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A Survey on Image Analysis Techniques in Agricultural Product

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Abstract

Background/Objectives: In this paper we have analyzed various image analysis techniques and their issues in seed technology. The crucial role of these techniques is identification and classification of seeds,grading of seeds, quality determination of seeds in seed science and food processing sectors. We provide a complete survey of image analysis techniques and propose a processing module for seed identification and classification.**Methods/Statistical analysis:**We identified the problem of manualidentification and classification of seed in agricultural sector. We provide five important processing steps as a proposed methodology for identification and classification of seed. By using this technology, we able to discriminate the defected seed from normal seed.Our proposed methodology includes noise removal,edge detection, segmentation and classification for seed identification. These methods provide a significant way for seed identification. **Findings:** In this work, we implemented a five processing module for seed identification. Seed image has taken for the basis of image acquisition and then a seed image is pre-processed by noise removal and image enhancement. Enhanced image goes through the processes of edge detection and segmentation. From the segmented image we extract features like colour, shape and texture for normal and defected seed which may help to identify the seed by image analysis techniques. **Application/Improvements:** Our work is useful to know about various issues in seed identification in agricultural sector. This work provides efficient methods to overcome the manual identification of seeds. We can also extend this work with an efficient identification and classification methodology in image analysis techniques in agricultural sector

Keywords: Classification, Edge Detection, Feature Extraction,Noise Removal, Segmentation

1. Introduction

Now-a-days, automation and intelligence system technologies have revolutionized our food production and agricultural processing. Machine vision system provides an alternative to manual inspection of seed and foreign materials. This system has two important aspects like image analysis and pattern recognition. The most important input for increasing agricultural production is seed. Image analysis has standard techniques for identification of seed variety,measurement of seed, and acquisition of large amount of quantitative data. Seed testing plays an important role of all other seed technologies. It means that itis a measure of viability and physical factors that regulate use and maintenance of seed. Germination test of seed is not alone enough to assess seed quality asvigour test is also required. So that during seed handling operations like extraction of seed information, seed quality, seed viability test is needed. Seed type and quality usually are assessed by visual inspection. But it is not economically good in time and costwise. Also the varietal identification and classification is not uniform, because itdepends on the human ability and with personal circumstances. Issues like eye fatigue, call variations between seed inspectors isowing to human involvement throughout the seed test procedure.This

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method is adapted to assess physiological disorder of seed stage and for seed maturity. Bruise in seed can also be detected.Likewise,an Image analysis technique includes capturing, pre-processing,interpretation,quanti fication and classification of seed image.

2. Processing Modules

Identification and classification of seed is based on image analysis classical methods like image acquisition,pre-processing, feature extraction and classification. In section 3surveys of existing methods are analyzed. This paper attempt to show the aspects of thesefive processing module as shown in Figure 1. Inthe remaining sectionsthe importance of processing modules is discussed. At the end of this paper there is a proposed work which may give further exploration in the field of by recent image analysis techniques for identification and classification of seed.

3. A Survey of Existing Works in Agricultural Sector

Image analysis techniques arewidely used in agricultural product and food engineering in identification cereals, pulses, grainsand also used in the detection of cracks,dark spots etc. The substantial work done in seed technology like seed variety identification and classification, seed germination test, seed purity test using image processing techniques has been presented here.Identification of nine Iranian wheat seed varieties by textural analysis by applying machine vision techniques. Texture Feature was extracted by using GLCM,GLRM,LSPand LSN.Discriminant methods were used to select most significant feature for classification[1].Parental form and hybrid spelt for wheat were analysed by shape and colour descriptors[2].Purity of maize seed were analysed by discrete wavelet transform and BP Neural network. RGB colour model were obtained from maize image and processed and analysed by two levels DWT and corresponding parameter selected as input for BP neural network[3].The quality of areca nuts were detected and classified by neural network and image processing techniques.Six geometric parameters and defected area were used in classification procedure[4].Identification of five china corn varieties were analysed by external feature of corn obtained by flatbed scanner. Colour, shape and geometric features were extracted from the corn kernels. By discriminant analysis significant features were selected as input for BPNN[5].In [6] determined *Bacillus thuringiensis*in rice seed by combined multispectral imaging and chemo metric methods. This method determined the transgenic rice seed from non-transgenic seed very accurately. Soya bean seed vigor characterization was obtained by content based image retrieval techniques according to seed definition[7].Determining the protein content of the seed using machine learning algorithm is developed by [8]. They presented an algorithm based on nearest neighbour approach, MLP and support vector machine method which provides higher classification accuracy. Quality measurement of milled rice grading developed by fuzzy inference system combined with image processing to give qualitative decision support system[9].Image analysis technique not only for identification and classification of the above materials and also used to detect the infestation seed materials to detect infestation inside the wheat kernels using thermal imaging[10]. Ayurvethic Plant leaf detection by image analysis technique was also developed by Tajane etal.[11]. Ethiopian Coffee bean classification using image analysis technique was also developed by extracting colour, morphological and texture feature. Then significant feature set input as ANN for better coffee bean classification[12].

