Abstract

In this research work, segmentation, classification and disease identification of arecanut have been addressed. Classification has been carried out using color and texture features. Color features are invariant to rotation and scaling. Results are experimented with the kNN, SVM and Decision Tree classifiers.

In chapter 2, a method is proposed for classification of arecanut with husk to two classes based on color features. The proposed method has three steps: (i) Segmentation; (ii) Masking; and (iii) Classification. Three sigma control limits are used for segmentation of arecanut. The upper and lower control limits of the color components of YCbCr are used to segment arecanut object. Classification has been done based on mean color of the green and red color components of an RGB image using conditional rules. A novel method is proposed for classification of arecanut with husk using color features of different combinations of color components of various color spaces such as RGB, YCbCr and HSV images of arecanut. The results have been analyzed with kNN and SVM classifier. A novel hybrid classifier has been proposed using Support Vector Machines (SVM) and k-nearest neighbor (kNN) classifiers for classification of arecanut. The combined approach reduces feature dimension considerably which in turn speeded up classification process of arecanut. The kNN rule is a simple and effective method for a multi-way classification that is much used in Computer Vision. However, its performance depends heavily on the distance metric being employed. The kNN classifiers suffer from the problem of high variance in the case of limited sampling. Alternatively, one could use Support Vector Machines but they involve time-consuming optimization and computation of pairwise distances. The proposed method uses combination of these two methods that deals with the multiclass problem with reasonable computational complexity in classification and also gives excellent results in practice. The basic idea in this method is to find support vectors using Support Vector Machine Classifier. These support vectors are highly potential features, these support vectors are treated as a training set. The kNN classifier is used in testing phase, which queries an unknown sample by
comparing with nearest neighbors of support vectors. A novel method for classification of arecanut with husk using the color features of the RGB, YCbCr and HSV color spaces of arecanut image is presented. The color histogram features such as mean, variance, skewness, kurtosis, energy and entropy have been extracted from color components of RGB, YCbCr and HSV color spaces of arecanut image. The best discriminative subsets of features have been selected provided whose variance is high.

In chapter 3, a method is proposed to construct a Gabor Response Co-occurrence Matrix (GRCM) which is analogous to Gray Level Co-occurrence Matrix (GLCM). In this work, image dataset of arecanut without husk is considered. Classification has been done using kNN and Decision Tree (DT) classifiers. The GRCM features have been extracted from arecanut image. There are twelve Gabor filters are designed (Four orientations and three scaling) to capture variations in lighting conditions. Results are compared with kNN classifier and found better results. Splitting rules for growing decision tree that are included in this work are Gini Diversity Index (GDI), Twoing rule, and Entropy. A method is proposed for classification of arecanut based on texture features of arecanut. Classification is done using Mean around features, Gray level co-occurrence matrix (GLCM) features and combined (Mean around-GLCM) features. Decision tree classifier is used for classification of arecanut without husk to six classes. The Local Binary Pattern (LBP) operator is a powerful means of micro texture description that has been used in texture analysis of arecanut in this work. The arecanut dataset without husk has been considered. The Gabor filters and GLCM (Gray Level Co-occurrence Matrix) will capture data with different scale and angle. The Local Binary Patterns (LBP) based Gabor and GLCM have been proposed for classification of arecanut data. In the proposed method, LBP has been applied on arecanut image then Gabor filters and GLCM have been applied on LBP image. These Gabor filters and GLCM texture features of arecanut have been extracted for classification. The results are compared and discussed with Histogram correlation, GLCM, Gabor and combined (Gabor-GLCM) features. The kNN classifier has given good success rate for combined features.

In chapter 4, a method is proposed to use of Wavelet decomposition for feature extraction. The statistical feature energy is derived from the approximation
coefficients for each level of decomposition and color features are also extracted from arecanut image for classification. The main advantage of the wavelet transformation is the multi-resolution analysis. Furthermore, wavelets enable localization in both space and frequency domains and high-frequency salient feature detection. Wavelet transformation can use various basis functions. The decision tree classifier has been used for classification of arecanut. The tree splitting rules that are included in this work are GDI, entropy and twoing rule.

In chapter 5, a histogram based approach has been proposed for classification of diseased and undiseased arecanut. An RGB arecanut image has been transformed to HSV image. The saturation component and value component of HSV color space is used for segmentation and feature extraction respectively. Segmentation of arecanut has been done using threshold based Otsu method. LBP has been applied on the value component of HSV color space. The LBP operator has been modified in this method. Each neighbor pixel is compared with the average of the pixels encompass by a mask and this average value is considered as a threshold. The obtained threshold is insensitive to noise. The statistical method correlation is used to measure the distance between training set and testing sample. A method is proposed for classification of diseased and undiseased arecanut using Haar Wavelets, GLCM and Gabor features. In the proposed method, arecanut is segmented from a given image using threshold based Otsu method. Texture features and kNN classifier have been used for classification of diseased and undiseased arecanut. The best discriminative subset of features from YCbCr and HSV color models are selected empirically based on combination of features using kNN classifier. A symbolic data approach is presented for classification of diseased and undiseased arecanut. In this model, the texture features of GLCM, Gabor and Haar wavelets have been used to obtain a symbolic data. In this work, symbolic models range method and sigma control limits are used. The kNN is used to measure the distance between the crisp value of query sample and interval value of a training set.