An Approach to study of various image processing techniques

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Abstract

The image processing techniques plays vital role on image Acquisition, image pre-processing, Clustering, Segmentation and Classification techniques with different kind of images such as Fruits, Medical, Vehicle and Digital text images etc. In this study the various images to remove unwanted noise and performs enhancement techniques such as contrast limited adaptive histogram equalization, Laplacian and Harr filtering, unsharp masking, sharpening, high boost filtering and color models then the Clustering algorithms are useful for data logically and extract pattern-analysis, grouping, decision-making, and machine-learning techniques and Segment the regions using binary, K-means and OTSU segmentation algorithm. It Classifying the images with the help of SVM and K-Nearest Neighbour(KNN) Classifier to produce good results for those images.

Keywords: Image Acquisition, Image preprocessing, Image enhancement, Clustering, Region of Interest (ROI) Image segmentation, Classification.

1. INTRODUCTION

In this paper study on analysis of image processing techniques with various images have been discussed. One of the image processing techniques apply in disease identification of fruit or vegetable images in agriculture industry and classify the different variety of fruits like apples and bananas which can be used to identify a fruit and generate its price automatically in a shop or supermarket with help of automation machine vision [1]. The Digital images are effective to identifying and classifying the defects in any fruit like apple depends upon the size, color, shape. Different kinds of defects can be identified such as rot, blotch, cork spots, scab, fungi attack, bitter pit, bruising, punches, insect holes and growth defects. An apple detecting defects in fruits at an early stage can help to reduce infection spreading to other parts of the fruit which will help the agricultural industry. Computer vision to get closer to human levels of recognition, to use different applications related to food items which are based on image processing techniques suchas fruit

grading, yield mapping, robot harvesting, leaves disease detection, weed detection, etc. [2]. In terms of the bagging green apple images in the work, Segment the fruit regions via common fruit color or texture features and sub region extractions. Another method is to segment image by BP neural network or support vector Classifier, hybrid classifier, K-means machine clustering segmentation constructed through the training and integration of fruit shape and color features. Histogram equalization (CLAHE) algorithm use fruit green region and improve edge definition in image, and then the R-B color image based on CLAHE image was obtained. The linear contrast of the original RGB image was enhanced to improve color in the normal light regions of fruits and leaves [3]. A bayberry image segmentation method based on salient object detection homomorphic filtering and performs image enhancement and binary segmentation algorithms. It performs different type of fruits segmentation such as apple, lychee and orange. Apple segmentation was achieved using the method based on the adaptive meanshift and Ncut methods. The colour features and surface texture were used to segment apples and extract the colour and edge features [4]. The vein images using spatial domain and frequency domain to enhance the vein patterns in hand image and captured hand image to detect the vein patterns to remove unwanted noise in hand image which result in order to avoid false detection of veins. It applies pre-processing and improves the image for visual perception of humans and making further easy processing steps on the resultant images by machines, it gives exact information about the vein pattern in the captured image. As a result, vein can be detected using this technique appears to be clearer and would provide ease further analysis in vein applications [5].Brain tumor extraction of magnetic resonance image (MRI) shows very effective and difficult to perform tumor extractions so using the machine learning techniques and perform the tasks. Segmenting brain tumor and their regions using deep learning methods in MRI sequences and provide clear tumor regions [6]. The traffic is the world vast problems to control the traffic with the help of License Plate. If monitoring traffic count and detecting vehicle and its license plate can reduce traffic congestion at peakhours

and can avoid accidents and crime. The locating license plate, fetching characters in the license plate and extracting the license plate number and display them using an enhanced threshold technique. It classifies the vehicle license plate using K-nearest neighbor Classifier, and the subtraction method is being used to count the vehicle in a motion video to give good accuracy [7]. To enhancing and detecting a text in digital images and have some shimmer and shades. Some complex background to detect a text to enhance a text by removing noise using filters and improves the sharpness by gradients using Sobel and Laplacian method. This method provides better results by improving blurred and shimmer based digital text images as well as it is applicable for normal text images. Normally, Text detection and recognition are usually done in handwriting images, and historical documents with various languages like Tamil, English, Telugu, and Hindi. Similarly, for numbers is also applicable. Recent days all the process is moving to digital process like swiping, ATM, mobile, and LED boards in railway stations and buses. Since it is necessary to enhance and detect texts in digital images. To achieves better result and generates a combination of gradients using Sobel and Laplacian and apply histogram equalization techniques[8].