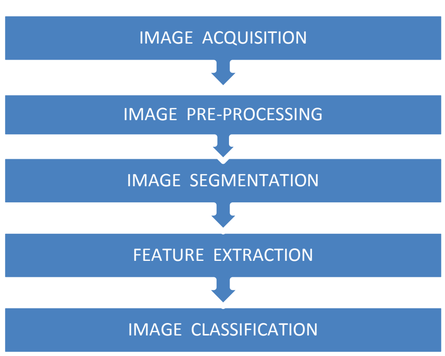

Figure 1. Architecture for processing modules.

4. Image Acquisition

Image analysis starts with image acquisition. To obtain the high accuracy quantitative and qualitative data processing, selection of image capturing sources and sensors has to be considered very carefully. Major impact is the relative position between source and object and their background. This geometry of viewing situation has been very carefully noted for further processing of agricultural product.Therefore, image acquisition plays most important factor for the success of image analysis application.In an agricultural sector image acquisition aided by computer technology, providing a highly adaptable tool to produce digital image suitable for subsequent processing. In this section some of the image acquisition techniques used in analysis of agricultural product has been presented.Image of three types of product (paddy,white,brown rice) were acquired using scanner HP Scanjet G33110 with 300dpi resolution and 540x390 pixels in BMP format[13].Barley varieties were acquired in colour at the resolution of 400dpi,24bitsper pixel, in the Epson 4990 flatbed scanner which is covered by velvet and top covered was removed[14]. To improve the visual differentiation other highly potential imaging system were used.One of the imaging techniques is Near-Infrared hyperspectral imaging. NIRhyperspectral imaging is used to differentiate Canadian wheat classes. The sample wheat captured by wavelength range 960-1700nm with 75 slice segmentation[15]. MRI imaging is a non-invasive platform provides a three dimensional visualization and quantification of lipid in plant materials. It uses the nuclear spin of NMR-sensitive atoms to produce a signal.In the case of MRI images in three dimensions can be acquired by Borisjuk etal.[16]. Moisture content of grape seeds were measured by a CCD camera (Canon IXUS 960IS; a 12-megapixel camera with 3.7Xoptical zoom)[17]. Thermal imaging system used thermal camera to identify each development stage of aseed product. To diagnose seed viability, infrared thermography used. It is an eminent tool to estimate the seed temperature and inner components in less time. Normally this has been done by two to three hour in a classical method[18]. Thermal imaging provides a study of seed quality with non-destructive manner which helps in germination performance evaluation, estimate the morphological features used in seed storage and seed testing. This kind of technology with recent success of optical methods which incorporate high-speed optical sensing and to facilitate quality evaluation and inspection of agricultural product with high degree of accuracy and more complex images also is processed easily. Some of the imaging technique's images are shown in Figure 2.

Table 1 shows the comparative analysis of various image capturing methods. The various types of imaging system shown in Figure 2 and the quality of image capturing type shown in Figure 3. Visual reducing conditions for various types of image shown in Figure 4.

5. Image Pre-processing

Each imaging system may suffer from the common problem of noise. This unwanted data causes change in the size and shape of the object of an image, and blur

a) Electron microscopic image
b) Digital Camera Image
c) Thermal Imaging
d) MRI Imaging of corn

Figure 2. Various imaging sample.

