

# **Role of Computer Vision in Automatic Inspection System**

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## **ABSTRACT**

Computer vision is the process of acquisition, processing and analysis of real world scenes in order to take different decisions based on applications. Computer vision systems are electronic replacement of human visual ability. Applications of computer vision systems are wide. This paper reviews the progress of computer vision in various fields of automatic inspection systems. Since conventional defect detection systems are prone to many disadvantages, computer vision with its efficiency and cost effectiveness is emerging as the latest revolution of technology. At the end of this paper, some advantages and disadvantages of computer vision and a suitable area and method for further research are also discussed.

## **Keywords**

Computer vision, Automatic inspection systems, Biscuit inspection.

## **1. INTRODUCTION**

Image Quality control is the most important factor for any manufacturing industries. Since the conventional defect detection methods are slow, subjected to errors and time consuming, most of the industries now opt for automatic inspection systems. Also, the increasing production speed and high labour charges also paved way for the fast existence of this new trend. Increased expectation of high quality products from customers made the industries more responsible. As a solution to these problems, artificial vision based automatic inspection systems arrived. Decreasing size and cost of computer vision systems [7] with increasing functionality, power efficiency and ease of use is making such systems an inevitable device of industries and factories. Camera, lighting system and an image processing [6] unit is the main components of every computer vision based automatic inspection system. In this paper it is described some of the gesture detection systems and the related algorithms used, results obtained, challenges faced etc. Rest of the paper is organized as follows. Section 2 describes the motivation and related work and section 3 presents some of the hand gesture detection systems, their recognition methods, applications and design challenges etc. Section 4 discusses a performance

## **2. COMPUTER VISION**

Human vision means understanding the world by looking into it. Computer vision is also the same except the medium through which knowledge is gained is a machine, most probably, a camera. The whole applications of computer vision can be classified on the basis of its functionality as:

- Inspection: associated with part verification, detection and classification.
- Sorting: associated with part identification and recognition.
- Gauging: associated with dimensional characteristic measurement and tolerance checking

Invention of two core technologies laid foundation for all computer vision systems. They are CMOS (Complementary Metal Oxide Semiconductor) and CCD (Charge Coupled Device). CMOS has the advantage of long battery life, less heat dissipation and better performance. CCD is noted for high image quality and greater sensitivity. When multiple cameras are used for image capture, then that technology is called stereo vision.

## **3. GLASS DEFECT DETECTION**

Glass defect detection [3] comes under the class automatic surface detection system of computer vision. After the production of glass sheets, it is sent to defect detection unit for testing purpose. Various type of defects that may be present in the glass are foreign materials stucked to glass tops, dark marks or scratches that may occur due to careless transportation, air bubbles inside glass and presence of impurities. For detecting foreign materials [10], the surface is scanned using a laser light. Two estimators which is widely used in computer vision applications, model-fitting estimator and Least-square estimator, are used for inspecting scratches and impurities. Canny edge detection algorithm is used for locating impurities present in glass. Then a rectangular region is drawn around these areas and it is then segmented out.

#### **4. INSPECTION OF FOOD AND AGRICULTURAL PRODUCTS**

In food and agricultural industry, quality inspection systems play a significant role because human hands in assessment of quality factors like flavour, appearance, nutrient, texture, etc. is inconsistent and slow. Therefore computer vision forms a suitable alternative to automate this process. In [9], Computer vision has been used to pick up fresh strawberries on the basis of size and shape with an accuracy of 94%. Grain quality inspection was the first application of computer vision in the field of food processing in 1987. First, image is grabbed using a mounted CCD camera [1]. Then image is converted into a suitable colour space and enhancement is done to solve noise and low contrast problems. Features are extracted and feature classification is done using neural networks and fuzzy systems. Finally image is segmented out for inspecting each factors. Use of RGB cameras is not sufficient to detect fruit decay. Therefore hyper spectral sensors must be used for such image acquisition.

#### **5. COMPUTER VISION IN ROAD SAFETY**

Computer vision plays a major role in traffic signs and road maintenance for providing road safety [2]. First step is the detection of vertical traffic signs and its recognition. Inside the vehicle, a camera is mounted which is looking towards the road. An infrared illumination system is positioned on the rooftop of vehicle. A Hough transform is used for the identification of rectangular signs, triangular signs, arrows and circular signs. Edge is detected using canny. Then these detected signs are classified, validated and a report is generated

#### **6. FABRIC INSPECTION IN TEXTILES**

Weaving defects of cloths are inspected using computer vision and image processing software[5].Importance of fabric inspection lies in delivering high quality textile materials. Components used are camera, lighting system, transport encoder for giving timing pulses, frame grabbers for converting camera image to digital image and an image processing unit. Fast Fourier transform approach is used here.

#### **7. CIGARETTE PACKING INSPECTION**

For high package quality, inspection and classification of cigarettes packed in a container is important[4].Cross sectional view of cigarette packet is grabbed using a camera and it is then converted into a different colour space. Boundary of each object and its centroid is then calculated. Using this, no: of object in the case in counted. Cases containing joined objects are rejected.

#### **8. FACE DETECTION AND FACE RECOGNITION**

Face is the most important part in the human body to identify a person. Human faces are the most photographed item in this world. Face detection [8] is the art of distinguishing faces from non faces present in an input image. In face recognition [9], a face is automatically identified and verified from a large database. Various methods have been developed for face detection and recognition and they can be broadly classified as knowledge-based methods, template matching methods, feature- invariant methods and appearance based methods. All these method uses algorithms which operate on receiving an input from a computer vision systems such as camera.

