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Inspection of Capsules using Image Processing and Removing Defective Capsules

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Abstract: Real-time quality inspection of capsules manufacturing in pharmaceutical applications is an important issue from the point of view of industry productivity, competitiveness and quality aspect of the product. Pharmaceutical products are susceptible to several common flows like incorrect size or colour, surface defect, missing, broken capsules. To guarantee every capsule is free of defects, each capsule must be inspected individually. We proposed system which we have compared different approaches of image processing for detection of defective capsule and presence of category of defects.

Keywords: Deep Learning, ResNet50, CNN, Python, Feature Extraction.

I. INTRODUCTION

Pharmaceutical industry produced drugs in very large scale. These drugs play most important role in human life. Medicines become part of human life. But during manufacturing there may be defects in tablets so it need proper inspection. Hand-operated inspection of these tablets that are manufactured on massive scale takes lots of time and hence it is a very challenging task. So, here some methods for identifying defects in tablet blister using image processing are proposed. Image processing is a method which is used to perform some operations on an image, in order to get an enhanced image or to extract some meaningful information from it. Image processing is a type of signal processing where input is given as an image and output may be image or characteristics or useful features associated with that image. Image processing provides so many benefits to science and technology as on modern society digital images have a greater impact. Some types of image processing Techniques are used to detect defects in tablet blisters. Blister Packing is used by pharmaceutical industry to package tablets and capsules. The need for good accuracy and flawlessness with regard to the products as well as the packaging in the pharmaceutical industry, these blister packs need to be checked correctly.

II. LITERATURE SURVEY

Sudharshan et.al [1] proposed median filtering used to remove noise while retaining edges and region based bounding box properties are used to exactly mark the boundaries of the tablets in the blister. The system is implemented in MATLAB which helps in automatic detection of defects that occur in tablet blisters after its production. The system uses a median filtering technique to remove noise from an image. It then uses thresholding to convert the gray image to a binary image of tablet blister. By using bounding box property of MATLAB, it draws a rectangular box around each tablet on the tablet blister hence detecting the boundary of each tablet. By using the region properties, the system helps in detecting foils in tablets like cracks, wrong colour, missing tablets or size variance from one tablet with others. Finally, the system separates the defected tablet and non-defected tablet using if condition.

Deepti and Rajiv [2] proposed Enhanced feature extraction technique which is implemented with the different type of tablet blisters and capsule blisters. There are so many methods for the detection of broken or missing tablets in tablet blister. Here it uses two technique one is centre of mass and other is colour segmentation. In the Centre of Mass, we calculate the centres of each tablet in tablet blister, if centres are detected then the tablet is present in the tablet blister, if centre is not detected then tablet is broken or absent.in the Colour Segmentation Method, template matching are used colour Detection are applied on the blister of Capsules. There are two images of blisters, the first image of the blister with Missing Capsule and another image of the blister with all Capsules present in capsule blister. By applied matching operation on pixels of these two images, we concluded that there is a missing capsule or not. That is, if the pixel values are same then there is no missing capsule in capsule blister. If these values are different then capsules are missing. The number of capsules which are present is displayed in the results. The Centre of Mass method easily detects broken and missing tablets in tablet blister. The colour detection method can detect any colour of capsules or tablets in the blister only by changing the value of colour. Thus we can say that both the methods are easy to implement and shows their results of blisters precisely

Shobha Rani Et.al [4] proposed methodology performs the automatic inspection and verification of tablet blisters in three phases like pre-processing, segmentation, classification, and recognition. In the first phase, the pre-processing of the

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tablet blister is performed by applying various spatial filtering techniques and gray level intensity transformations to convert the input image into a gray image. The second phase focuses on the segmentation of tablet pills using horizontal and vertical histograms on a finalized image obtained from a well-pre-processed image. The third phase performs the feature extraction, classification and recognition of the segmented components of the image into either of classes like a valid tablet, broken tablet, unfilled tablets, and half-filled tablets by extracting correlation features of each segmented components. Once the classification is performed the tablet pill is considered to be a recognized one.