Table 1. Analysis on image capturing technique

Types	Advantages	Disadvantages
Camera Input Image (jpg)	Provides quality pictures and give lossy compression	Not support transparency Generate a bigger file size for small resolution images.
X-Ray	Ability to retrofit to existing biography equipment, easily accomplished. Excellent image quality	Still have to use an imaging plate, Little real time saving benefit over traditional radiography
Micro-Scope	Superior to bright-field optics. invisible under bright-field optics show up in high contrast	Not ideal for thick samples Effects or 'phase artifacts' may be present distorting details
Thermal image	See through smoke/fog/dust/sand, through leaves and thin materials Track residual heat (handprints, footprints)	More expensive, Larger/Heavier, Long start up/warm up time

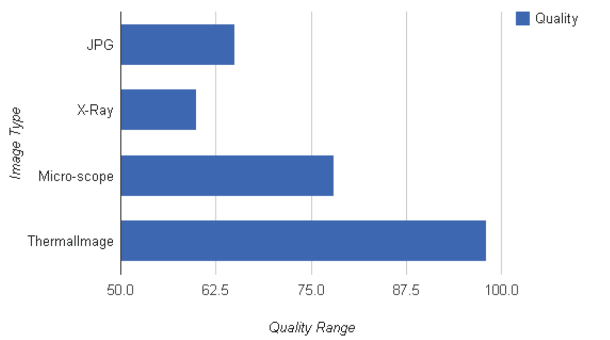

Figure 3. Image Quality of image capturing Type.

the edge information. Noise may occur by physical condition of the system or may due to environmental conditions. So thisstate needs noise removal and image enhancement processing. Image pre-processing increases the accuracy classification of object. It includes noise removal, image enhancement techniques, Imagequ antization,binarization,spatialfiltering,background removal, resizingand cropping operations. In[19]used image resizing,RGB to Grayscale conversion and gray to binary conversion,closing and opening operations to obtain the pre-processed image in their proposed work. In [20] used morphological filtering to extract object features for further processing in paddy variety classification. In [21] used same pre-processing techniques like resizing,RGB conversion, Grayscale conversionfor quality analysis of Indian Basumathi Rice identification.In [22] included RGB to Grayscale conversion,noise reduction by filtering,object separation,centroid detection,background removal in their proposed work of identification and classification of bulk paddy varieties. In [23] applied morphological operations like dilation and erosion to obtain a pre-processed image. Erosion in which materials are removed from the surface and dilation filling the hole and broken area and also increases the brightness of the object to make image brighter for further processing.In[24]used mainly binariesof the image first for object separation from background in the olive stone varietal identification. In[25]applied image scaling, image enhancement,resizing for his proposed work. Scaling is a non-trivial process that involves a trade-off between efficiency,smoothness and sharpness and cropping also done in their work. In[26] included pre-processing techniques like image clipping simple filter and median filter to remove noise.In[14] used the pre-processing technique for computation of kernel attributes. Morphological features depend on the region shape, colour, texture,brightness,kernel orientation and germ-brush detection, closing and opening operations are also used for identification of barley varieties.The visual differentiation of wheat classes suffers from consistency, low and labour intensiveness. So that hyperspectral imaging system was used to develop for clear visualization of object.For hyperspectral image pre-processing single median spectrum wasincludedto find ROI, PLS calibration method and statistical mean centering were used to reduce the data volume of hyperspectral image[15]. In[27] stated that the speckle and salt, pepper noise were removed by linear and non-linear filtering. Linear filtering is more effective for impulse noise. A median filter has advantage over linear filter. But median filter has high computation cost. Recently infrared thermal imaging system was developed to identify and classify the infested grain[28]. Thermal Imaging isaffected by speckle noise. This noise is a multiplicative noise having granular pattern and it degrade the quality of image. Kaun filter, frost filter, wiener filter, Bayes threshold are the filters used as speckle noise reduction.In[29] proved thatKaun filter performance is better in preserving image sharpness while suppressing noise.In[30] proved that Hybrid filter remove the speckle noise from the echocardiography image in a better way. This filter removes the impulse noise also. In[31] used Hybrid directional lifting technique for image denoising that involves pixel classification and orientation estimation and it also improves the visual quality of image with rich texture[32].Sample images for pre-processing methods like gray scale conversion, background removal, binarization and noise removal by filter images has been presented in Figure 4.

Table 2 shows the comparative analysis on pre-processing techniques used for noise reduction and image

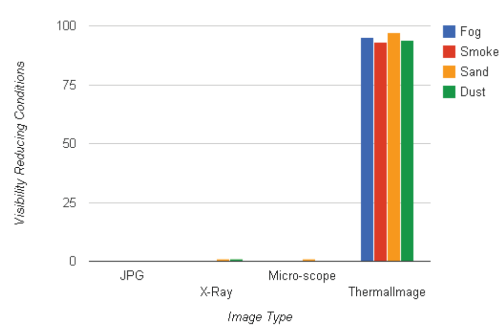

Figure 4. Visual Reducing conditions.