This paper presents study on various image Processing Techniques using images to apply different techniques. The rest of the paper is organized as follows. Section II describes related work done in this area. Section III explains the various existing methods. Section IV shows the observation of previous experiments and finally Section V yields the conclusion.

2. RELATED WORK

Figure 1 illustrates the general framework of different kind of images such as fruit images, medical images, vehicle images, digital text etc. The traditional steps followed in order to apply various image processing algorithms in a given images are as described below:

K Tarale, et al., have introduced a fruit detection 1) using morphological image processing technique and proposed a new method for fruits recognition system [9]. AnujaBhargava, et al., The automated machine test and classify the defects fruits and vegetables using computer vision techniques. This paper presents a detailed overview of various methods namely preprocessing, segmentation, feature extraction. classification which addressed fruits and vegetables quality based on color, texture, size, shape and defects. In this paper, a critical comparison of different algorithm proposed by researchers for quality inspection of fruits and vegetables has been carried out [10].

2) Ghobad et al., The researcher has take six apples and find the defects with the help at CCD matrix camera, then the shape of apple images are extracted by Active Counter Model [ACM] algorithm in the pixel values have been counted and measure the statistical histogram-based EM algorithm accuracy for healthy pixel and 94.86% [11].

3) The vehicle images, all the license plates are rectangular in shape and find the edge information using plate. Multinational vehicle license plates have been detected based on rear-lights and Heuristic Energy Map of vertical edge information and using a unique histogram approach [12]. The license plate is detected in both morning and night time using the line and clip functions to analysis Gaussian function [13]. A method for recognizing the vehicle number plate based on template matching using modified Otsu's method algorithm for threshold partitioning with normalized cross correlation[14].

4) Tumor Regions in MRI images: In this tumor images are collected and extract tumor features automatically using deep learning based convolutional neural networks (CNN), it automatically segments the regions and classifies particular regions in effective manner [15].

5) Digital text image: The text images are divided into three types such as document images, scene images, and digital images. Document images contain text and graphics, these images are originated by scanners and cameras. Scene images can have text images such as advertising boards and banners [16] and it apply gradients using Sobel and Laplacian methods to extract the noise text regions using segmentations method to enhance those text and clearly visible onmachine.



Fig1: Apple images with defects, fruits, Digital text, brain tumor (MRI), vehicle license plate, vein, bayberry images

3. EXISTINGMETHODOLOGIES

3.1 IMAGEACQUISITION

PL. Chithra et al., [1] RGB color images can be acquired using a Digital camera using an illumination chamber. The researcher using images research work images size is 800 x 800pixels.

AnujaBhargava et al., [10] the fruits and vegetables find the defects in light systems. The light system inspect surface quality attributes are front lighting is color, texture and skin defects. However backlighting inspects the boundary quality attributes like size and shape with help of image acquisition tools. The image acquisition tools used are camera, ultrasound, magnetic resonance imaging (MRI), and electrical tomography and computed tomography(CT).



Fig2: Automatic machine to find defects in fruit

3.2 IMAGE PRE – PROCESSING

The pre-processing technique is used to removing unwanted noise and improve images by using image processing techniques are smoothing and sharpening. Image Pre-processing techniques used are scaling, transforming, zooming, resizing and converting images to grey scale images.



Fig3: Digital Text images.

3.2.1 IMAGEENHANCEMENT

PL.Chithra et al., [8] Image enhancement is used for improvising the quality of image. This technique is most widely used in many applications. Sometimes images captured from satellites and digital camera is having less contrast, brightness and noise because of illuminations. Main goal of image enhancement is to improvise the blurred and noisy image by sharpening and removing noise in the image. Here, this paper suggests some image enhancement techniques such as histogram equalization, filtering to remove salt and pepper noise, and sharpening using Text images and bib numbers[8].