Huvaidaet.at [5] proposed statistical method which used to find the defect in tablet blisters. RGB image of the tablet blister is converted into gray and then it converted to binary. The binary image has noise so in order to get a noise-free image of tablet blister, some morphology opening is used to remove the noise. Boundaries of the output are detected after pre-processing operations. After this pre-processing determine the roundness of each tablet in tablet blister, find the area and perimeter of each tablet. After calculating area and perimeter, find the metric of each tablet in the tablet blister. Metric which closer to 1 indicates that tablet is not broken or tablet is completely round.

Munish et.at [6] propsod Canny Edge Detection and RC Algorithm which are used to find the defective tablets in the tablet blisters. It consists of the steps which include pre-processing, edge detection, and template matching and calculating the matching percentage. It was implemented with different samples of capsules and tablets blister. This approach covers all the aspects of the defects related to shape, size of the tablets or capsules. This algorithm can be implemented in many digital Image processing environments and it can be a part of complex automated manufacturing and testing system of image. Canny and RC algorithm is the most powerful edge detection techniques and can easily detect the edges of each tablet in the tablet blister.

Shilpa and Arun[7] proposed The Centre of Mass (COM) edge detection technique with Prewitt Operator is used for detecting edges by knowing the centre of the tablets in the tablet blister. This method can be used as a template for multi-scale edge detectors for processing with different types of images. From the experimental result and analysis, it is concluded that the COM with using Prewitt Operator Technique provides better results. Centre of Mass method calculates the radii of each tablet in the tablet blister and hence helps in determining the edges of each tablet in the blister. The centre of each tablet in the blister is detected by using Centre of Mass if centres are detected then the tablet is present in the blister, if not then the tablet is broken or missing. Similarly, we applied the Centre of Mass to count the number of capsules in the blister. We take an image of the blister with all Capsules present in the blister. Find the distance between the Centre of Mass with all the pixels along the boundary for each tablet. Find out the range and select the object having greater than equal to the selected range. Thus Total no of capsules present in the blister is calculated.

Peng and Shutao [8] proposed a novel approach for tablets vision inspection to find the defects in tablet blister based on Fourier descriptors for feature extraction and SVM for classification is proposed. The Fourier descriptors method is used to extract the boundary features of tablet image effectively and the SVM classifiers are very suitable for high-dimensional samples of tablet features extracted. Experimental results demonstrate the method's efficiency and application value in a tablet inspection system for the pharmaceutical industry

Hardeep and Nidhi [9] proposed Harris Algorithm which used for Feature Extraction and Pattern Recognition in the blister. Using this algorithm, the corners are efficiently detected. It finds the defects related to shape, size and surface types of defects in the pharmaceutical drugs. Harris algorithm can efficiently detect the interesting point in the tablet blister image. It can also help in comparison to a test image of the blister with the template image. The first step is the Pre-processing of the input image. Image enhancement is used as Pre-processing of the input image. The best de-noising method of the image is the median filtering. Harris Algorithm is used for feature extraction and Pattern Recognition of the tablet blister. The main components in this algorithm are detection, description, and matching. Detection, identify the interest points and then to get the corner score of the pixel of the tablet image. The matrix for the tablet image is then computed. Points with larger corner response which is greater than some threshold are found. Description, extract the vector feature descriptor surrounding each interest point that is Correlation matrix is determined around interested points in the tablet image. Then Take the points of local maxima and Perform non-maximum suppression. Finally, it finds the correspondence between the descriptor in two views by Auto-correlation. If there is a correlation mismatch then defects are detected in the blister. These work approaches detect all the aspects of defects related to the shape, size and surface defects of the pharmaceutical drugs.

Table 1 Literature Survey

Sr. no.	Name of author and paper	Advantages	Limitations
[1]	Sudharshan Duth P, Shehran Ahmed Haji Ameen, Kareem Baig "Dynamic Detection of Anomalies in	This proposed method can detect the defected tablets accurately with 95% accuracy.	Anything relatively small in size compared to the size of the neighbourhood will have minimal affect on the value of the median, and will be filtered out.

