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Image Enhancement Techniques on Plant Leaf and Seed Disease Detection

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ABSTRACT: Digital image processing is manipulating the digital images by using the computer algorithms. Image Enhancement techniques have been widely used in many image processing application where the subjective quality of images are important. Image enhancing techniques are used to suppress the both high frequencies such as smoothing the image and low frequencies such as enhancing or detecting the edges of the images. This paper explores the image sharpening techniques such as Unmask sharpening, Gaussian Sharpening and image enhancing techniques such as Color Histogram Equalization. These proposed preprocess techniques are applied on plant seed and leaf image dataset and PSNR, MSE are measured. When comparing the results of the proposed methods, Gaussian sharpening technique results with better PSNR, MSE measurements.

KEYWORDS: Plant Leaf; Plant seed ; PSNR; MSE; Enhancement Techniques.

I. INTRODUCTION

Digital Image Processing dominates in all kinds of information processing systems. Image processing refers to progress the digital images and mine knowledge from images. It is a widely used technology for digital image developed field on its own within image processing. Generally Digital images are collection of pixels and these pixels remain prearranged now a systematic rectangular display. The row and column of that array is specified as height and width of the image. The image width and height is determined from the number of columns and the number of rows in the array [2].

Leaf and seed is most important part of the plant. Damage in seed is an important quality factor for grading, marketing. Seed damage can be caused by weather, fungi, insects, artificial drying, and by mechanical damage during harvest, transportation, storage and handling[1].Detection and recognition of diseases in plants using machine learning is very fruitful in providing symptoms of identifying diseases at its earliest. Detection means detecting of weakening of health or a condition of abnormal functioning or the action of identifying the presence of something suppressed. Identifying is the action or process of identifying something or the fact of being identified [1]. Find the particular disease By observing the signs and symptoms.

Diseases in leaves are cause major production and economic losses in agricultural industry. Monitoring of health and detection of diseases in leaves is critical for agriculture. This is report a machine vision system for the identification of the leaves diseases, from colored images [6]. This work divided into five stages. First stage is preprocessing the input image and second stage is shape, color, texture features are extracted from that image. Third stage is segmenting the disease regions and the normal regions from that image. Fourth stage is detecting the disease using classifier and fifth stage is give optimum solution using genetic algorithm.

Generally images have some unwanted things. Preprocessing is an improvement process of image data to suppresses unwanted distortion or enhances some image features for further processing. There are various enhancing techniques are available. This work expresses the Histogram Equalization and Image Sharpening Techniques. Enhance the image by using these techniques.

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In this paper, literature survey is presented in Section 2. Section 3 describes Methodologies and section 4 describes experimental results. Conclusion is presented in section 5.

II. LITERATURE STUDY

Chopade, *et al.* [1] have proposed identification and detection of infected glycine max (Soybean) seed using image processing. The paper discusses detail study about diseases, causes and techniques used to identify and detect them. Proposed work has greater social impact by helping farmers to identify the seed borne diseases at early stage and thereby increasing yield. Then segment the image and matching that image in database and whether the match is found or not. Reliable detection of seed borne diseases in early stages is essential for economic, production and agricultural benefits. Key contribution to the paper is to identify the issues related to seed borne diseases.

Prasad, *et al.*[5] have proposed the Image Sharpening Method by Suppressing the Noise. In this paper image noise, noise suppressing methods and image sharpening methods are discussed. This paper was experimented the median filter with sharpening techniques and without sharpening techniques, Homomorphic Filter and Gaussian low pass filter. The experimental result shows that de-nosing effect of median filter on salt and pepper noise is much better than low pass filter on Gaussian noise and if noise is salt and pepper then de-noising with sharpening in spatial domain is much better than in frequency domain for this type of images, microorganisms.

Padmavathi, *et al.* [6] have presented a genetic algorithm to identify and detect the plant leaf disease and gives optimal solution. Pre-process the image using various techniques like image resize, filtering, segmentation, morphological operations etc. feature extracted by color, shape, texture. Genetic algorithms can provide a number of potential solutions to a given problem. The final choice is left to the user.

Image Enhancement using Sharpen Filters have been proposed by Singh, et al. In this paper, a new nonlinear filtering technique is introduced for enhancement of images that are highly contaminated by impulse noise. The proposed filtering technique is more effective in eliminating impulse noise and preserving the image features. The filter replaces a corrupted pixel by the median value or by its processed neighboring pixel value [7].