Table 2. Analysis on noise reduction filter

Type	Advantages	Disadvantages
Mean Filter	Improve the image quality for human viewers. Mean filter replaced each pixel with the average value of the intensities in the neighborhood. It locally reduced the variance, and easy to carry out	Averaging operations lead to the blurring of an image, blurring affect features localization. Averaging operations applied to an image corrupted by impulse noise A single pixel with a very unrepresentative value affected the mean value of all the pixels in neighborhood significantly
Median Filter	Replace each pixel value with the median. removing salt and pepper noise Keep the sharpness of image edges while removing noise. The effect of the size of the window increases in median filtering noise removed effectively	Computational complexity Non linear filter It is difficult to treat analytically the effect of a median filter There is no error propagation.
Wiener Filter	Optimal estimate of the original image by enforcing a minimum mean square error constraint between estimate and original image. The wiener filter is an optimum filter. The objective of a wiener filter is to minimize the mean square error. A wiener filter has the capability of handling both the degradation function as well as noise.	Results often too blurred Spatially invariant They assume your process dynamics are linear Only provide a point estimate. Handle processes with additive, unimodal noise.
Homomorphic filter	Used for image enhancement. Normalizes the brightness across an image and increases contrast. Remove multiplicative noise.	Noise amplification in flat region. Discontinuity between region Computational intensive
Anisotropic filtering	Improves the clarity and crispness of textured objects provide superior image quality in virtually all cases at the slight expense of performance. The major advantage when you get close to the camera the image looks less blocky.	Requires an even bigger memory bandwidth. Almost impossible on traditional rendering system Use very expensive memory architecture.
Wavelet average filter	Efficient in removing out of band signals. If applied to in-band signals, then conventional filters will also remove the signal of interest. De-noising works well in conjunction where the noise and signal spectra overlap. -The scheme employs a threshold in order to de-noise the signal, but without removing the signal of interest.	To use a suboptimal universal threshold and identical Neighbouring window size in all wavelet sub bands. To yield overly smoothed images because the universal threshold is too large.

a) GrayScaleImage
b) background removed image
c) Image Binarization
d) Filtered Image

Figure 5. Sample pre-processed image.

enhancement. Figure 5 shows an output of pre-processed seed image. Figure 6 shows the quality constraints of filters.

6. Image Segmentation

Image segmentation method subdivides the image into its constituent part of objects. It is a most difficult task in image processing. Mainly in agricultural sector used thresholding method for segmenting the image to identify the particular part of an image. In [33] segmented an image by using edge function, Laplacian Of Gaussian(LoG) method and from the segmented image features were extracted.In[34]identified food grains by segmenting an image using edge detection and thresholding approach.

He also proposed watershed segmentation based on region orientation.According to his study,sobel edge detector results more accuracy than canny edge detector. Edges are also detected by Gaussian filter. In[35] used thermal imaging to detect infestation by using global thresholding technique to obtain temperature value from the surface of grain. In[36] used binary mask in contourinner segmentation. Thisdual segmentation is more robust and controlled approach. Automatic thresholding segmentation was used with maximum histogram value similar to otsu's thresholding techniques and followed by hole filling,opening operations.They used kmeans clustering and edge detection for segment the image. In [37] segmented an image by SISE(shen-castan infinite symmetric exponential)filter based edge detector which gives optimal filtered image and followed by binary laplacian and non-maxima suppression technique.In[38]proposed histogram based thresholding and edge detection to segment the coffee seed. In[39]segmented paddy image from background by thresholding technique. They performed morphological opening to remove the noise from thermal imaging of paddy seeds, to measure moisture content. In[40] used segmentation algorithm based on improved ant colony algorithm. Search by ant colony has high edge detection accuracy. Ant colony is intellectual bionic evolutionary algorithm. In [41] used hierarchical segmentation delivered by ultrametric Contour Map(UCM) andproved to be indispensable tool. In this method optimization is not necessary.In [42] used ant colony optimization for edge detection improvement. Canny,sobel edge detection methods have a drawback of broken edges. In[43] segmented an object by using Fuzzy method. In [44]presented a segmentation by combining seed based region growing and boundary segmentation in a sequential order. It resulted 94% accuracy in segmentation.In[45]segmented seed varieties by using mean-shift segmentation.It uses a colour merge of the contours. The above segmentation method has a difficulty in finding broken edges and contour information. Edge information plays a crucial role for feature extraction. Recently image segmentation has done by adaptive ant colony edge detection and segmentation. It catches the broken edge easily and smoothing the image without any loses of information.In[46] investigated Fuzzy entropy approach performance was investigated to the segmentation of infrared object. In addition to that ant-colony optimization is used to obtain optimal parameter and it significantly reduced the computation[47]. To improve the accuracy and efficiency of weed recognition ant colony optimization and support vector machine were proposed to select optimal feature set[48].Region growing segmented image output of seed and histogram image has been presented in Figure 6.Before obtains the segmented image we should concentrate on edge detection. Table 3 shows the comparative analysis in edge detection operators and segmentation methods. Table 4 and Figure 7 show the analysis on various segmentation techniques and also give the computation complexity of segmentation techniques in image processing. The detection rate and accuracy ratio of various edge detection operators used for identification and classification of agricultural products are shown in Figure 8 and Figure 9. The complexity ratio of segmentation technique as shown in Figure 10.

