



# Advanced Convolution Neural Network Approach for Optimized Detection of Coffee Beans

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*Abstract— Evaluating the color of green coffee beans is an important method for determining their consistency and market price. This measurement is generally carried out by visual inspection or by using conventional instruments with some limitations. The purpose of this thesis was therefore to create a computer vision framework that would produce CIE (Commission International d'Eclairage) L\*a\*b\* measurements of green coffee beans and identify them according to their color. Artificial Neural Networks (ANN) were used as a transformation model was used to classify coffee beans by the Bayes Classifier, in four distinct groups: white, cane green, green and blue-green.*

## I. INTRODUCTION

Color is an important characteristic that is commonly used for the measurement of food quality and is a crucial factor in the reception of food on the market. In the physical features in green coffee beans, color is of great economic value as discolored beans are correlated with lower retail values. While recent advances in coffee bean quality measurement, such as the study of hyper spectral photographs, remain a major factor in the marketing of the commodity. CIE L\*a\*b\*, the International Color Measurement Standard introduced by the Commission International d'Eclairage, has been used worldwide for food color measurement because it has a standardized distribution and because it is a device-independent color space. Traditionally used instruments for color analysis in CIE L\*a\*b\*, such as colorimeters and spectrophotometers, typically only consider small and uniform surfaces. This weakness has contributed to the need to improve machine vision systems.

The tools traditionally used to measure color in CIE L\*a\*b\*, such as colorimeters and spectrophotometers, normally only consider small and uniform surfaces. This limitation has generated the need to develop computer vision systems. A computer vision system typically consists of a digital camera for images, a standard lighting system and image recognition and interpretation tools. Quantitative color information is obtained by image processing from digital images and analyzed for fast and intrusive color measurement. This method, which can be referred to as a digital colorimeter, is less expensive and more versatile than the use of traditional instruments to measure color.

## II. LITERATURE REVIEW

Due to the data checked findings, the coffee bean roast degree can be recognized Classified by the neural network techniques of back propagation. The identities of the coffee For a maximum value of epoch 1000, fixed targets for precision achieved 97.5 percent. THIS The greater the importance, the greater the precision. The study will be recognized in the following Combine other enhancement approaches. There are some features of coffee beans roast. Any people, but, The coffee beans roast degree can not be understood. We propose to establish a method in this study Digital image analysis to understand the roasting stage of coffee beans Back propagation neural network classification.

The measures include collecting the Image data collection, preprocessing, gray-level co occurrence matrix ( GLCM) features extraction and finally normalization of data extraction using decimal methods photos Features for scaling. The values of decimal scaling characteristics become the classification input Network of neuronal back propagation. We use the back propagation approach to classify the Roast coffee beans.

The findings have shown that the approach suggested will classify The precision of coffee roasts is 97.5 percent. Coffee is one of the world's most popular drinks. In the cultivation of chocolate, This is a roast phase which will yield a number of roasts of coffee beans.

Industry wants to pick the right quality in an increasingly successful and protected way. For a demanding market, coffee beans. Factors essential are color, morphology, style and size helping to recognize the best quality beans, however traditional, visual and/or visually oriented strategies To satisfy the criteria, mechanical inspection is not necessary. This paper therefore offers An Arduino Super board image recognition and machine learning methodology, In choosing the top quality green coffee beans, to assess these four essential considerations. That's why. The aim is to define the quality of coffee beans and their closest neighbor algorithm Default forms corresponding. The method involves conceptual procedures, the retrieval of images and the supervised learning algorithms programmed with MATLAB and then implemented Board of Arduino. The results demonstrated that the classification of each system is very successful. Green coffee beans can accommodate many of their key visual features by recognizing them. In a single photo, coffee beans present. Statistical analysis indicates that the mechanism can defects and recognize them High precision quality.

The artificial approach to the collection of quality coffee was helpful Beans and beans can be beneficial for growing demand, cutting demand time and enhancing quality management. Every day in the world, more than two billion cups of coffee make up coffee The world market's most valuable drink commodity[1]. Therefore, coffee and the Over the years the market for coffee beans of good quality has increased[2]. Important characteristics in Color, morphology, shape and scale [3] are part of a physical presentation mechanism for collection. Thereby, Quality evaluation of green coffee beans has become a big market price problem, storage. Stability and general approval by customers .

