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SIMPLE CODED IDENTIFICATION REFERENCES OF HARVESTING TIME FOR OIL PALM FRUITS

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Abstract: The ripeness grading of oil palm fresh fruits is very important. The conventional practice in the oil palm factories is to grade oil palm manually by sending some samples to laboratory. This method takes two weeks to get results and may subject to dispute. An automated grading system for oil palm fresh fruits using Red, Green and Blue colors system is used as an alternative way. This grading system is developed to distinguish between the different categories of oil palm fresh fruits. The maturity or color ripening index is based on different color intensity. Hence, a coded method with sunflower plots will be introduced to give a better inference on the colors in identifying harvesting of oil palm fresh fruits.

Keywords**:** oil palm, harvesting, coded, sunflower plot

INTRODUCTION

Oil Palm Growth and Variety

The growth of oil palm tree takes about 42 months, including 10 months from establishment to initial sexual differentiation, 24-26 months from sex development to flowering, and 5-6 months known as weeks after anthesis starts from flowering to yield. Tenera is one of the varieties of oil palm. This variety is the result of a hybridization of Dura and Pisifera (DxP). Tenera has a high commercial value because of high mesocarp content up to 95 percents.

RGB Colors System

The Red, Green and Blue (RGB) colors system is an additive primary color system which is red, green, and blue light are added together in various ways to reproduce a broad array of colors. The main purpose is for sensing, representation and display of images in electronics system even though it has also been used in conventional photography. In this case, the color matching rate using RGB extractor software was used to calculate the values of red, green and blue on the fruit image. These RGB colors will be used to analyse the ripe class of the fruits and to identity the best time of harvesting oil palm given by coded table.

Exploratory Data Analysis

Tukey [12] defines data analysis as procedures for analyzing data, techniques for interpreting the results of such procedures and ways of planning the gathering of data to make its analysis easier. Good [7] states that Exploratory Data Analysis (EDA) is an extension of descriptive and graphical statistics. Smith and Prentice [11] state EDA is both a philosophy of the investigation of data and a recommended set of tools and techniques or survey some of the principle techniques of exploratory data analysis. Ellison [5] suggests that graphics serve two general functions in the context of data analysis which is a tool to explore patterns in data prior to formal statistical analysis and communicate large amounts of information clearly, concisely, rapidly and illuminate complex relationships within datasets. Meanwhile, Shitan and Vazifedan [10], and Velleman and Hoaglin [13] state that EDA is a collection of techniques that enables one to explore data. Coded Table is one of the technique in EDA.

In the harvesting of oil palm, Oo et al. [9], and George and Arumughan [6] state that there is a substantial change of oil mesocarp content during weeks after anthesis, meanwhile Abdullah et al. [1] add that the decreasing of moisture content in oil palm fresh fruits also affects the harvesting of oil palm. Several studies from Choong et al. [3], Alfatni et al. [2], and Hudzari et al. [8] also state that there is a positive correlation between the ripeness stage of oil palm fresh fruit bunch and the oil content, with unripe fruits give low oil content and ripe fruits give high oil content.

METHODS

Coded Table

Tukey [12] proposed that in huge tables that are clustered with figures it might be a daunting task to discover the patterns contained in the tables. Hence, EDA coding methods has been devised which is great assistance in discerning patterns contained in a given data. Coded tables are particularly useful because information and trends are quickly picked up. When looking for trends along a particular column, we should move from top to bottom along the column.

Then, the values of median, first quartile (Q1), third quartile (Q3), Lower Inner Fence (LIF = Q1 - 1.5IQR), Upper Inner Fence (UIF = Q3 + 1.5IQR), Lower Outer Fence (LOF = Q1 - 3IQR) and Upper Outer Fence (UOF = Q3 + 3IQR) are calculated and identified. IQR stands for Interquartile Range that measure statistical dispersion, being equal to the difference between Q3 and Q1. Any value below LOF will be coded 0, below LIF but within LOF will be coded 1, below Q1 but within LIF will be coded 2, between Q1 and Q3 will be coded 3, above Q3 but within UIF will be coded 4, above Q3 but within UOF will be coded 5 and above UOF will be coded 6.

