels and for each pixel find out the length of connected pixels.
Step 4. Counting all length of the connected pixels found from step 2 and step 3, find out the maximum number and set it to c_count.
Step 5. Finally, apply step 2 to specify the crack detected pixel coordinates so that other types of defects are not affected to it.
Step 6. If c_count > c_length, then make decision that crack is found, otherwise crack is not found. The same operations have been applied to the other kinds of defects detection algorithms but without the same arrange and the number of processing cycles to the images. Figure 6 shows the Spot, Longitudinal Spot, and Depression Spot detection algorithm

3.2 SPOT DEFECT:

This are the defect that forms a hole on the surface during manufacturing due to extra pressure. This are also formed when there is access amount of material left on the surface and we try to remove it forcefully at time it may lead to such type of defect.

Algorithm to Determine Spot

Defects Let, matx as size of spot, row as the maximum number of image pixels along any row and col as the maximum number of image pixels along any column.
Step 1. Let, start=(matx/2)+1; Here start is the middle element of (matx*matx) . Step 2. Check every pixel coordinate (i, j) from left to right up to the last pixel element.
   (a) If any pixel coordinate (i, j) is 2, then
      1) Considering it as the middle element and check the total (matx*matx) elements around it to find out how many 2 exists into this region.
   2) Let, the total number of 2 is equal to s_length.
   3) If s_length = (matx*matx), then Make decision that spot defect is found and exit From loop. (b) Otherwise, switch to next pixel coordinate at step 2. Step 3. After searching every pixel coordinate, if there is nos_length matches to (matx*matx), then make decision that spot defect is not found.

3.3 PIN HOLE DEFECT DETECTION

It is easier to detect the Pin-hole defects. That by applying some morphological operations directly to the input image followed by SDC morphological operation (morphology operations specialized for gray scale images). Finally in this algorithm the image passes to Noise reduction processing to get a clear image for the defect. Figure 6 shows the Pin-hole defect detection algorithm

Algorithm to Determine Pinhole Defects

Let, p_count as a variable for pinhole count, c_range as the range of corner, e_range as the range of edge and row as the maximum number of image pixels along any row and column as the maximum number of image pixels along any column.
Step 1. Set, temp_a=c_range , and temp_b=e_range. The rests are same as step 3.
Step 2. Divide the total searching area for pinhole into three regions.
Step 3. For left side region, for row consider the range from temp_a+1 to rowc_range-1 for column consider the range from temp_b+1 to c_range
   (a) Check every pixel coordinates whether it is 0 or not.
   (b) If it is true then (i) For each coordinate (i,j) check all of its eight neighbours.
      (ii) If (i-j-1), (i-j+1), (i+1-j), (i+1+j) position values are 1 and the rest are 0, then P_count will be incremented by 1.
Step 4. For right side region, range for row is from temp_a+1 to row-c_range-1 and range for column is from coltemp_a+1 to col-e_range. The rests are same as step-3.
Step 5. For other middle side elements, range for row is from temp_b+1 to row-e_range and range for column is from coltemp_a+1 to col-c_range. The rests are same as step-3.
Step 6. Finally, check value of p_count. If p_count>0, then pinhole is found, otherwise not found.

3.4. FLATNESS DEFECT DETECTION

Here we have performed various operations in order to check the quality of the tile. But as we know that when there is a large production of the tiles the flatness of all the tiles does not remain same there are variations in it .This variations are caused due to excessive material left on the surface or uneven cutting .In order to overcome this defect we can use laser sensor.
There is a laser on both the side of the tile i.e vertically and horizontally there will be a light sensor on the other end. If light (laser beam) strikes to the sensor without any obstruction then the surface is flat. If the laser beam does not strike the sensor then the tile does no have seven i.e smooth or flat surface.

4.0 DETECTION METHODS

The significant field of computer vision is to detect major objects under complex background by reducing the time and cost. The image detection methods are classified into two types namely space domain method and frequency domain method. The segmentation algorithm segments the images and removes the unwanted features such as the optic disk. Pre-processing is the first step which is done using filtration method such as adaptive median filter. Colour enhancement can be performed by changing the intensity mapping rate and by using histogram equalization techniques.

