Maturity Classification of Oil Palm Fresh Fruit Bunches Using Thermal Imaging Technique

Authors : Shahrzad Zolfagharnassab, Abdul Rashid Mohamed Shariff, Reza Ehsani, Hawa Ze Jaffar, Ishak Aris

Abstract : Ripeness estimation of oil palm fresh fruit is important processes that affect the profitableness and salability of oil palm fruits. The adulthood or ripeness of the oil palm fruits influences the quality of oil palm. Conventional procedure includes physical grading of Fresh Fruit Bunches (FFB) maturity by calculating the number of loose fruits per bunch. This physical classification of oil palm FFB is costly, time consuming and the results may have human error. Hence, many researchers try to develop the methods for ascertaining the maturity of oil palm fruits and thereby, deviously the oil content of distinct palm fruits without the need for exhausting oil extraction and analysis. This research investigates the potential of infrared images (Thermal Images) as a predictor to classify the oil palm FFB ripeness. A total of 270 oil palm fresh fruit bunches from most common cultivar of oil palm bunches Nigresens according to three maturity categories: under ripe, ripe and over ripe were collected. Each sample was scanned by the thermal imaging cameras FLIR E60 and FLIR T440. The average temperature of each bunches were calculated by using image processing in FLIR Tools and FLIR ThermaCAM researcher pro 2.10 environment software. The results show that temperature content decreased from immature to over mature oil palm FFBs. An overall analysis-of-variance (ANOVA) test was proved that this predictor gave significant difference between underripe, ripe and overripe maturity categories. This shows that the temperature as predictors can be good indicators to classify oil palm FFB. Classification analysis was performed by using the temperature of the FFB as predictors through Linear Discriminant Analysis (LDA), Mahalanobis Discriminant Analysis (MDA), Artificial Neural Network (ANN) and K- Nearest Neighbor (KNN) methods. The highest overall classification accuracy was 88.2% by using Artificial Neural Network. This research proves that thermal imaging and neural network method can be used as predictors of oil palm maturity classification.

Keywords : artificial neural network, maturity classification, oil palm FFB, thermal imaging
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