If there are slightly the same results of coded observation between several types of ripe class, a second stage coding will be used to distinguish and separate the ripe class clearly. The second stage code will use the same data, but only focuses on the ripe classes of concern.

Sunflower Plot

After coding the observations, there is a possibility to deal with ties observations of large data. Thus, overlapping points in scatter diagram may occur. Cleveland and McGill [4] introduce sunflower plot as an alternative to scatterplot when the density of plots in a region become high. A sunflower is a number of short line segments, called petals, which radiate from a central. In a sunflower plot, the x - y plane is divided into a lattice of regular square bins; a sunflower is placed in the center of each bin that contains one or more observations. The plots are drawn so that the number of petals of each sunflower equals the number of observation in the associated bin. Sunflower plots are effective in dealing overstrike problem that arises with high-density scatter plots. Unfortunately, information on the precise location of points is lost-density regions of the graph. This is particularly true when the bin size is large. In this case, sunflower plot will illustrate the pattern in the coded table. See Figures 1 and 2.

Data

Data will be obtained from Dami Mas progeny of tenera variety planted at Kandista Sari Estate (KNDE), Indonesia. Sample fruits were taken from three palms for a total of 1,890 fruits. The study was conducted from May to October 2014. The sample fruits were taken at different stages of ripeness starting from 6 to 26 weeks after anthesis. There are 563 observations in the data. The main variables of interest are Red, Green, and Blue to be coded.

RESULTS AND DISCUSSION

First Stage Code

Figure 1 shows the first stage coding, where the coded for 'Under Ripe' and 'Ripe' are almost the same, we need to distinguish both ripe classes by using the second stage coding method to get clear information and separation boundary of both classes. Table 1 shows the value of statistics for the RGB colors.

The second stage coded method will use the same data in first stage, but only focus on week 21 until week 24 to discern the pattern of coded in sunflower plot.