(a)Grey scale image

(b)Histogram

Fig4: Histogram equalization using Digital Text

3.2.2 NOISE REMOVINGFILTERS

To remove noise like salt and pepper, and Gaussian noise in an image usually mean and median filters are used. The image processing techniques perform median filter to remove noise and to make sharpness in image it includes Sobel and Laplacian filters to improve quality of image. Noise occurs usually variation in brightness of color information. It typically use median filter takes the midpoint value in a given set of values. Sometimes median filter works better than the average filter.



Fig 5: Remove noise images

Homomorphic filtering is an image enhancement algorithm and is a special filtering method used to compress the brightness range and enhance the contrast in the frequency domain [4]. It enhances the image details in dark regions and maintains the details in light regions to reduce the unclear illumination by reducing the low-frequency component and increasing the component. higfrequency Before applying the homomorphic filtering process [25], in the optical properties in low frequencies reflecting light conditions. To enhance the luminance component use butter worth filters to maintain the hue and saturation components.



Fig 6: Homomorphic filter

3.2.3 SHARPENING

The digital images have some lighting conditions, colour contrast and resolutions. The sharpening in two ways by gradient direction and gradient magnitude by using Sobel and Laplacian with sharpening an image. Sharpening of an image is generated the low-level frequencies. Similarly smoothing of an image is produced by suppressing the high-levelfrequencies.

3.3 FEATUREEXTRACTION

The Feature extraction classifies the apple and banana samples using Wavelet transformation, Statistical features Texture features. Wavelet transformation is DWT (Discrete Wavelet Transformation) performs coefficients of diagonal, vertical and horizontal pixel values. Statistical features second level decomposition of the segmented image and its measures the mean and standard deviation. Texture features like Energy, Homogeneity, Contrast and correlation. The Correlation measures the segmented image, M x N size of the image with M rows and Ncolumns.

3.3.1 REGION OFINTEREST

PL. Chithra et al., [1] the researcher classifies the apple/banana and vegetable images [17] to extract the

ROI. The RGB image was converted into HSI color space. It takes the Hue component images and subtract those image values Otsu'smethod.

$$S(x,y) = \begin{cases} 1 & if gri(x,y) > Th \\ 0 & if gri(x,y) \ge Th \end{cases}$$

Then 'Th' value was obtained using. Here gri(x,y) was the background subtracted image.

3.3.2 LICENSE PLATE NUMBER EXTRACTION(LPNE)

PL. Chithra et al., [7] the various vehicles detects and classifies in two stages: (i) Training images using KNN Classifier and Pre-processing of input images Feature Based Multiple Vehicle License Plate Detection and (ii) Plate Recognition and Extraction of License Plate [27].

3.3.3 CLUSTERING

PL. Chithra1et al., [2] the pixels are exchanged by cluster. Pixels may belong together because of same color, texture etc., it identifying the diseased part in any fruit [18]. The food image clustering is an efficient method. This method classifies pixels into different groups called clusters. The cluster measures the distance. Partitioning the pixel set into k subsets is often referred to unsupervised learning. Clustering algorithm assumes that a vector space is formed from the pixel features and identify cluster is a very fast procedure and also an attractive one. When color histogram in different color space that L*a*b provided better feature space for segmentation of color images. L* is the lightness factor, a*and b* are the chromaticity coordinates. L*(lightness) axis -0 is black; 100 iswhite.

$$L^* = 116(\frac{y}{yn})^{1/2} - 16$$

The Median measures the intensity level of pixel are high intensity value pixels from lower intensity value pixels. It is one of the statistic filter and rank filters is the median filter. It works by selecting the middle pixel values measures the arithmetic average. This filter simply sorts all values within a window, finds the median value and replaces the original pixel value with the median value and gives good result.



