DETECTION OF DEFECTIVE ON JONAGOLD APPLES WITH IMAGE PROCESSING

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Abstract— Nowadays, the development of image processing techniques has shown the impact of technology in the industry. Varieties of applications in the work of awareness and cost reduction activities have been developed in recent years, especially in agriculture. Previous years in various agricultural areas intact and defective products, although there have been studies on the separation should display hardware features of the computer where the processing as well as image with failure because of the techniques used in processing the desired efficiency is achieved. A computer again Jonagold apple varieties using advanced image processing techniques with advanced hardware features Starting from this point, which is made of those who work for the separation of defective. Therefore, people made this an industrial process that occurs in the hand, aimed to reduce costs and improve quality. In this study, treatment with OpenCV image processing in a breath of fresh apples on images obtained with the software focused on performance. To be well-optimized image processing techniques can avoid the problems experienced. Using an open source C and C ++ languages, "Computer Vision" library of optimized image processing software by using OpenCV software means based on the detection of defective pre-treatment have been made apple. Apple displays and receipt of necessary image processing techniques and the optimization of the images obtained using a filter description. Different techniques, systems using the devices and operating system versions running performance were tested.

Index Terms—Defects, Image Processing, Jonagold apple, OpenCV, Performance.

I. INTRODUCTION

Today, image-processing techniques have been used in many fields. Detection of disease in medicine, car license plate recognition, face recognition systems and palms, agricultural and industrial systems are the main field. The size of the fruit, such as apples companies operating in the industrial, agricultural, color, shape, and by the presence of defects divides the International Quality Assurance and classifying categories. This is the first industrial grade on two quality criteria are automatically classified according to the presence of flaws but the fruit is not yet sufficient productivity and repetitive, require manual operation, unsafe and expensive method [1].

The machine vision is used for the classification of the apples is optionally carried out in four steps; obtaining images, the division of the images obtained, classification and interpretation of the resulting fruit [1]. Of course, such processing efficiency and the processing time is important. Therefore, real-time (real time) image processing method will give faster results. OpenCV obtain images using a USB or built-in camera can be performed using software acquisition. If there is more than one camera system should be given the necessary camera IDs and IDs are entered as a parameter to the relevant functions in OpenCV software [2].

In this context, obtaining images using OpenCV software apples, gray level conversion threshold, mean filter, median filter, abrasion, made pretreatment and performance such as expansion process were evaluated.

II. MATERIALS AND METHODS

In this study, image-processing operations on the images of Jonagold apple varieties are made. This procedure was tested for viability and performance.
In practice, Intel Core i5 2.6 GHz processor, 6 GB of RAM capable connected to the computer 2 providing two CCD(Charge Coupled Device) cameras lighting is positioned at an angle 45o'lik obtained images through the reflector and real-time displays are processed. Desktop applications and testing operations on the Visual Studio 2012 platform was developed with C # and C ++ programming languages. Performance improvements in image processing is utilized to provide OpenCV library.
OpenCV was developed using a picture or video in the relevant information by removing the INTEL C and C ++ languages to handle, open source "Computer Vision" is a library. Computer Vision (Computer Vision / Vision) named using the initials of the words CVE component, basic image processing functions and Computer Vision / high-level algorithms structure used for the blind is one of the hosts five major libraries. [2]. OpenCV library is licensed under the BSD(Berkeley Software Distribution) license. This license code area known as the free people in free licenses, is free to use as they wish [3]. Academic and commercial use of the library is free for Windows, Linux,MacOS X can be used on different platforms such as [4]. In the scope of this study, OpenCV library is used for the following reasons:
Gray Level Transformation: The aid received by the camera RGB (Red, Green, Blue) format image of the skin is converted into a gray level in order to undergo further processing. Gray level conversion in a pixel's

red, green and blue values of weights indicated on the rate of reduction is done with a single value [5].

Thresholding: Image is converted to gray level. The threshold value is selected as 128. The pixels that are over the threshold assigns as 1 means that are white pixels, otherwise these are 0 means that are black pixels.