4.1 BLOB DETECTION ALGORITHMS

To detect regions or points in digital image processing blob detection method is used mainly based on mathematical functions. The regions or points which have perceptible difference with their surroundings is called blob.“Blob is the region which can be either brighter or darker than the neighborhood, or may be the same colour in the video or image. Blob detectors can be classified as:

(1) differential methods which are derivative functions based on the position
(2) methods based on finding the local maxima and minima of the function.

4.2 OPTIC DISK AND MACULA DETECTION

An unified method used for Optic disk and macula detection is the Generalized Motion Pattern Techniques (GMP) [11]. The location of OD (Optic disc) and macula helps in determining the severity of the disease and need for intervention. For instance, the nearness of a bright/dark lesion to macula indicates a higher likelihood of impaired vision and hence calls for immediate medical attention. Such precise location is also needed in registering images acquired across patient visits and assessing disease progression. In general the detection of OD and macula from colour retinal images has been treated as two separate problems, with OD detection receiving more attention than macula detection. OD detection methods typically exploit the appearance info, such as colour and roughly circular shape.

4.3 CSCR DETECTION AND ELIMINATION TECHNIQUE:

To detect the particular region the first step is to remove the unwanted noise. This can be performed by the following steps:

1. Image intensity adjustment: in which we make intensity value as a reference colour and compare it to the retinal image intensity in order to change the original retinal image intensity colour to the reference intensity color.
2. Since there is a disparity in colour intensity that might influence the result of optic disc detection and elimination we need to solve the non uniform illumination problem. In this step we apply principle component analysis PCA.
3. Colour enhancement intensity is applied in this step to adjust the intensity gray level by rearrange this intensity and make the optic disk clearer and brighter than the other foreground and background of the retinal image.
4. CSCR segmentation: in which we apply general threshold value that is obtained from the histogram of the enhanced image.
5. Since the optic disc represents the central region from which the blood vessels stem in this step we apply a filter and morphological operators to remove all residuals remaining from the blood vessels and that crossing the optic disc boundary. To make the optic disc boundary more clearly we apply dilation followed by erosion processes.

6. After optic disc segmentation, we apply the same technique for the retinal fundus and optic disc boundaries elimination to find out the optic disc boundary values denoted in x and y coordinates. Principally, to find these values we compute the (OD) diameter value.
7. After obtaining the OD boundary values in x, and y axis’s, we introduce a polynomial function to draw and eliminate the optic disc on the original image. In this step we use roipoly Matlab function to specify a polygonal region of interest (ROI) within the image. The roipoly function returns a binary image that can be used as a mask.

4.4 BOUNDARIES AND AREAS DETECTIONS A MATLAB function can be used to trace and find out the area of Boundaries. Area detection is mainly used to simplify the measurement of the exudates size. This function can trace the exterior boundaries of objects, and also boundaries of holes inside these objects, in the binary image. E. SIZE MEASUREMENT For Size measurements the method used are poly area function and pixel method is used for complicated shape. Depending on the measurement size we can able to determine the severity of the macula as compared to normal image. Once the segmentation and detection methods are applied the next step is to measure their sizes, and compare them to the background size of the image. Based on that, we can identify the diseases severity which can be observed by ophthalmologists. The approach introduced to this measurement is by utilizing mathematic operation represented in polyarea MATLAB function. Since the coordinates of the interest area (exudates lesion) are obtained from boundary function, they can be fed up to the polyarea function to compute the exudates size. Area = polyarea(X, Y) Where Area = Area of polygon (area of exudate) (X, Y) = Coordinate values in x, and y direction for boundary position.

5 CONCLUSION

Here we have used various algorithms to detect the defects related to the dimensions and appearance of the tile. Here we have also used laser to detect the flatness of the tile.

6 REFERENCES

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