A Plant leaf disease recognition method has provided by Zhang, *et al.* First, the spot is segmented, and the disease feature vector is extracted. Then, extracted features are involved the K-nearest-neighbor classifier to recognize the plant diseases. From the Experimental results the proposed approach is effective one. The proposed method can recognize and classify the plant diseases with high recognition rate [8].

III. METHODOLOGY

Image enhancement is the process of adjusting digital images so that the results are more suitable for display or further image analysis [16].

This section describes the Image Enhancement techniques such as Unmask Sharpening Technique, Gaussian Sharpening Technique and Histogram Equalization. All these procedures are used together to solve a complex problem. The proposed work is shown in figure 3.1

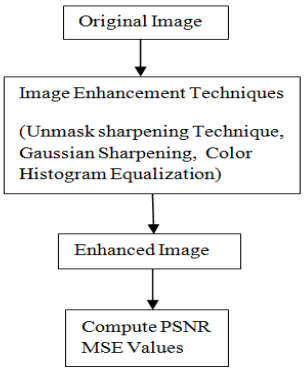

Fig. 3.1 Block Diagram

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Sharpening is a process of manipulating an image so that image is more suitable than the original image [5].
There are many types of sharpening techniques are available that listed below:

1) Capture Sharpening
2) Creative Sharpening
3) Output Sharpening
4) Unmask Sharpening
5) Gaussian Sharpening

A. *UNMASK SHARPENING*

In many image processing application is necessary to improve the image quality by increasing its sharpening. The image sharpening is a process to sharp the edges of that image. Unsharp masking (USM) is an image sharpening technique, often available in digital image processing software. The Unsharp is the technique uses a blurred, or unsharp, negative image to create a mask of the original image. The un sharped mask is then combined with the positive (original) image, creating an image that is less blurry than the original. The resulting image, although clearer, may be a less accurate representation of the image's subject. In the context of signal processing, an Unsharp mask is generally a linear or nonlinear filter that amplifies the high frequency components of a signal [9].

Steps for Unmask Sharp

- Blur the Original Image
- Subtract the blurred image from the original image
- Add the resulting mask to the original.

$$g(x, y) = f(x, y) + k(f(x, y) - f(x, y))$$

k = 1 un sharp masking
k> 1 high boost filtering

where *k* is a scaling constant. Reasonable values for *k* vary between 0.2 and 0.7, with the larger values providing increasing amounts of sharpening.

B. *GAUSSIAN SHARPENING*

There are two types of enhancement techniques called spatial domain and frequency domain techniques. There are two commonly discussed filters in the frequency domain:

- Low pass filters, sometimes known as smoothing filters
- High pass filters, sometimes known as sharpening filters

Frequency Domain Filters :

Low pass filters:

- create a blurred (or smoothed) image
- attenuate the high frequencies and leave the low frequencies of the Fourier transform relatively unchanged

Three main low pass filters are discussed in Digital Image Processing

1. ideal low pass filter (ILPF)
2. Butterworth low pass filter (BLPF)
3. Gaussian low pass filter (GLPF)

High pass filters:

A high-pass filter is a filter that passes high frequencies well, but attenuates frequencies lower than the cut-off frequency.

sharpen (or shows the edges of) an image

- attenuate the low frequencies and leave the high frequencies of the Fourier transform relatively unchanged

Three main low pass filters are discussed in Digital Image Processing

1. ideal high pass filter (IHPF)
2. Butterworth high pass filter (BHPF)

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3. Gaussian high pass filter (GHPF)

The high pass filter (H_{hp}) is often represented by its relationship to the low pass filter (H_{lp})[12]

In this work executing the Gaussian high pass filter.Gaussian low pass and Gaussian high pass filter minimize the problem that occur in ideal low pass and high pass filter[14].

The Gaussian function is used in numerous research areas:

– It defines a probability distribution for noise or data.
– It is a smoothing operator.
– It is used in mathematics [15].

C. COLOR HISTOGRAM EQUALIZATION

Histogram equalization is a technique used to enhance the image. Histogram Equalization is defined as equalizing the intensity distribution of an image and it is used to improve the contrast of an image [10]. This method usually increases the global of the usable of the image is represented by close contrast values. Through this adjustment, the can be better distributed on the histogram. This allows for areas of lower local contrast to gain a higher contrast [11].