#### **9. METHODOLOGY OF MY RESEARCH WORK**

The existing bakery inspection systems are inefficient to give the real time robust inspection of the quality of the biscuits. The focus of the Research in the area of biscuit inspection is to build a robust and high speed system which will process 5 biscuits per second with a false rejection of 1%. Also the work focus on exact crack detection, shape detection, proper bake detection and no: of almond detection.This work is an industrial application which will decide the quality of the rich biscuits. It can be built in real time. As a part of NDA (Non Disclosure Agreement), the name of the company and biscuit model are kept confidential.

##### **9.1 Tools used**

- Scientific python
- OpenCV
- Linux
- IBM PC or ARM architecture

#### **10. ADVANTAGES**

- Easy and quick way to acquire data
- Fast and objective for visual feature measurement
- Undisturbing manner of information collection
- Reduce visually intensive workload of humans
- Possible to make permanent record for future analysis
- Fast recalling of values
- Generate precise and accurate data
- Cost effective, efficient and robust

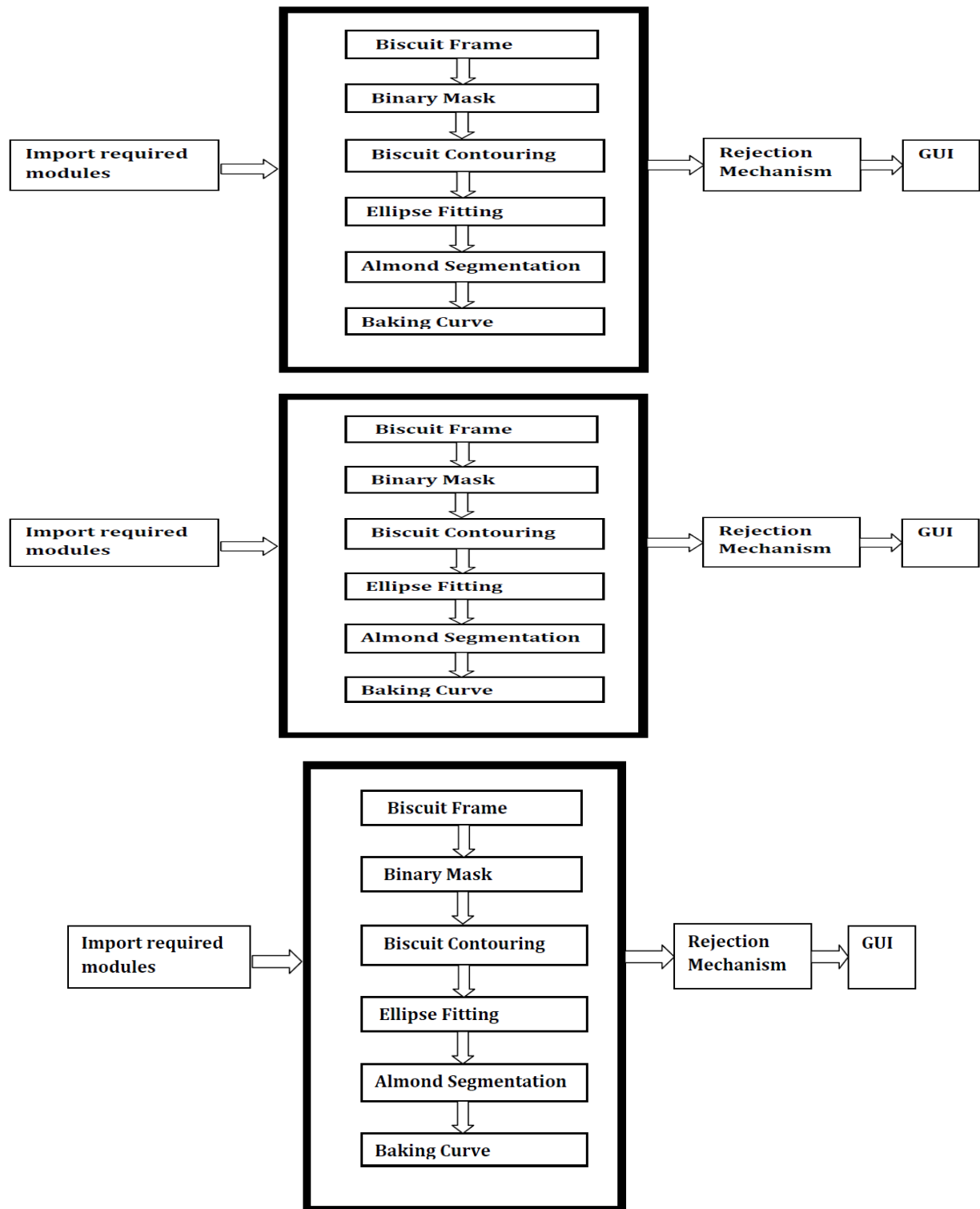


Fig 1: Methodology

## 11. DISADVANTAGES

- Converting collected data into useful information is very challenging
- Unable to detect objects in complex backgrounds
- Accuracy affected by climate and illumination
- Artificial lighting is required in many applications.
- Large amount of redundant data is generated
- High processing time and memory requirement

## 12. CONCLUSION

Currently computer vision based automatic inspection systems is one of the most active research area and the technology has covered a long way starting from 1995. Even though the technology has developed, there are still many areas where the ideas still not implemented. My project focus on developing an computer vision algorithm which can efficiently inspect the quality of biscuit. Paper also summarizes several application fields of computer vision based inspection systems along with their advantages and disadvantages.

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