7. Feature Extraction

Feature extraction methods extract the distinct features from the images like edges,corner, which can be used to match or discriminate image from other similar image.In[13] developed an algorithm for extraction of 36 colour features from bulk rice samples. Generally, the colour,shape,and texture features extracted from the image to recognize an image. To find reliable quality analysis of Indian Basmati rice, they extracted the features like area,major axis length,minor axis lengthand eccentricity,circularity for differentiating normal seed from large and small seeds[49]. In wheat class identification process l*a*b* colour features are extracted for all moisture level. Nearly 32 features such as mean, entropy, contrast etc.were extracted[50]. In NIR imaging system,principle componentis used as feature extrac-

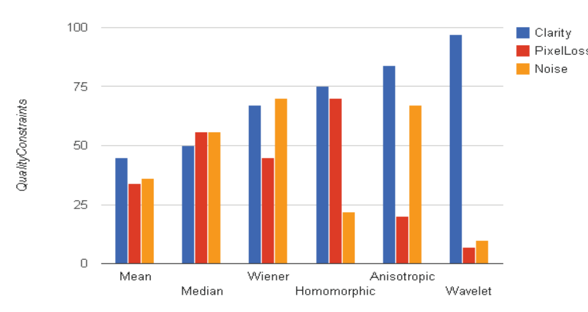

Figure 6. Quality constraints of filter.

Table 3. Analysis on edge detection operators

Edge Operators	Advantages	Disadvantages
Classical (Sobel, prewitt, Kirsch)	Simplicity, Detection of edges and their orientations	Sensitivity to noise, Inaccurate
ZeroCrossing(Laplacian,Seconddirectional derivative)	Detection of edges and their orientations. Having fixed characteristics in all directions	Responding to some of the existing edges, Sensitivity to noise
Laplacian of Gaussian(LoG) (Marr-Hildreth)	Finding the correct places of edges, Testing wider area around the pixel	Malfunctioning at the corners, curves and where the gray level intensity function varies.
Gaussian(Canny, Shen-Castan)	Using probability for finding error rate, Localization and response. Improving signal to noise ratio, Better detection specially in noise conditions	Complex Computations, False zero crossing, Time consuming
Colored Edge Detectors	Accurate, More efficient in object recognition	Complicated, Complex Computations

Table 4. Analysis on segmentation techniques

Segmentation Techniques	Method Description	Advantages	Disadvantages
Histogram thresholding	Requires that the histogram of an image has a number of peaks, each correspond to a region.	It has less computational complexity	Without any obvious peaks or with broad and flat valleys; Does not consider the spatial details.
Region-Based Approaches	Group Pixels into homogeneous regions. Including region growing, region splitting, region merging or their combination.	Region homogeneity criterion is easy to define. More noise immune than edge detection approach.	Quite expensive both in computational time and memory. Region growing has inherent dependence on the selection of seed region.
UCM (Ultrametric Contour map)	Allows representing an indexed hierarchy of regions as a soft boundary image called ultrametric contour map.	It does not limit the assessment to a reduced set of partitions. It better discriminates the random trees from actual ones, which reflects a better qualitative behavior.	Reduced set among all found in a hierarchy is also masking the real upper-bound performance of the technique.
Watershed Segmentation	Combines elements from both the discontinuity and similarity based methods Extended to a computationally efficient form.	Boundaries form closed and connected regions. The boundaries of the resulting regions always correspond to contours which appear in the image as obvious contours of objects.	Transform is that for most natural images it produces excessive over-segmentation
Edge Detection Approach	Normally tries to locate points with more or less abrupt changes in gray level.	human perceives objects and works well for images having good contrast between regions	Not work well with images in which the edges are ill-defined .It is not a trivial job to produce a closed curve or boundary; Less immune to noise than other techniques.
Fuzzy Approaches	Provide a way to handle the uncertainty inherent in a variety of problems due to ambiguity rather than randomness.	Fuzzy membership function can be used to represent the degree of some properties or linguistic phrase, and fuzzy rules can be used to perform approximate inference.	The determination of fuzzy membership is not a trivial job; The computation involved in fuzzy approaches could be intensive.

