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Gender Segregation of Silk Moths in Cocoon Stage

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A B S T R A C T

Silk moth sex identification and its automation is one of the important processes within sericulture industry because sex identification can assist in effectively separating the male and female moths in early stages of silkworm seed production process which could avoid unregulated mating process and automation enhances the precision and mass production. The gender detection and separation methods are done based on the average weight of the cocoon during pupa stage using weighing machines manually or based on size and physical structure of matured moths are handpicked by experts before they will mate. This conventional method of gender detection and separation prone to increase in error rate, time consumption, labour and decrease in production rate and quality of eggs. In the proposed system, high precision weighing sensor with microcontroller detects the accurate weights and colour of the individual training samples and the K-Means linear regression model can able to accurately fix the threshold for statistically varying physical weights in nature. Then based on the threshold the test samples are segregated into male and female cocoons. The linear regression model can identify the threshold from the set of physical weights of individual training samples and system can able to segregates 700 to 800 samples per hour which increases the rate of segregation process and accuracy tremendously compared to traditional segregation techniques by approximately 95%. And also here we have implemented identification of cocoon breed based on colour using image processing.

Keywords:Cocoon, Breed identification, Gender identification, Image Processing, Convolutional Neural Network, Raspberry Pi.

1. INTRODUCTION

A report by Central Silk Board exhibit that India globally ranks 2nd within the total silk production only behind China. However, India gives only 15% of world silk production as contrasted to China's massive 85%. The most reason that may be identified for such a large disparity is lack of automation within the sericulture process. Automation is that the use of control systems for handling different processes and machineries to interchange human efforts. Automated systems generally utilize complex algorithms which lower manual efforts, time consumption. It also prevents danger which could occur when humans are made to figure in hazardous environments. Thus, utilization of automation is effective in manufacturing industry. Sorting supported weight is finished in many industries to make sure the standard of the article is consistent and up to the mark. Automated sorting also reduces the labour cost and also the production time. The error caused because of human negligence are avoided using automated system. Success of sericulture hangs on quality silkworm eggs. The grain ages are the places where silkworm seeds are produced. In grain ages, parental seed cocoons are reared additionally as preserved under optimum conditions. The sexes of pupae or matured moths are acknowledged and accordingly male and females are reared separately. Following their emergence, healthy man and feminine moths are allowed to mate and oviposit by different methods. The gender detection and separation methods are done supported the common weight of the cocoon during pupa stage using weighing machines manually orsupported size and body of matured moths are handpicked by experts before they'll mate. This conventional method of gender detection and separation susceptible to increase in error rate, time consumption, labour and reduce in production rate and quality of eggs. Hence the implementation of science and technology to the following level within the place of conventional method is way needed.

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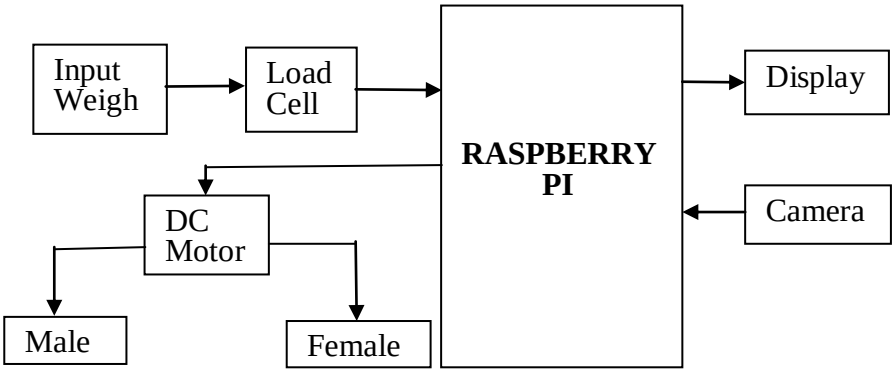
2. PROBLEM STATEMENT

The industry is faced with several difficulties which result to reduced productivity. One in all the foremost common kind of problem facing these industries include gender discrimination. Within the case of silk worm culturing, gender discrimination affects the standard produced and gotten from the aesthetic worms within the production cycle. Therefore, this paper seeks to supply a literature review and analysis of written information concerning the problem of gender discrimination within the silk industry. In the proposed system, high precision weighing sensor with microcontroller detects the accurate weights and colour of the individual training samples and therefore the K-Means statistical regression model can able to accurately fix the edge for statistically varying physical weights in nature. Then supported the edge the test samples are segregated into male and feminine cocoons. The linear regression model can identify the edge from the set colour and of physical weights of individual training samples and system can able to segregates 700 to 800 samples per hour which increases the speed of segregation process and accuracy tremendously compared to traditional segregation techniques by approximately 95%.

