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Research Article

PRINTING DEFECT IDENTIFICATION IN PHARMACEUTICAL BLISTERS USING IMAGE PROCESSING

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ABSTRACT

Objective: Our aim is to detect printing defects in pharmaceutical tablets from the manufacturing line using image processing techniques.

Methods: The printed labels contain the details of the chemical composition, date of manufacture, date of expiry, manufacturing location, etc., images of the labels are obtained and processed using image processing algorithms to detect any defects on the labels before dispatch.

Results: The printing defects on the labels such as missing letters, words, lines, and disorientation of alignments.

Conclusion: Euclidean distance method was used for comparison that yielded 95% accuracy in removing tablets with printing defects.

Keywords: Blisters, Print defects, Image processing, Labels, Segmentation.

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INTRODUCTION

Pharmaceutical industry requires stringent quality control measures to enable customer satisfaction. Quality assurance during packaging stage is of critical importance within the pharmaceutical industry to avoid defective packaging and recalls [1,2]. Packaging the tablets along with details of tablets are printed on the blisters to ensure the reliability of the tablets. Hence, it becomes necessary for the printing details to be clear to the customers. Images of printing labels can be obtained from the production line using the appropriate camera. Image processing techniques can be used for identifying defects in pharmaceutical blisters and remove them from the production line.

Image feature for color printed image using sift method [3] can be used to detect defects rapidly and effectively but cannot be employed for complicated images. Image processing methods are widely employed for detecting number plate detection. MOB-Lab technique employed [4] using geometrical transform and morphological process for detecting critical shadow conditions on real-time lane and roads. The above technique is difficult for detecting patterns. High-speed image scanning algorithms can be used to detect edges and boundaries [5] for line defect detection in web offset printing. The above technique can detect non-uniformities that appear, but the image quality is slightly inferior when compared to other printing. The surface defects on rail surfaces [6] such as cracks, groves can be detected using image processing but cannot match patterns and can be employed for surface defects only.

Defects on wood surface such as bruises, knot holes, and wormholes can be measured using roughness [7] using traditional algorithms, but pattern matching cannot be achieved. Image segmentation algorithm [8] to measure the quality of fit of estimated flow can be implemented that is computationally expensive and is sensitive to various noise. SVM classifier can be employed for fabric defect [9] detection and sorting them using image processing techniques. Defect detection on PCB [10,11] effectively done using image processing techniques. Skin disease detection [12] can be quickly identified using image processing methods.

MATERIALS AND METHODS

Camera was placed on the production line for obtaining the printed labels at Kausikh Therapeutics Private Limited, Chennai, for identifying defects in printing. Matlab tool was used for carrying out the various

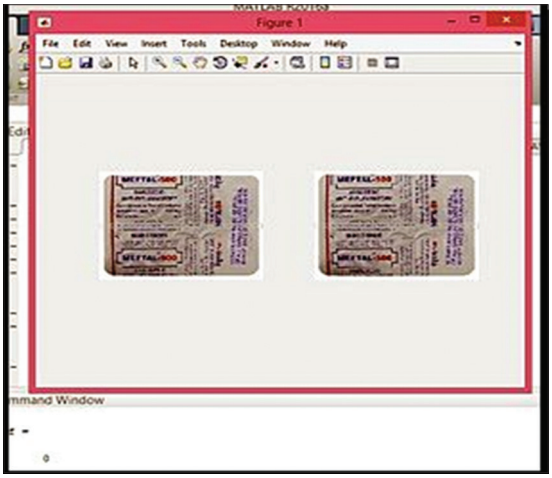

Fig 1: Guide image and test image without defect

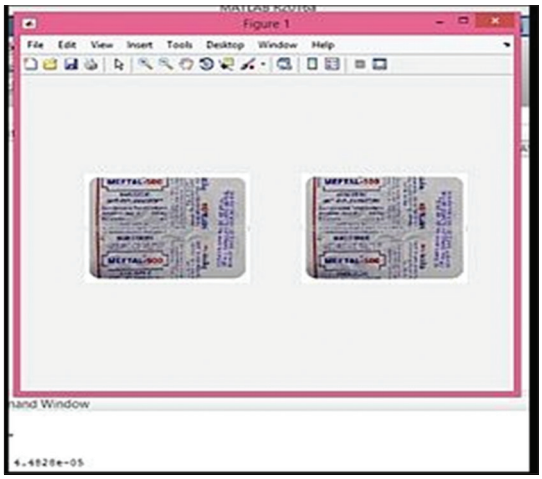

Fig 2: Guide image and test image with defect.