In Color histogram equalization, the histogram equalization methods applied into separated RGB color components. Color histogram equalization can be achieved by converting a color image into HSV/HSI image and enhancing the Intensity while preserving hue and saturation components. However, performing histogram equalization on components of R,G and B independently will not enhance the image. At the end of this post, check the histogram of before and after histogram equalization of an image which is obtained by performing histogram equalization on the components(R,G and B) independently[12].

Steps to be performed:

1. Convert RGB image into HSI Image
2. Obtain the 'Intensity Matrix' from the HSI Image matrix
3. Perform Histogram Equalization on the intensity Matrix
4. Update the Intensity Matrix from the HSI Image matrix with the histogram equalized Intensity matrix
5. Convert HSI Image back to RGB Image[12]

Fig 4.1 shows the steps of proposed work

IV. RESULTS AND DISCCUSSIONS

The Unmask Sharpening technique, Gaussian Sharpening , Color Histogram Equalization are applied the various plant leaf and seed images.

Fig. 4.1 displays unmask sharpening result. In this Sharpening technique first get the motion blurred image then get the blurred image and finally obtain the sharpened image.

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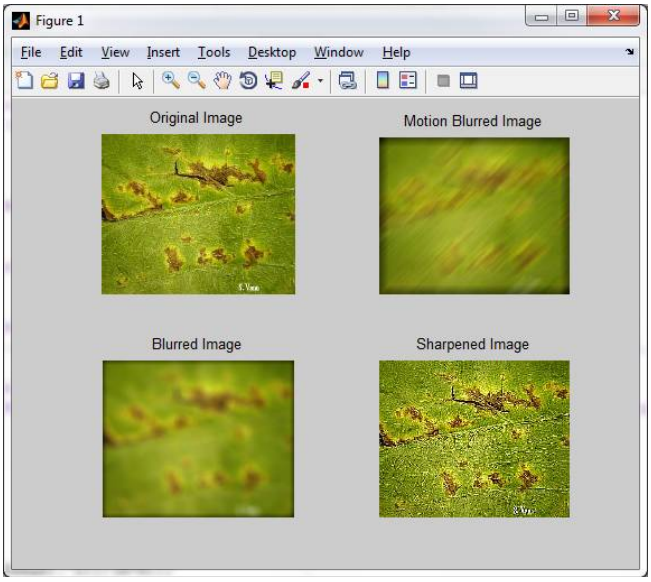

Fig. 4.1 Result of Unmask Sharpening Technique

The PSNR and MSE value of sharpened images of different plant leaf and seed images after applying Unmask Sharpening technique are listed in the Table 4.1.

Table 4.1.Unmask sharpening of different Plant Images

S.NO	IMAGES	PSNR VALUE	MSE VALUE
1	Soybean Leaf	33	30
2	Soybean Root	31	51
3	Soybean Seed	47	31
4	Cabbage Leaf	28	83
5	Tomato Leaf	34	24
6	Soybean Root	34	25
7	Wheat Leaf	34	26
8	Cabbage leaf	31	49
9	Soybean Stem	32	40
10	Sun flower leaf	30	64

The result of Gaussian sharpening technique shows in Fig. 4.2. Obtain the sharpened image by using the Gaussian sharpening Technique.

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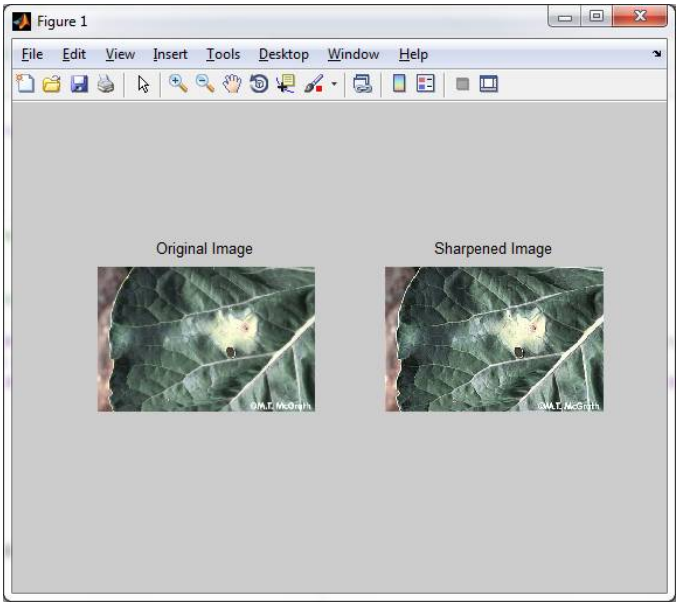

