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A Defect Tea Leaf Identification Using Image Processing

Abstract: *This paper introduces defect identification on tea leaves during production .This frame work introduces an active learning strategy through a set of passively trained leaf parameters. Under the supervision of support vector machine the trained parameters and input image are compared to know the characteristics of the leaves This algorithm is been used for identification of defective leaves using image processing techniques and for the removal of defective leaves through real time techniques.*

Streszczenie. *W artykule opisano metodę oceny jakości liści herbaty w procesie produkcji. Na wstępnym etapie układ trenowany jest do rozpoznawania uszkodzonych liści z wykorzystaniem metody SVM. W metodzie wykorzystuje się narzędzia graficznej przetwarzania obrazu. (**Identyfikacja uszkodzonych liści herbaty z wykorzystaniem metod przetwarzania obrazu**)*

Keywords: detection, rejection, image processing and real time techniques, SVM, Haar filter.
Słowa kluczowe: przetwarzanie obrazu, defektoskopia, liście herbaty

Introduction

In tea dust production there are different types of qualities available for the consumer usage. The quality of the tea dust has been based on the character of the leaves. The character of the leaves are acquired under different circumstances. The defects of the leaves are usually observed through its colour, irregular shape and oter diseases. These are the following ones that causes the quality of tea to be bad so these are the following factors that has to be examined during production .

While on the human work supervision sometimes these parameters are failed to be observed. So, to avoid that, we are using image processing techniques and real time techniques.

Image processing has been introduced to identify whether the leaf is a defective one or a good one. Real time techniques are been used for removal of defective leaf. However, in image processing techniques normal identification do not have good accuracy. Hence, we must train the processor about the leaf characteristics. To observe that we train the tea leaves through image processing algorithm then for the removal of leaf we are transferring message of the characteristics of the leaf in the processor itself, to remove the leaf using the real time techniques.

Techniques

(a)Tracking and identification

In the image processing techniques identification part of defect leaves are done using image processing algorithms. Certain image processing algorithms do not match for this techniques (Table 1) denotes about the techniques hence we must know about the characters of leaves that has been used for good quality production. To study the characteristics of the leaves, it is to be trained to the processor using image processing algorithm. support vector machine algorithm is been used to identify the defect on the leaves [2]. In SVM techniques a set of parameters has been trained on this algorithm about the leaves then image that has been as input is compared on this algorithm and the defect has been identified on this as good or bad.

The comparison parameters of the leaves is been trained on their characteristics such as colour, shape, & disease on processor. The input image that has been identified by camera compares the image of leaves with the trained leaves as parameters of the leaves that has been trained to the processors then after analysis of the processors leaf is identified as good or bad leaf for the production.

Table 1.

RESEARCH STUDY	FEATURE EXTRACTION	LEARNING, CLASSIFICATION	SELECTIVE SAMPLING QUERY	TARGET OBJECT
Abramson and Freund 2005	Control points	Ada-boost	Seville visual interface	Pedestrians
Kapoor 2007	Sift+Pca	SVM	Probalastic selective sampling	Various objects
Enzweiler and Gavrila 2008	Haar wavelets	SVM	Probalastic selective sampling	Faces
Roth and Bischof,2008	Haar wavelets	online boosting	Manual initialization +tracking	Various objects
Vijyanarasimhan and k grauman,2008	local features	SVM	Semi automatic annotation-based selective sampling	Various objects
This paper,2013	Haar wavelets	SVM	A active learning methoda set of passively trained leaf parameters	Tea Leaves

(b)Rejection:

In this paper we are not only identifying the leaf quality we are getting it into rejection part also after identification. To reject defect leaves we are introducing real time techniques for rejection part. The real time techniques are introduced here to increase speed on rejection part and work on accurate timings while the conveyor bed that has been used to move the leaves for production section uses induction motor to run conveyor belt .The speed control of the conveyor motor is given to processor to stop and run conveyor belt according to the processor control conveyor motor runs.

While stepper motor has been used for rejection of the defect leaves (Fig 5) denotes about defect leaves. Stepper motor has been placed with slider plate that be moved forward and backward using stepper motors. These Stepper motors character are well know it works step by step angle which can be used to operate forward and backward this character of stepper motor helps us to work in rejection part. The stepper motor rejection slide plate has been placed close to side of conveyor belt which rejects leaf when controller operates while leaf is defect stepper motor control is also been controlled by processor.

Algorithms& filters:

(a) Haar filter

Discrete wavelet transform (DWT) is a wavelet transform for which the wavelets are discretely sampled [4]. As with other wavelet transforms, a key advantage it has over Fouriertransform is temporal resolution: it captures both frequency and location information (location in time. For an input represented by a list of 2^n numbers, the Haar wavelet [5,6,7] transform may be considered to simply pair up input values, storing the difference and passing the sum.

This process is repeated recursively, pairing up the sums to provide the next scale: finally resulting in 2^n-1 differences and one final sum.

(b) Gabor filters:

Gabor filter, Gabor filter bank, Gabor transform and Gabor [1] wavelet are widely applied to Image processing, computer vision and pattern recognition. This function can provide accurate time-frequency location governed by the Uncertainty Principle. A circular 2-D Gabor [1,8] filter in the spatial domain has the following general form such Gabor filters[8,9] have been widely used in various applications.