Average: The average values of each pixel with the neighboring pixels are formed by writing instead of collecting its value. This procedure is done using a core matrix of 3x3 luxury. Thus softening the image, it would be made.

Median: the median as the average of the values found in the nuclei 3x3 matrix and is written instead of the pixel value. The median filter is used to reduce noise in the image [6].

Erosion: Still a 3x3 matrix core value on showing to instantly match the image made 1 0 is done in other cases. Wear and expansion of operations to reduce the roughness of the image, closes the pores, used to reduce indentations [7].

Diffusion: Edges of a region expands to outward. 3x3 convolution matrix is applied on the image. When a pixel matches the center of the convolution matrix, all pixels under the matrix are set to 1.

III. APPLICATION

Apple on the received images with OpenCV software, which may benefit from the OpenCV library function, the gray level transformation, thresholding, mean filter, median filter, wear, image processing techniques including pre-processing such as expansion processing is used. These practices could occur in real-time, performance of the image processing application process is very important. In addition, three-dimensional identification system to be used due to the global properties of apples [1].

After obtaining images of apples must be removed in healthy and imperfect in this image. Image processing techniques for this and segmentation should be performed. For images segmentation process was characterized by the color, shape and texture features. Thus, the segmentation process was provided to be more healthy. Detection of apple, images of related operations of segmentation and defect detection are shown in Fig1.

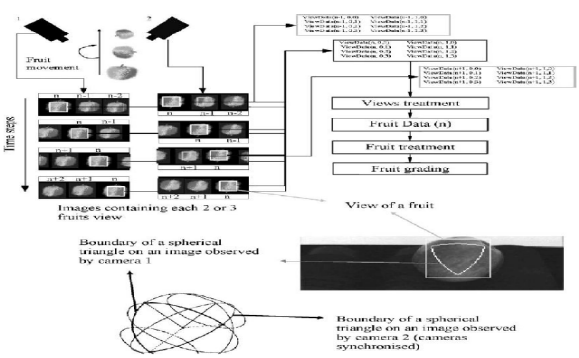

Fig. 1. The detection of defectives on Jonagold Apples

Applied the necessary image processing and performance tests were compared (Table 1).

Table 1: Comparisons of Performance Tests of Image Processing

Programming Language		C# (Not Optimised)
Tested Device		Samsung RV520 (i3 processor 8GB RAM)
Tested Operating System		Windows 8.1
Image Processing Operations	GrayscaleTransformation	71,6 ms
	Thresholding	11,23 ms
	Meanfilter	2334 ms
	Medianfilter	2876 ms
	Erosion	3254 ms
	Dilation	3103 ms

Programming Language		CPP+OpenCV
Tested Device		Samsung RV520 (i3 processor 8GB RAM)
Tested Operating System		Windows 8.1
Image Processing Operations	GrayscaleTransformation	3,3 ms
	Thresholding	1,2 ms
	Meanfilter	13 ms
	Medianfilter	32 ms
	Erosion	13,34 ms
	Dilation	12,56 ms

Programming Language		Java+OpenCV
Tested Device		*CASPER CN-V5D5200X* (i5 işlemci 6GB RAM)
Tested Operating System		Windows 7
Image Processing Operations	GrayscaleTransformation	3,17 ms
	Thresholding	3,45 ms
	Meanfilter	12,23 ms
	Medianfilter	29,75 ms
	Erosion	5,57 ms
	Dilation	6,015 ms

CONCLUSIONS

Pre-processing required for the removal of the feature vector to be used for the identification of defective apples in studies conducted with OpenCV, assessed in terms of performance and reached the conclusions:

1. In terms of performance, applications developed with OpenCV functions, the optimizing C # function that gave much better results.
2. OpenCV library made using image processing operations, ready stemming from the use of function efficiently and fast.
3. Jonagold apple varieties due to the color characteristics of healthy tissue can reduce the success rate of this system may be perceived as flawed.
4. Systems can be further developed in cooperation

with agencies and companies operating in the agricultural field.

5. Used and required artificial neural network, by creating and taking advantage of the OpenCV library of database segmentation just not the type of Jonagold other fruits and vegetables in this operation.

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