Deficient during development from green beans to coffee bean packs Bean removal is one of the most labour-consuming steps (or quick, deficiency removal) and a significant number. Companies are researching this phase automation to minimize human effort. In this book, We are suggesting the DL-DBIS, along with a deep learning faulty bean inspection system Structured automatic marked data raise method GAN (generative adversarial network) (GALDAM) for the improvement of the scheme proposed, so that bean removal is automated For coffee industries, robotic weapons may be further developed. The scheme proposed is targeted to provide a deep-learning object detection module with an appropriate model for accurate Defects between dense beans may be established. The GALDAM can be used to cut work substantially Price, as data labeling in this form of solution is the most labor-intensive task.

## III.EXISTING SYSTEM

1. Strong coffee selection methods are significant. The farmer cultivates and picks coffee fruits to add the coffee to the cup from the harvest.
2. Particularly significant during processing, drying and storage is the level of coffee fruit ripening and mould contamination.
3. The seed must dry and remove the fruity portions of the seeds as the two main moves for coffee consistency and character.
4. Since some of the important coffee beans are considered to have a bad condition, black beans are one of these flaws. Black grapes typically come out of grain harvest or grain harvests that are eventually created by the rose.
5. Exposure to humidity, sun, and insect damage can also result in black beans. Black beans can be labeled unroasted coffee beans with a surface of over 25 percent black, deep-blau and dark-brown.

6. The typical method of identifying coffee defects such as black beans has been used by a general inspection and a naked eye examination.
7. This approach is long and non-congruous since it is subjective and depends on the person who makes a distinction between black and ordinary bovine.

*Problem Statement*

The traditional approach to the identification of coffee defects like black beans is usually seen and only naked looks. This approach takes considerable time and lacks coherence, since the person carries out a mission to distinguish the black booties from normal boots.

*Objective:*

The aim is to cultivate coffee specializing in the treatment of different flavors, aromas and acidity. This is because of the signature smell of the coffee roast from the beginning to the green beans. The research has shown how to construct a green bean machine.

**IV. PROPOSED SYSTEM**

1. This approach presents a computer vision system to analyse and classify green coffee beans based on computational intelligence techniques. The findings demonstrate that it is possible to specify the colour of the coffee beans in the CIE  $L^*a^*b^*$  colour space with accuracy and objectivity in this method.
2. To do this, it had to be: i. Using an appropriate lighting device in a dark picture chamber; ii. Configure the right parameters on a digital camera; iii. Pick colour charts reflecting colours that are identical to those used in green coffee beans; and iv.
3. To translate colour spaces of RGB into CIE, train the Transformation Model, consisting of three neural networks. Their classification has been an simple task (linearly divided classes) after accurate steps for the CIE  $L^*a^*b^*$  values for green coffee beans, and we achieved a 100 % classification accuracy with Naive-Bayes.
4. Thus, the entire system developed herein is capable of distinguishing the colours of green coffee beans achieving results consistent with coffee experts who classify coffee beans using visual inspection.
5. Finally, coffee farmers may use the computer vision technology to evaluate green coffee beans and the process can be applied to other food sectors to enhance product characterization and thus to improve the quality of foodstuffs.

**V. SYSTEM IMPLEMENTATION**

*Coffee samples*

Our sample consisted of green beans harvested from commercial Arabica (Coffee Arabica L.) coffee, supplied by coffee farmers from Minas Geris Province, Brazil. Using the SCAA and COB processes, we picked 50g (30 per hue) samples of the following color groups: white, orange, cane gray, and bluish-green. The most commercially used colors correspond to certain colour classes.

*Architecture*

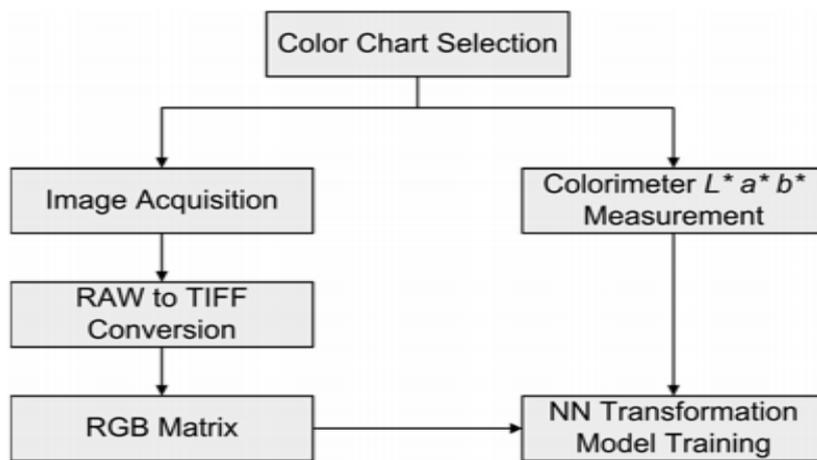


Fig:1 Procedure for processing classification of coffee beans

### Computer vision system

The computer vision system developed in this study consisted of:



