

# A Review on Application of Image Processing for Automatic Inspection

Hema L. Chavan., Santosh A. Shinde

## Abstract

Automation plays vital role in any mass production manufacturing industries. Accepting or rejecting final component before delivery to customer depends on its accuracy of required dimensions and other features. To assure quality; such as dimensions and features of final manufactured product checked manually in almost all manufacturing industries. Manual inspection is costly, time consuming, sometimes inaccurate and manual inspection for complicated shapes is very difficult so also the method is destructive in some cases. Again human judgment is influenced by prior knowledge. To overcome these problems quality control management for sensitive industrial product is possible using image processing technique. In this paper literature survey has been carried out to study application of image processing for quality control management. Different techniques used for feature extraction of industrial product are summarized here. Use of image processing to inspect complicated industrial product will increase speed of inspection as well as give assurance of product quality by reducing manual errors.

## Keywords

Image processing, Feature extraction, Quality control management

## 1. INTRODUCTION

Image processing is one of the most increasing areas now days. By converting analog image into the digital system and using digital image processing technique it is possible to extract various features from the image. The edge detection process used to simplify the analysis of images by drastically reducing the amount of data to be processed, while at the same time store useful geometrical information about object. There is certainly a great deal of variety in edge detection applications, but it is felt that many applications share a common set of necessities. These requirements give up an conceptual edge detection problem, the solution of which can be applied in any of the original problem domains. [12] Here in this paper various types of features extraction techniques are discussed.

As shown in fig. 1.1; any manufacturing industry follows typical cyclic process during manufacturing products. Quality assurance is very important to withstand in market. Measurement and monitoring are very important steps to in quality management cycle which gives assurance of quality of manufactured product. Computers can be used for automatic measurement and monitoring of manufactured product. To check quality of manufactured product it is necessary to identify defects in manufactured product to stay away from delivery to customer. One of the most important operations on digital image is to identify various kinds of defects. Thus to identify the defects from any image some methods are established and placed. Generally, the edges are representation of the discontinuities of image intensity function. There could be various reasons such as lighting conditions, object geometry, type of material surface texture,

and their mutual interaction for discontinuities. Edge detection algorithm is primarily a process of detection of this discontinuities in an image.

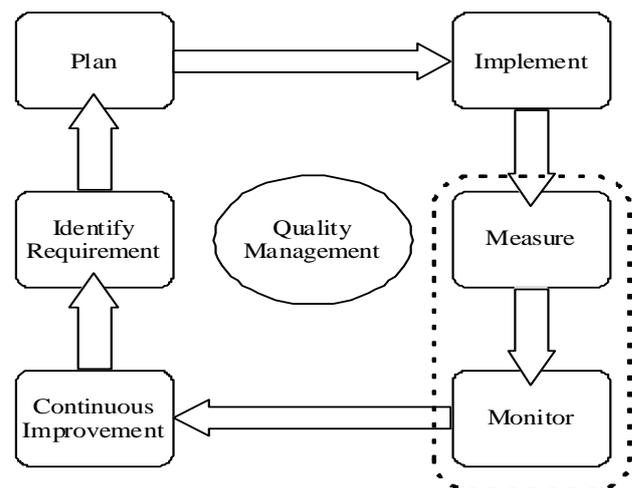


Fig.1 Quality Management Cycle

Monitoring of product quality is required for continues improvement. Based on previous attempt to achieve customers' requirements by redefine and planning same procedure can be repeated.

## II. APPLICATIONS AND FEATURE EXTRACTION TECHNIQUES

Feature plays a very important role in image processing applications like character recognition, face recognition, defect detection in industrial products. J. M. Sebastian et al. (1994) [10] developed a system that works out an automatic inspection of the bill sheet. The inspection algorithm is performed in two different stages, first off-line stage and second on-line stage. Using this system speed of inspection increased from 400 to 3600 sheets/hour.

Steve (1994) [18] implemented the Multimission VICAR Planner (MVP) system, which uses models of the image processing programs to automatically make executable image processing procedures for radiometric correction, color triplet reconstruction, and simple mosaicking tasks. For these tasks MVP reduces effort to generate an initial PDF for an expert analyst from 1/2 a day to 15 minutes. MVP uses classical operator-based planning techniques to solve sub-problems produced by the decomposition based planner.

Q. M. Jonathan Wu et al. (2001) [14] designed a 3-D sensing system applying artificial intelligence methodology for quality assurance in automatic manufacturing processes. Using a single 2-D CCD camera, laser structured light, and fuzzy techniques for rule based decision making, it is possible to successfully interpret 3-D view. The surface

environment information can be converted into the orientation, curvature, and depth of the shape to incorporate into the symbolic 3-D object oriented information base and reasoning algorithms.

Suzana Vasilic and Zeljko Hocenski (2006) [19] used the edge detecting method for surface and color defect detection in ceramic tile. The methods were the Canny edge detector method and the sub-pixel corner locator method. The Canny edge detector method is the optimal detector that first smoothes the image, then finds its gradient, does non-maxima suppression and threshold to eliminate insignificant edges. The detected defect were cracks, scratches, spots and blobs and better results achieved by the Canny edge detector method. For simplicity second derivative edge detector operator such as laplacian of gaussian operator can be used. [1]

Zhou Xing-lin and Peng Kai (2009) [20] introduced method using the principle of subtraction to separate the image of LEDs from the original image efficiently at the first step of the image processing. CCD camera and background were kept invariable at the time of measurement to obtain the efficient data of image from subtracting image background with lighted LEDs. The method of object recognition includes image binarization, contour extraction and ellipse tracing, etc. Sobel operator is used to detect edge around light spot in image using first order differentiation.