3. OBJECTIVES

Design and develop of statistical algorithm to find the weight of cocoon for gender separation and colour of the cocoon for breed identification. Designing a prototype which can segregate the cocoons based on the weight and colour. Analyse the quality of the Cocoon and log the data for further analysis.

4. SYSTEM DESIGN



Load Cell

Load cell calculates the weight of the cocoon when the cocoon is made to fall automatically on the load cell one by one. As the weight of the female cocoon is more than male cocoon it automatically differentiates as male and female cocoon.

Camera

After the calculation of weight the camera opens and captures the cocoon image and based on image processing it identifies colour of the cocoon and if the colour of cocoon is white it identifies as CSR2 cocoon breed and if the colour of cocoon is yellow it identifies as Pure Mysore breed cocoon.

Raspberry Pi

The Raspberry Pi is the brain of our project. The equipments we have used are connected to Raspberry Pi. Load cell calculates weight and sends it to Raspberry Pi and based on the weight input it automatically separates male and female cocoon and also through image processing breed of the cocoon is identified.

DC Motor

DC Motor automatically segregates the cocoon through the strip connected to it and the male and female cocoons fall in their respective trays.

5. METHODOLOGY

We implemented a smart system for the gender segregation of cocoon based on weight and breed identification based on color. The load cell measures the weight of the cocoon, once the cocoon placed the camera opens. The camera is implemented to capture the input image and send to the raspberry pi, the gender of the cocoon is segregated by its weight and calculated weight matches the threshold. The classification of the cocoon is done by the CNN algorithm. The male and female cocoon separated by the mechanism of the auto regression model. Then the camera will open to detect the colour of the

cocoon. If the colour of the cocoon is white the system will classify it as CSR2 breed cocoon, if the colour of the cocoon detected yellow, it will classify it as Pure Mysore cocoon.

COLOR IDENTIFICATION ALGORITHM

This system is designed to identify the breed of the cocoon. There are two sets of cocoons used in the research with different type of sizes and gender. Each set contains of between 10-14 pieces of cocoon. Each image of the cocoon is captured in four different positions and the images are captured. It has three main stages: pre-processing, feature extraction and ripeness classification.

PRE-PROCESSING

In the pre-processing stages, the captured images are resized so as to scale back the colour index of the pictures. Each image of the cocoon is extracted by pixel into its red, green and blue colour component as displayed in Figure. These red, green and blue colour components are displayed in gray-scale index.

FEATURE EXTRACTION

In comparison with the mechanism of normal human eyes, a breed of the cocoon is decided by a straightforward glance of the eyes to the majority colour that dominates the cocoon. In a very micro scale observation, the colour of a Mysore breed cocoon is not totally all yellow as there'll some black dotted colours or still any green-yellow colour skin. Therefore, from these principles, each pixel of the colour a part of the image is analysed and rescaled into three groups. Within the feature colour extraction, the histograms are normally used as a feature vector. For instance, Swain and Ballard have introduced the initial idea of using histograms in indexing of huge image database. Besides, a binary histogram is proposed in using the image gray scale level. In 1995, a colour histogram is utilized as feature in colour recognition. As for the intensity of colour component that lies between 0-85, the image are going to be rescaled to 0, for the colour component that lies between 86-170, it will be rescaled to 122 and for 171-255, the colour component are rescaled to 255. Therefore, colour histograms are granted for each colour component by counting the number of pixels that have same colour scales in the image array as displayed within the example in Figure. These histograms are used because the feature vector to work out the breed of the cocoon by employing a simple heuristic method. Some samples of cocoon will be allocated in the CSR2 folder and few samples of the Pure Mysore cocoon will be allocated in Mysore folder. The results of these two types of those samples are saved in an Excel file and therefore the data are sort out randomly and will be utilized to train the network because the input patterns for the Neural Network developed using OpenCV.

6. CONCLUSION

The work presented in this project represents a kick-off in modern sericulture automation to eliminate human intervention in classifying silkworms based on gender in the cocoon stage without damaging the shell.The developed system has the potential to boost the productivity of grain age centers who are currently carrying out the gender classification process manually.The results obtained during testing showed a maximum accuracy with demonstrating a potential suitability of the proposed method for industrial applications. Our proposed method is also able to identify Pure Mysore breed and CSR2 breed cocoon. In conclusion, it is evident that the silk industry has been ventured. Silk production highly relies on the ability of any industry to differentiate between male and female worms. The productivityrates are highly dependent on the ability to enhance reproduction in the worms. Classifying them into different genders could be achieved through the use of various models as outlined in the above proposed system.

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