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	Pharmaceutical Blisters using Image Processing"		
[2]	Deepti, Rajiv Bansal, "Enhanced Feature Extraction Technique for Detection of Pharmaceutical Drugs"	The Canter of Mass method easily detects broken and missing tablets in tablet blister. The colour detection method can detect any colour of capsules or tablets in the blister only by changing the value of color.	Accuracy is low
[4]	N. Shobha Rani, Nithusha V . K. , Roshna T. P "Automatic Recognition And Verification Of Defective Tablet Blisters Using Entropy Based Filtering And Histogram Processing"	Simple, effective and low complexity.	It may increase the contrast of background noise, while decreasing the usable signal.
[5]	Huvaida Manzoora, Dr.Yogeshwer Singh Randhawa, "Edge Detection in Digital Image Using Statistical Method"	It is concluded that the whole process takes less than 2 seconds of time.	It deals with quantitate chars only; it does not deal with isolated measurement.
[6]	Munish Kumar Dhiman, Dr Rajat Gupta, "Detection of Broken Blister using Canny and Rc-algorithm"	This approach covers all the aspects of the defects related to shape, size of the tablets or capsules.	it is time consuming, due to its complex computation
[7]	Shilpa, Arun Bhatia, "Enhanced Center of Mass Technique for Detection of Missing & Broken Pharmaceutical Drugs"	This method can be used as a template for multi-scale edge detectors for processing with different types of images.	More costly and depend on variation of parameter, it uses lot of memory during processing
[8]	Peng Zhao and Shutao Li "Tablets Vision Inspection Approach Using Fourier Descriptors and Support Vector Machines"	the method's efficiency and application value in a tablet inspection system for the pharmaceutical industry	Resistance to noise, occultation and non-rigid deformation is very high
[9]	HardeepKaur, Er.NidhiGarg, "Inspection of Defective Pharmaceutical Capsules using Harris Algorithm"	These work approaches detect all the aspects of defects related to the shape, size and surface defects of the pharmaceutical drugs.	it can be only applied in a single scale, and it is difficult to implement multi-scale corner detection.

Identifying defects in tablet or capsule blisters is an automated visual inspection of pharmaceutical drugs. In The inspection system of tablet blister image processing techniques are used. There are so many image processing techniques which are used to detect defects in tablet or capsules blister. Detecting some defects in tablet blister is a major subject of industrial inspection that includes a large area of products. In this paper, we present a study on all the techniques for the detection of broken tablets using image processing techniques in an object-oriented image processing software. All The algorithms can be implemented in various digital image processing environments and can be a part of a complex automated manufacturing and testing system. The methods used by different author in paper [1]-[9] can easily detect broken and missing tablets. Thus we can say that all the methods are easy to implement and showing their results precisely. But they also suffers specific limitation, therefore it is important to define new system.

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III. PROPOSED SYSTEM

Real-time quality inspection of capsules manufacturing in pharmaceutical applications is an important issue from the point of view of industry productivity, competitiveness and quality aspect of the product. Pharmaceutical products are susceptible to several common flows like incorrect size or colour, surface defect, missing, broken capsules. To guarantee every capsule is free of defects, each capsule must be inspected individually. In this paper we have compared different approaches of image processing for detection of defective capsule and removing of defected capsules.

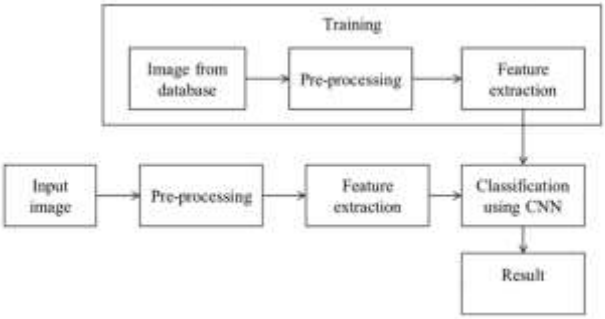

Fig 1 proposed system

Neural networks are a set of algorithms, modelled loosely after the human brain, that are designed to recognize patterns. They interpret sensory data through a kind of machine perception, labelling or clustering raw input. The patterns they recognize are numerical, contained in vectors, into which all real-world data, be it images, sound, text or time series, must be translated.