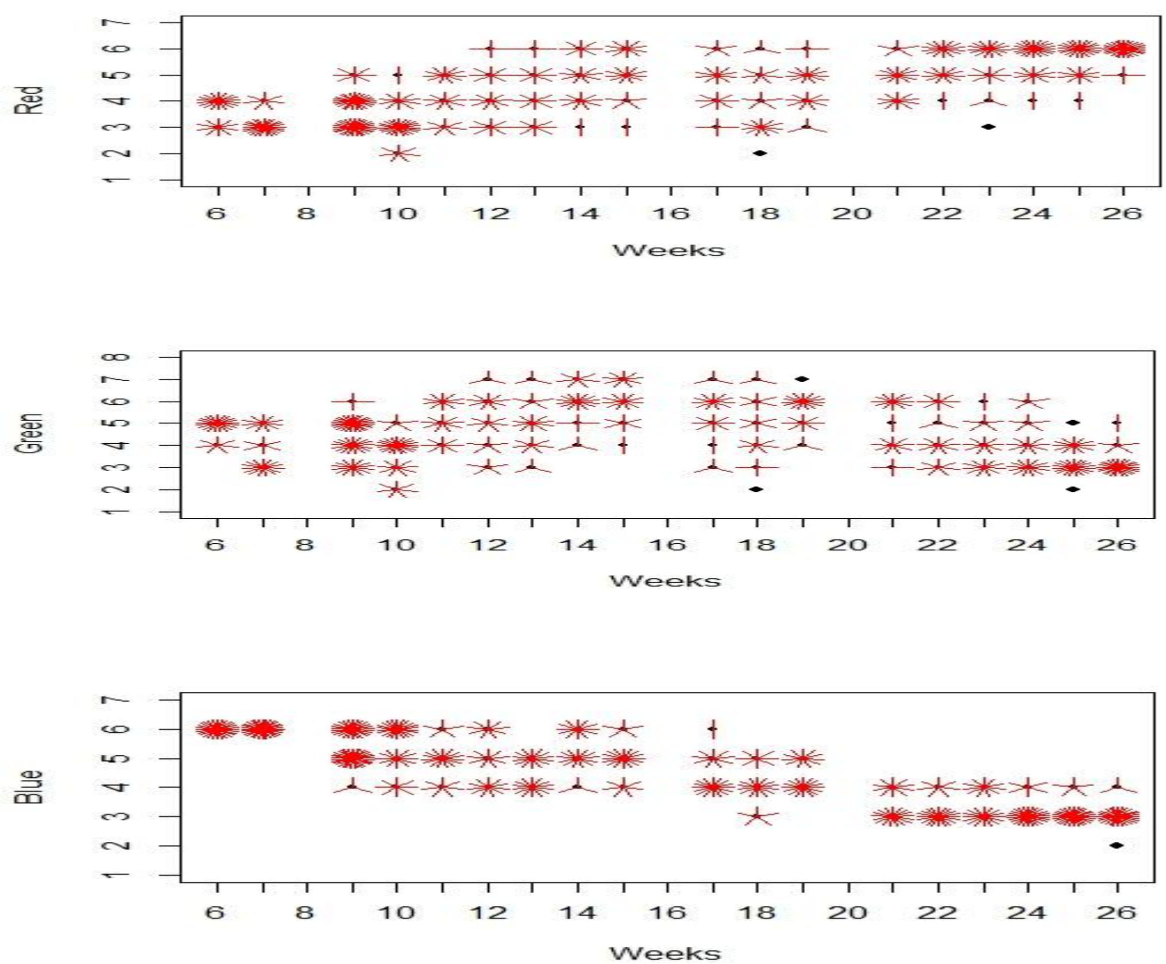


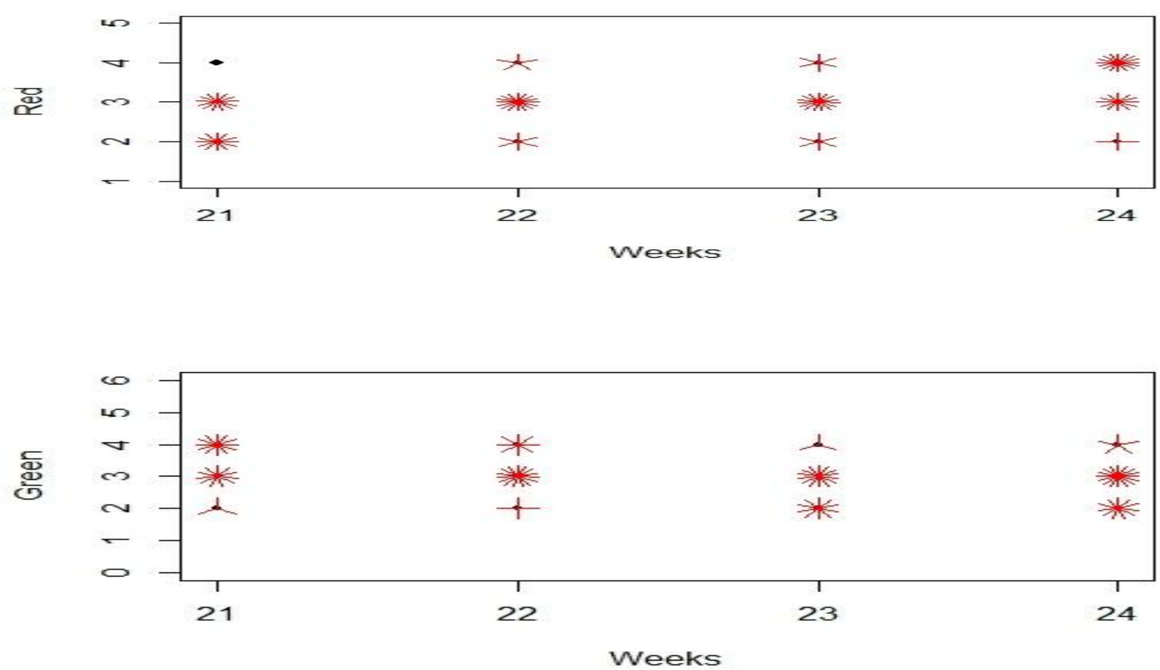
Figure 1: Sunflower Plots of Coded of Red, Green and Blue Colors for the First Stage Coding.