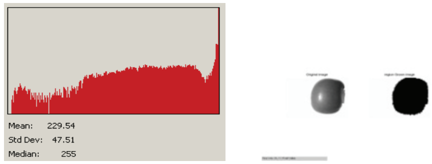

Figure 7. Output of segmentation of red gramseed.

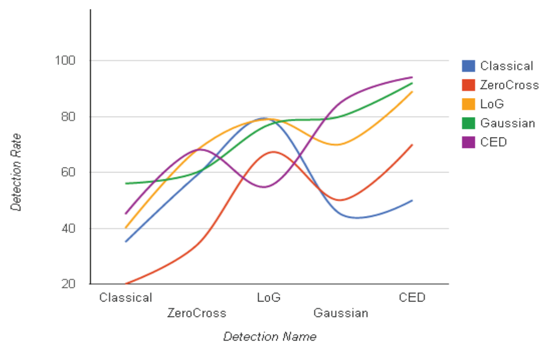

Figure 8. Detection rate for edge operators.

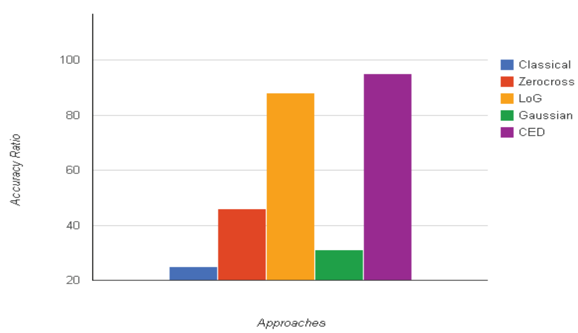

Figure 9. Accuracy Ratio.

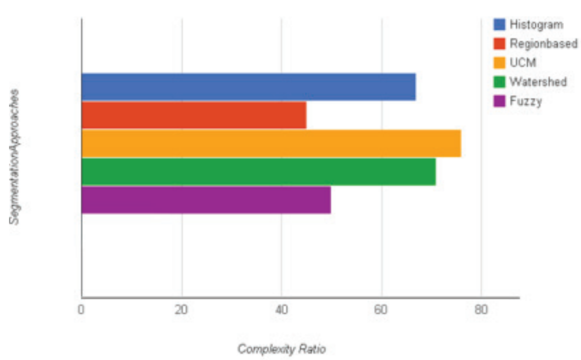

Figure 10. Complexity Ratio of Segmentation approaches.

tion method. Here six statistical image features such as maximum, minimum, mean, median, stand deviation andvariance from the image corresponding to significant wavelength were extracted. Then ten histogram features from the reflectance images and these features were used as input for discriminant classifiers[50]. To evaluate the moisture content of rice the following statistical approach were used. Mean Intensity (MI) and standard deviation of gray level image were estimated and MI were used as an index for predicting moisture content. Then the correlation between MI and MC were calculated[52]. In a pollen grain feature evaluation and classification morphological features and statistical features,transformed space moment, space frequency was extracted from the pollen image[53]. In a paddy variety classification, they extracted texture features, second order statistical features,Graylevel co-occurrence matrices, contrast,correlation,energy,entropy, shapefactors. They extract 64 texture-n-shape features formed three different feature set. To describe a particular region of an object there were more than 56 features were extracted[54]. In the identification of barley varieties by computer vision, attributes of an image were calculated. Attribute means features of an object may be colour, texture,brightness,etc. and it used as a feature vector. To describe a shape of a region they extracted