IV. RESULT

Fig 2. Registration Page

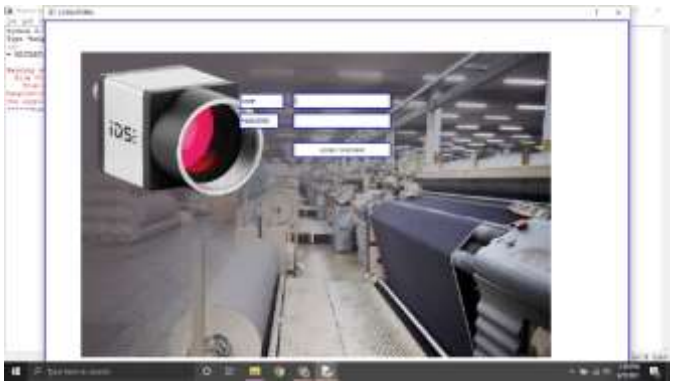

Fig 3. Login Page

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Fig 4. Capsules Image

Fig 5. Gary image

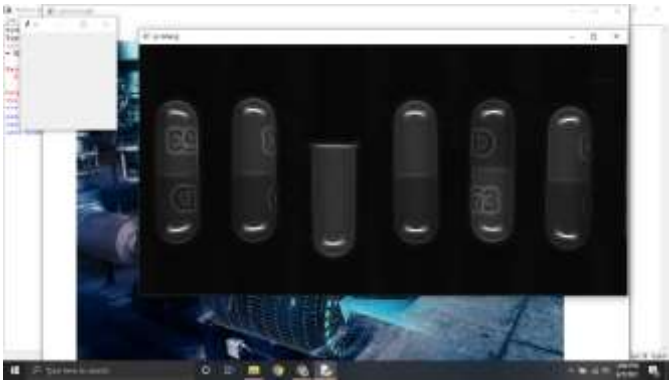

Fig 6. GF image

Fig 7. Defect Detected

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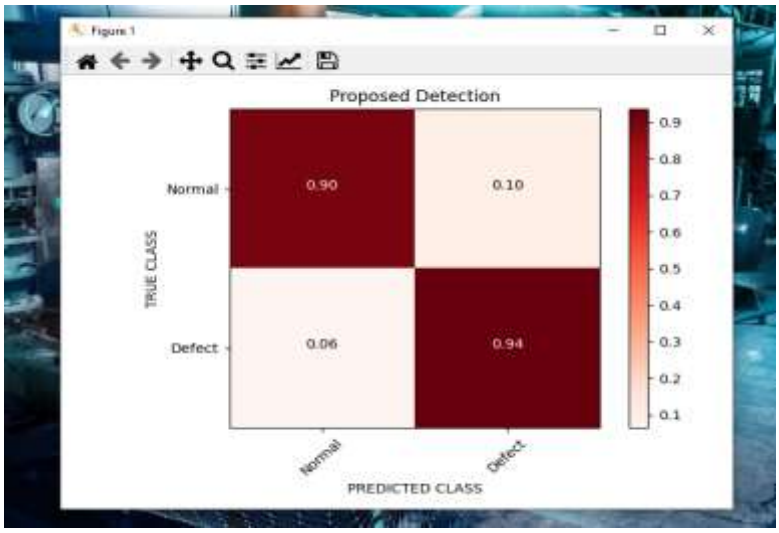

Fig 8. Accuracy

V. CONCLUSION

Identifying defects in capsule blisters is an automated visual inspection of pharmaceutical drugs. In The inspection system of capsule blister image processing techniques are used. Detecting some defects in capsule blister is a major subject of industrial inspection that includes a large area of products. In this paper, we presented a study on convolutional neural network technique for the detection of defected capsules using image processing techniques in an object-oriented image processing system. Defects like crack, holes, dents, size and cuts are detected by the system. Accuracy of detecting a defect by this system is 94 percent.

VI. RESULT

It suggests that radionics features can provide additional strengths over the image features extracted by the CNN model. Compared Retentive with Rest-Net and Rest-NetAtteRadi with Re-entered, we observed that the attention mechanism could effectively boost the classification accuracy.

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