Diwan P. Ariana and Renfu Lu(2010) [3] used hyperspectral imaging technique for non-destructive and non-contact sensing of surface color and bloater damage in whole pickles. Principal Component Analysis (PCA) was applied to the hyperspectral images of the sample pickle for damage detection and to model color of the pickles. Simultaneous hyperspectral reflectance and transmittance imaging is useful for color and internal defect detection of pickles.

Domingo Mery et al. (2011) [4] developed X-ray imaging technique for effective detection of fish bones in the quality control process. The steps of methodology for this work include image acquisition, preprocessing, segmentation, feature extraction, classification and post-processing. This work yielded a detection performance of 100%, 98.5% and 93.5% for large, medium and small fish bones respectively.

Gopinath Bej et al. (2014) [7] used of X-ray imaging technique for estimating the silk content and to determine the quality of cocoons. GRNN (General Regression Neural Network) method is used for estimation of the silk content. For the grading purposes SOM (Self Organizing Map) algorithm has been used and result shows that it can easily classify the cocoons and grade accordingly.

S. Dutta et al. (2013) [17] studied application of image processing technology applied for tool condition monitoring. The digital image processing techniques are very useful for automatic, fast and easier detection of various types of tool wear which are very difficult to recognize by other modes.

R. S. Jadhav and S. S. Patil (2013) [16] presented a fruit size detecting and grading system based on image processing. The fruits' size detecting algorithm was based on its symmetry; mainly contains two parts: finding the shape and axis of fruit in the image.

Renata Klein et al. (2014) [15] used image processing technique for bearing diagnostic. Gang Li et al. (2014) [5]

used image processing for long distance precision inspection for bridge cracks. Murthad Al-Yoonus et al. (2014) [12] compared accuracy of using 3D edge deflections detection is compared with 2D. Results showed that in many cases, 3D edge deflections detections assist the decision making better than 2D edge detections algorithms. Here Principle Component Analysis (PCA) is used to extract features.

### III. LITERATURE SURVEY SUMMARY

Sr. No.	Author and Year	Work	Methods / Algorithm	Tools / Parameters
1	John Canny, 1986[9]	Computational approach to edge detection	Feature synthesis ; Gaussian Operator	Edge points and profile
2	Mitra Basu, 2002 [11]	Survey on Gaussian based edge detection method	Gaussian Filter	Edge detection
3	Suzana and Zeljko, 2006 [19]	Colour and surface defect detection in ceramic tiles	Canny edge detector and the sub-pixel corner locator method	Thresholds , minimum distance
4	D. Lu and Q. Weng, 2007[2]	Survey on techniques for improving image classification performance	Remote sensing, classification process	Remote sensing and GIS
5	N. Senthil kumar and Rajesh, 2009 [13]	Survey on Edge Detection Techniques for Image Segmentation	Soft computing approach based on the Fuzzy logic, GA and NN	Edge detection
6	Diwan P. Ariana and Renfu Lu, 2010[3]	Evaluation of internal defect and surface color of whole pickles	Hyperspectral imaging	Reflectance and Transmittance
7	H. Abdi and Williams[8]	Analysis of data from table	Principal Component Analysis	Points in maps
8	D. Mery et al., 2011[4]	Automated fish bone detection using X-ray	Image acquisition, preprocessing, segmentation.	X-ray

Sr. No.	Author and Year	Work	Methods / Algorithm	Tools / Parameters
9	Gaurav and Pradeep, 2014 [6]	Survey on feature extraction in image processing systems	Various image preprocessing techniques like zoning, resizing etc.	Image features
10	G. Bej et al., 2014[7]	Quality inspection of cocoons using x-ray imaging technique	GRNN, SOM	X-ray
11	M. A. Yoonus et al., 2014 [12]	Accuracy of using 3D edge deflections detection in comparison with 2D	2D and 3D edge deflections detection algorithms, PCA	Mismatching and misshaping

#### IV. CONCLUDING SUMMARY

In this paper, the image processing technique and application of image processing technology for automatic inspection and defect detection is discussed. The digital image processing techniques are very useful for automatic, fast and easier defect detection and quality control of various types of products.

Future research should be aimed to develop a system including lighting, camera and faster algorithm for real time quality monitoring technique which can replace manual inspection of industrial product. However, a nondestructive and less costly quality inspection method can be implemented with the help of digital image processing techniques through robust machine vision system.

Although lot of research carried by different researcher in images processing, there is scope to apply images processing techniques for quality control management of industrial product.

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**Ms.Hema L. Chavan** obtained her B.E. Degree in Computer Science and Engineering in 2014 from Solapur University and Doing Post graduation in Computer Engineering in VPCOE, Baramati.

**Prof. S.A.Shinde** obtained his B.E. Degree in Computer Engineering in 2003 from Pune University and Postgraduate Degree in Computer Engineering from Pune University 2010. He has approved Undergraduate and Postgraduate teacher of Pune University and has about 12 yrs. Of teaching experience. His autobiography has been published in Marquis Who's Who 2012 magazine. He has to his credit more than 20 research papers at National and International Level. He has also obtained IBM RFT Certification with 100% score.