Table 1: Criteria Interval Code of RGB in First Stage.

	Red	Green	Blue
Q2	211.8000	195.7500	183.8820
IQR	32.3150	22.6750	37.1520
Q1	199.6550	184.1450	162.9850
Q3	231.9700	206.8200	200.1370
LIF	151.1825	150.1325	107.2570
UIF	280.4425	240.8325	255.8650
LOF	102.7100	116.1200	51.5290
UOF	328.9150	274.8450	311.5930

Second Stage Code

Based on sunflower plots in Figure 2 the coded 3 gives the large density during the ripe stage. The pattern of coded value can be seen starts from week 21 to week 24 as the coded value of Red become increasing, meanwhile both Green and Blue, the coded value become decreasing. Hence, the farmers can start to pick the oil palm fruits when the value of Red is 220.4675 and above, value of Green is 180.9850 and below, as well as the value of Blue is 149.5275 and below, refer to Table 2 for the Q1 values. This suggestion is practical at the field as the researchers can capture the photo of oil palm fruit, then they will get the values of RGB immediately.



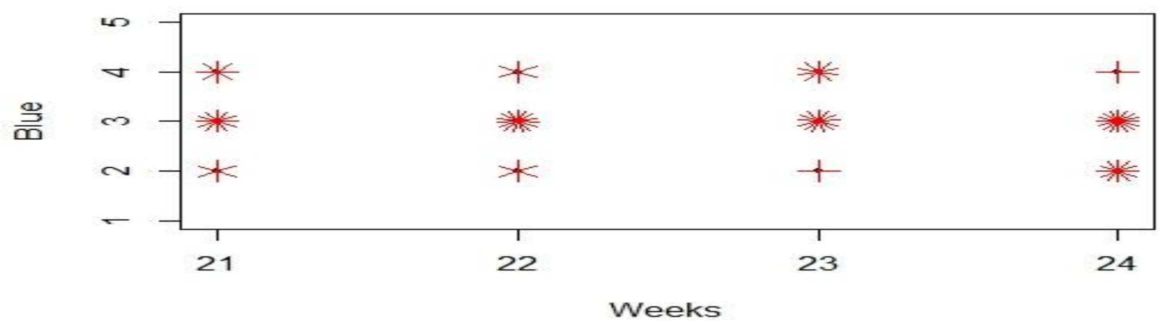


Figure 2: Sunflower Plots of Coded of Red, Green and Blue Colors for the Second Stage Coding.

Table 2: Criteria Interval Code of RGB in Second Stage.

	Red	Green	Blue
Q2	231.0800	191.0800	156.4800
IQR	22.3475	24.0725	14.5600
Q1	220.4675	180.9850	149.5275
Q3	242.8150	205.0575	164.0875
LIF	186.9462	144.8763	127.6875
UIF	276.3363	241.1662	185.9275
LOF	153.4250	108.7675	105.8475
UOF	309.8575	277.2750	207.7675

CONCLUSIONS

Coded method gives the suggestion based on colors of harvesting oil palm fresh fruits. Based on the results, the changes in coded value of RGB will change ripe class of oil palm fresh fruits.

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