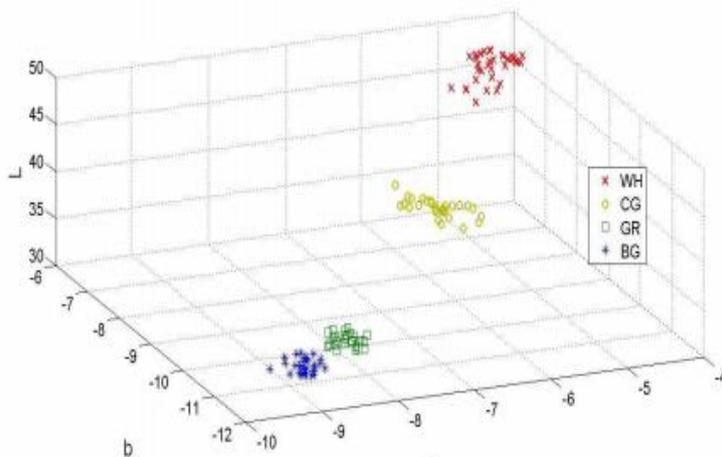
Fig 2:- Image acquisition system developed to classify coffee beans

- a dark metal chamber which minimizes background light and removes outside light interference (Fig. 2);
- a Canon Powershot G12 digital camera with 10 megapixels resolution installed 40 cm above the sample plane, with the following settings: no flash use, fluorescent white balance, f/6.0 aperture, 1/10-s exposure, and ISO 160 speed;
- Intense white illumination of two tube lamps with an intensive duration of 57 cm and a color temperature of six hundred thousand. The lamps were mounted at 45 degree angle to the sample plane 40 cm above the sample and the light intensity over the samples was uniform;
- a personal computer and image editing applications.

### VI. INTRODUCTION RESULT ANALYSIS

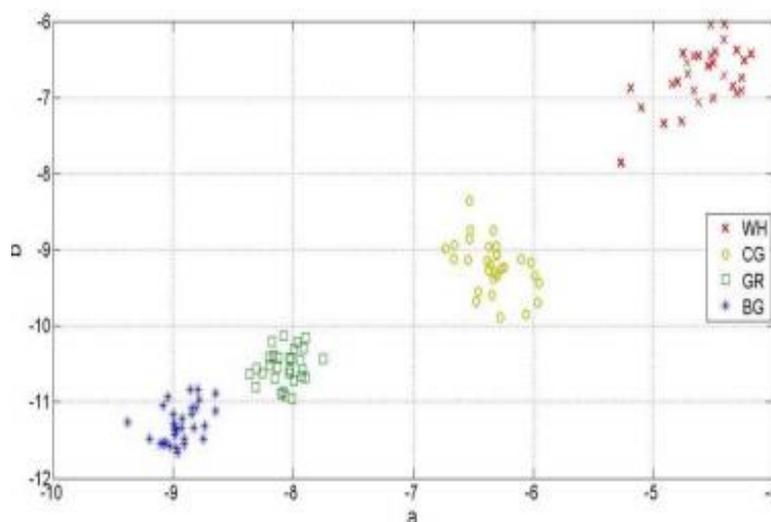
	Training	Validation
$e_L(\%)$	2.33%±2.23	2.26%±1.96
$e_a(\%)$	0.63%±0.51	0.57%±0.43
$e_b(\%)$	0.64%±0.64	0.62%±0.60
$e_c(\%)$	1.20%±1.24	1.15%±1.01

Table 1. Mean, ± standard deviation of error, obtained by the color space transformation models based on artificial neural networks (ANN).



	L*	a*	b*
Whitish	46.78	-4.62	-6.75
Cane Green	40.84	-6.35	-9.15
Green	32.83	-8.07	-10.56
Bluish-Green	32.49	-8.93	-11.27

Table 2. Mean values (m) of attributes (color units) for each class of the Naive-Bayes classifier



### VII. CONCLUSION

This research demonstrates a machine vision method for the identification and recognition of green coffee beans based on computer technology. The findings show that the method built allows the color of coffee beans in a CIE L\*a\*b\* color space to be accurate and impartial. To do this, it had to be: i. Use an effective lighting device in a dim picture chamber; Digital camera setup with the right configuration; iii. Choose color diagrams describing colors similar to those commonly used in green coffee beans. Shape the three-neural network transition model from RGB to CIE L\*a\*b\* color spaces. Train the transformation model.

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