In addition to accurate time-frequency location, they also provide robustness against varying brightness and contrast of images. Furthermore, the filters can model the receptive fields of a simple cell in the primary visual cortex. Based on these properties, in this paper, we try to apply a Gabor [1,8] filter

(c) SupportVectorMachine (svm):

SVM has proven its efficiency over neural networks and RBF classifiers. Unlike neural networks, this Model builds does not need hypothesizing number of neurons in the middle layer or defining the centre of Gaussian functions in RBF. SVM [1,2] uses an optimum linear separating hyper plane to separate two set ofdata in a feature space. This optimum hyper plane is produced by maximizing minimum margin between the two sets. Therefore the resulting hyper plane will only be depended on border training patterns calledSupport vectors The support vector machine operates on two mathematical operations: (1) Nonlinear mapping of an inputVector into a high-dimensional feature space that is hidden from both the input and output. (2) Construction of an optimal hyper plane for separating the features discovered.

Experimental analysis:

In this paper the leaf that possesses a super quality has to be made for the production process. Hence, while the image has been detected by the camera the picture has been taken for the comparison with the training leaf. While the SVM techniques have been used to separate the two factors normal leaf and defect leaf.

The captured image has been taken and Haar filter has been used to improve the foreground and background of the picture that has been taken as a input while after the improvement of foreground and background then Gabor filter has been used to improve texture that has been used on the image texture is important factor on a picture after the improvement on texture the message is sent to the controller.

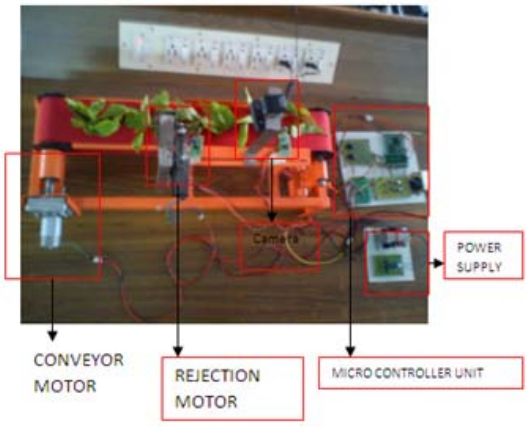

Fig.1. Experimental setup

The controller has been doing process to identify the defective leaves and their image have been compared to the trained leaf. This is carried out through svm especially to compare and denote the defect or normalcy as per the separation on the leaf identification of the following samples are tested. While in this paper, identified leaf image has been compared to the training pattern of SVM techniques and the leaf has been identified as a defect leaf conveyor dc motor has been stopped and rejection stepper motor starts for rejection process stepper motor rejects defect leaf after the defect leaf rejection conveyor dc motor starts running. When there is no defect on leaves the conveyor motor runs continuously fig (4) denotes about normal leaves.

Block diagram:

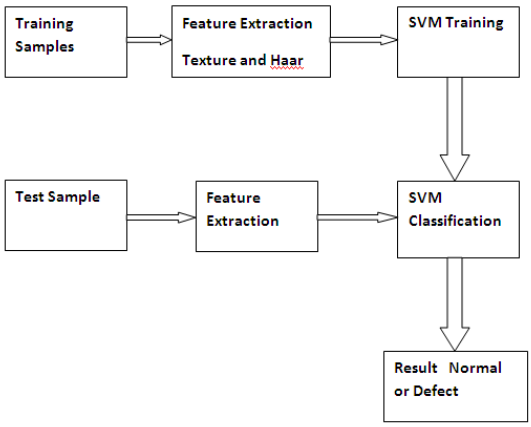

Fig 2 Circuit diagram

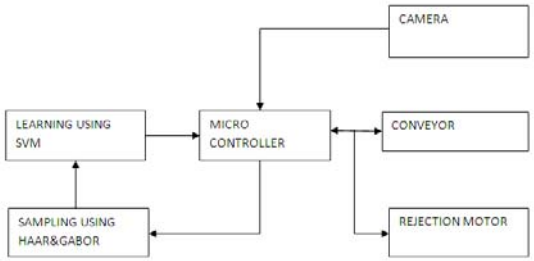

Fig 3 Circuit layout

Sample leaves

SAMPLE LEAVES: Normal leaves:

Fig.4. Camera capture good leaves

Sample defective leaves:

Fig 5 Camera capture damaged leaves

Tabulation &graph

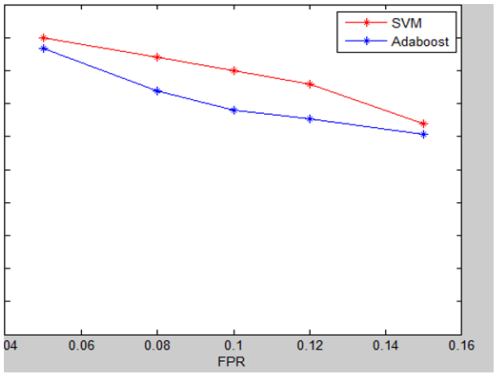

Fig 6 Represents the false throughput and true Positive rate of svm and ada boost algorithm

Table 2. Presentation of the values between adaboost and svm filters

Learning, classification	Feature extraction	TPR(true Positive rate)	FPR(false positive rate)	Time
Adaboost	Haar	0.9338 0.8406 0.8689 0.8271 0.8034	0.0662 0.1594 0.1311 0.1729 0.1966	3.9020 3.8630 4.4541 4.3892 4.7482
SVM	Haar	0.9500 0.9200 0.9000 0.8800 0.8200	0.0500 0.1000 0.1500 0.0800 0.1200	3.3000 3.6000 3.8000 3.7000 4.0000

Conclusion:

In this paper leaf identification and rejection is been done using the above discussed techniques. From the experimental analysis image processing techniques knows about the characteristics and identification of leaf rejection part is been done using real time techniques. From the analysis the quality of leaf can be improved.

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