Fig 7: Apple images with cork spot disease

3.4 IMAGESEGMENTATION

AnujaBhargava et al., [10] the author applies segmentation process in pre-processing, classification and clustering using Otsu method. The cluster minimize and maximize threshold values and unsupervised algorithm for fuzzy clustering used to segment colour images of apples which increases accuracy in segmentation algorithm [22]. It evaluates MFIS model as more accurate (86.00%) colour and fungal disease it extracts fungus attributes and stem depth of tomato and identifying fungus by using segmentation [23]. In this method, thresholding and k-means clustering algorithm are used for segmentation of image and identifying fungus using automatic machines and provide 97.98% accuracy, although nearest neighbor technique is also extended with 92.93% accuracy it depicts the accuracy of different Segmentation techniques implemented for quality analysis of fruits and vegetables.



Fig 8: Segment the defected fruit.

Jidong L [3] the natural environment, the image of bagging green apple tended to show highlighted area, the researcher difficult to segment fruit area. In the work, the fruit area was extracted through two kinds of ways. One method is to extract the normal-light area of fruit surface and other method is to extract the Highlighted fruit area-oriented extraction. The actual images convert the binary images and also use the Kmeans cluster segmentation base on R-Bmodel.



Fig 9: R-B model images.

Liming et al., [4] The researcher designed bayberry image segmentation the natural environments illumination will affect the detection of the salient target and the effect of image segmentation [21]. This work applies an image enhancement algorithm, homomorphic filtering, to conduct light compensation. As it measures visual saliency computation, Super pixel with a uniform size and similar image features of a red bayberry image is obtained using the SLIC (simple linear iterative clustering) segmentation algorithm. In this model select the super pixel nodes and apply binary segmentation. The Otsu's method is used to conduct binary segmentation of the obtained saliency maps, achieving segmentation of the red bayberry.



Fig 10: segmentation results produced by different algorithm.

PL.Chithra1 et al.,[6] the researcher analysed segmenting brain tumor images in deep learning techniques based on Convolutional neural network[19]. It is very difficult to segment the brain tumor so the researcher applies more than one convolutional layer for segmenting and classifying brain tumor automatically [20]. It use layered model in each images to do contrast (FLAIR) for non-enhancing and enhancing tumor and produce betterresult.



Fig 11:Four imaging modalities: (a) weighted MRI (b) weighted MRI (c) FLAIR and (d) FLAIR with contrast enhancement.

3.5 CLASSIFICATION

The SVM Classifier Support Vector Machines are based on the concept of decision planes that define decision boundaries. Feature values extracted after applying wavelet transformation on the segmented image using Haar filter. The researcher works those methodstoapplydefectedfruitimagestoprovide100 % accuracy.



Fig 12: RGB image original image, converted HSI image banana and apple sample.

The KNN based on the feature classification in the number plate find the exact match or the nearest match, it investigates the crime stolen vehicle or accidental vehicles. Some of the old list of vehicles in the database can be cross validated and produce the match's solution for the case. After extracting the number of the license plates, the extracted number is passed as input to the KNN Classifier to produce the best match relevant from the plate number given as input. In this proposed method the contour hierarchy function is used. The input passed to the contour hierarchy must be of black background and white text, to satisfy this condition the input image is pre-processed to a gray-scale and then adaptive threshold is applied[28].



Fig 13: Number plate classifier

4. OBSERVATION

PL.Chithra et al., [1] A machine vision system for segregating/ classifying apple fruit and banana fruit was developed and tested for 100% accuracy using KNN classifier. The researcher classifies defect fruits in easiest way using machine system. Liming Xu et.al [4]segmentation of bayberry images to produce average values of Precision, Recall and F-measure values are 0.93, 0.83 and 0.90, respectively performs more effectively than Otsu's and K-means segmentation algorithms. Jidong et.al [3] the average values of Af, FPR and FNR were reduced by 32.68%, 5.97% and 2.14% and Compared with the results of K-means clustering segmentation algorithm based on R-B, the average values of Af, FPR and FNR were reduced by 18.17%, 5.86% and 7.73%, respectively.

5. CONCLUSION

This study paper focuses on image processing techniques are image Acquisition, image preprocessing, Clustering, segmentation and classification to perform different kind of images and it produces the better performance. The different kind of researcher use those techniques and apply the different types images and gives better accuracy. The quality of images is based on clarity using best techniques. Our future work will be focusing on an efficient algorithm for image processing techniques for automated sewer pipe defects using CCTV image.

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