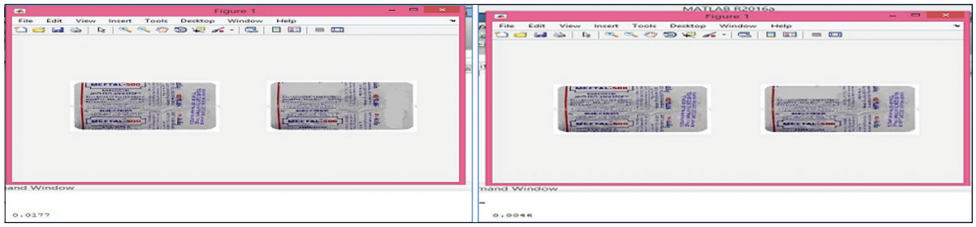

Fig 3: Guide and test image with single and multiple missing segments

Table 1: Euclidean value for various printing defects

Defects	Euclidean value
No defects	0
2% for noises	0.0011
One word not in the label	0.0014
One line segment not in label	0.0015
Deletion of word is not clear	0.0016
Overlapping line on the label	0.0018
Two-line segment not in label	0.0026
Missing multiple line segments	0.0049
Missing multi-content of segment	0.0237
Missing group of multi-content segment	0.0634
Fully missing content	0.2764

Table 2: Statistical results showing the accuracy of the algorithm

Printing defects	Identification accuracy
Single letter defect	98
Word defects	95
Line defects	90
Segment defects	90
Fully missing	100

image processing techniques. Training phase consists of initially capturing a perfectly printed label with all details, verified and stored in the database. Testing phase consists of identifying labels with various print defects using image processing techniques. The algorithm and method used for defect identification are given below.

Algorithm (printing label defect identification)

Training phase

- Step 1: Load guide image
- Step 2: Convert image from RGB to gray scale image
- Step 3: Obtain the normalized histogram of the image
- Step 4: Store the various parameters of the image as guide image in the database.
- Step 5: Stop

Testing phase

- Step 1: Load test Image
- Step 2: Convert image from RGB to gray scale image
- Step 3: Obtain the normalized histogram of the image
- Step 4: Obtain the difference between the guide image and test image using Euclidean distance.
- Step 5: If the distance measure exceeds the threshold value then reject the image else accept the image.
- Step 6: Stop.

RESULTS AND DISCUSSION

The above algorithm was implemented using Matlab and the results of the comparison of guide image and test images are given below. The Euclidean distance for various defects for the guide and test images is shown in Table 1.

The Matlab window displaying the Euclidean distance between the guide image and testing image is shown in Fig. 1 with no defects and Fig. 2 displays with (missing words) in the testing image.

The following Fig. 3 shows single and multiple segments missing from the blister.

Decision on determining the threshold value for rejecting the blister and further removing from the production line is very vital. It was decided that 0.0012 as the threshold value for removal of blisters from the production line. The statistical results on identifying the defective labels using the above threshold are given in Table 2.

CONCLUSION

Euclidean distance method has proved to be a simple and robust method to identify the defects such as missing words, lines, and segments in the testing images. Hence, it can be used to implement the above method on the production line to detect the defects on printing labels on completing the training phase. The accuracy was 95% where most of the missing words, lines and segments were identified and further removed from the production line. Future work is to identify the missing tablets in the blisters.

AUTHORS CONTRIBUTION

All authors have equal contribution in bringing out this article.

CONFLICT OF INTEREST: No.

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