Table 5. Feature extraction by colour for red gram seed

Green Component	Mean	185.5762	175.78
	Variance	1271890	16791
	Range	255	245
Blue Component	Mean	178.1513	172.28
	Variance	12178796	21639
	Range	254	244
Hue Component	Mean	0.5930	0.5984
	Variance	0.0047	0.0061
	Range	0.9990	0.9155
Saturation component	Mean	0.2581	0.2751
	Variance	0.0027	0.0026
	Range	1.0000	0.7539
Intensity Component	Mean	0.8429	0.8050
	Variance	8.3342e-004	0.0011
	Range	0.9961	0.9569

54 morphological features like aspect ratio, circularity, elongation, slenderness, compactness, and some more features were also calculated[14]. Some researcher used a swarm based feature extraction. Ant algorithm shows larger area of detection but suffers more from discontinuities along the contour[55]. In addition to size,shape,colour and texture, moisture content plays an important role in prediction of quality of food because features decreased when seeds lost their moisture[56]. In disease identification they used GLCM and GLRM histogram intensity extraction. In a Linear feature extraction of an object edge extraction uses Haar wavelet Transform followed by morphological operations

Table 6. Feature extraction by texture for red gram seed

Features	**Image1 (Good seed)**	**Image2 (Defected seed)**
Autocorrelation	0.9797	0.9761
Contrast	0.0093	0.0092
Energy	0.5322	0.6056
Entropy	0.9381	0.8259

Table 7. Feature extraction by shape for red gram seed

Feature	**Image1 (Good seed)**	**Image2 (defected seed)**
Area	457	512
Perimeter	514.5757	592.3574
Major Axis	244.8964	273.6062
Minor Axis	175.1780	213.5860
Eccentricity	0.6988	0.6250
Centroid	129.3063	138.6680
Convex Area	17507	23657
Extent	0.0219	0.0172
Solidity	0.0261	0.0216
Equivdiameter	24.1220	25.5323

Table 8. Analysis on feature extraction techniques

Extraction Approaches	**Advantages**	**Disadvantages**
Conventional Color Histogram	Simple , Fast computation	High dimensionality No color similarity No spatial info
Color Correlogram	Encodes spatial info	Very slow computation High dimensionality Does not encode color similarity
Steerable Pyramid	Supports any number of orientation	Sub-bands undecimated, hence more computation and storage
Contourlet Transform	Lower sub bands decimated	Number of orientations supported needs to be power of 2
Gabor Wavelet Transform	Achieves highest retrieval results	Results in over complete representation of image Computationally intensive
Tamura	Developed to computational approximations to the visual texture properties found to be important. -The six visual texture properties are coarseness, contrast, directionality, line likeness, regularity and roughness. Since the texture properties are visually meaningful.	slow computation in processing No information of spatial
Co-occurrence matrices	Constructs a co-occurrence matrix on the basis of orientation and the distance between the pixels. Then meaningful statistics are extracted from matrix as the texture representation.	The sub-band images of different scales and different directions are not obtained. The high-dimension singularity information.

such as dilation and erosion were used. For non-linear feature extraction circular Hough transform were used and feature extracted[57]. Features such as shape, colour, and texture are extracted from the image to characterize the image and the results are listed in Table 5, Table 6, and Table 7. The comparative analysis on feature extraction techniques is shown in Table 8. The extraction rate and processing rate of feature extraction methods have shown in Figure11 and 12.

8. Image Classification

In[13] used Artificial Neural Network for the classification of bulk rice sample. All the features set were trained and tested of ANN. The multilayer feed forward neural network with neuro fuzzy was developed for the classification of rice varieties[58]. In a wheat classification the extracted colour features as input for linear discriminant analysis and quadratic discriminant analysis function were used for classification[59]. Some researchers identified the wheat kernel using NIR imaging and extracted the features considered as input to a three discriminant classifiers like linear, quadraticand back propagation neural network. In [60] proved Quadratic discriminant classifier gave a high for hyperspectral features. One of the method he proposed were minimum distance classifier based on Euclidean classifier.In [61] used hybrid algorithm such as genetic algorithm and neural Network algorithm and rule based classifier for superior result. In [62]usedBayesian classifier as a statistical classifier for prediction of class membership probabilities. In [63]used

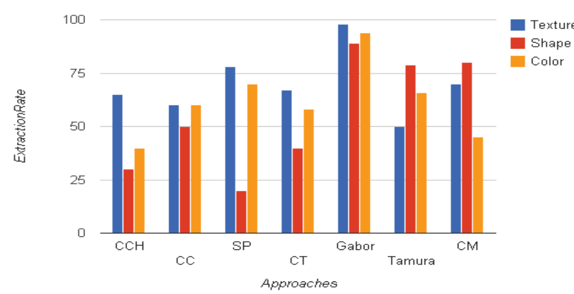

Figure 11. Extraction Rate for various.

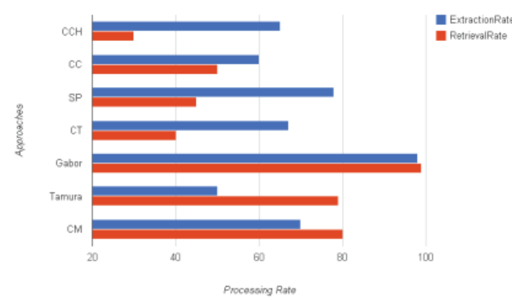

Figure 12. Processing rate of feature Extraction.

Table 9. Analysis on classification techniques

Types	Advantages	Disadvantages
Artificial Neural network	It is a non-parametric classifier approximation with arbitrary accuracy. Selfadaptivetechnique efficiently handles noisy inputs Computation rate is high	It issemantically poor. The training of ANN is time taking. .
Decision tree	Can handle non parametric Decision tree training data Provides hierarchical associations between input variables to forecast class membership and provides a set of rules n are easy to interpret.	The usage of hyper plane decision boundaries parallel to the feature axes may restrict their use in which classes are clearly distinguishable. Becomes complex calculation when various values are undecided and/or when various outcomes are correlated.
Support Vector Machine	Non linear transformation-good generalization capability. Reduction in computational complexity. Simple to manage decision rule complexity and Error frequency.	Result transparency is low. Training is time consuming. Structure of algorithm is difficult to understand Determination of optimal parameters is not easy when there is nonlinearly separable training data.
Fuzzy Measure	Efficiently handles uncertainty. Properties are described by identifying various stochastic relationships.	Without prior knowledge output is not good precise solutions depends upon direction of decision.

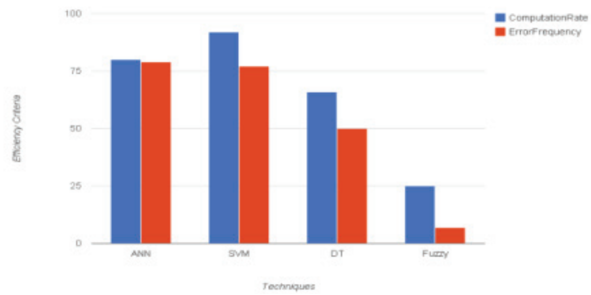

Figure 13. Efficiency of classification.

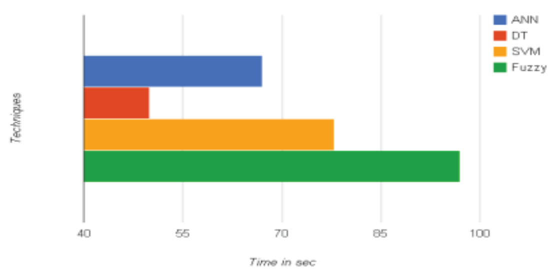

Figure 14. Time Conception.

multi-class SVM classifier to classify the rice kernel by examining the shape, chalkiness and percentage of broken kernels. The classification based on Bayes theorem and support vector machines were applied for diseased image classification and the performance were compared. Decision trees widely used learning method and do not require any prior knowledge of data distribution, works well on noisy data[64].Classification rules for the Indian wheat diseases uses the accuracy key combined with statistical and histogram features is significantly improve the c4.5decision trees algorithm[65].The comparative analysis of various classification techniques is shown in Table 9. The efficiencyand time conception of classification techniques isshown in Figure13 and Figure 14.

9. Conclusion

In this paper we analysed various image analysis techniques used in agricultural sector to identify and classify the red gram seeds. The system based on feature extraction and classification for discriminate the good seed from defected seed is also developed. In connection with this, important phases such as image acquisition, pre-processing, segmentation, feature extraction and image classification are analysed. Here image is acquired by digital camera then pre-processed using various noise removal filters. Pre-processed images are further used to detect edges using various edge detection operators such as sobel, canny, LoG and prevett. Finally, threshold and region growing based segmentation techniques are applied on edge detected seed images. We extracted the features such as colour, shape, and texture from the segmented images for further classification. One can extend this work to generate most significant feature vectors for efficient and accurate classification.

10. References

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