Fig. 4.2 Result of Gaussian Sharpening Technique

The result obtained by Image Sharpening by using Gaussian filtering techniques by different plant leaf and seed images are compared and listed in the Table 4.2

TABLE 4.2.GAUSSIAN SHARPENING OF DIFFERENT PLANT IMAGES

S.NO	IMAGES	PSNR VALUE	MSE VALUE
1	Soybean Leaf	36	15
2	Soybean Root	33	31
3	Soybean Seed	34	25
4	Cabbage Leaf	34	20
5	Tomato Leaf	36	15
6	Soybean Root	37	12
7	Wheat Leaf	36	13
8	Cabbage leaf	34	25
9	Soybean Stem	33	26
10	Tomato	41	4

Fig. 4.3 displays the output of color histogram equalization technique. After applying the Color Histogram Equalization technique to obtain the enhanced image.

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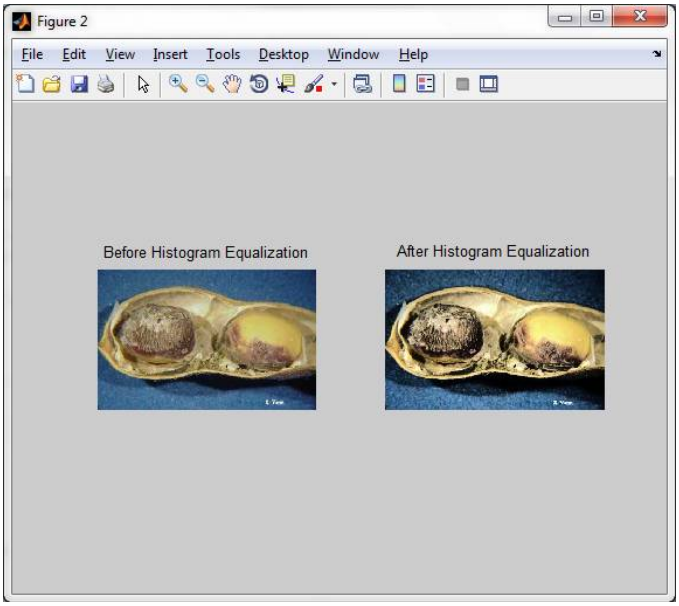

Fig. 4.3 Result of Color Histogram Equalization Technique

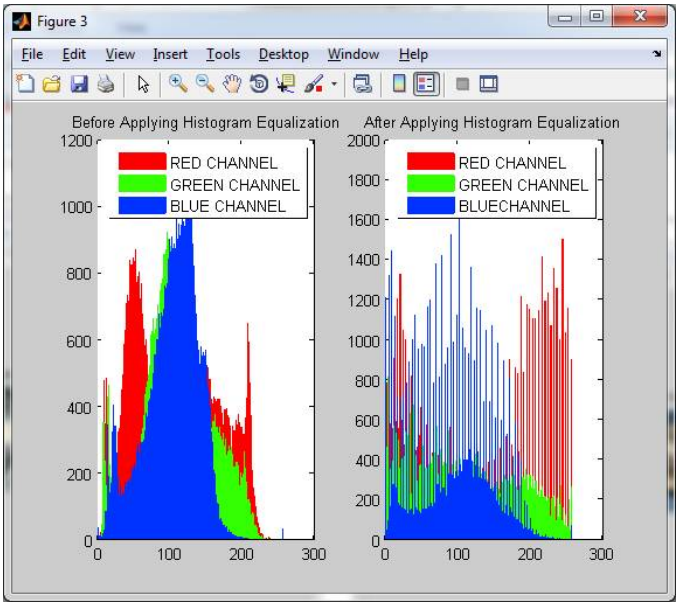

Fig. 4.4 Histogram of Color Histogram Equalization Technique

The result obtained by Color Histogram Equalization techniques by different plant leaf and seed images are compared and listed in the Table 4.3

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TABLE 4.3.HISTOGRAM EQUALIZATION OF DIFFERENT PLANT IMAGES

S.NO	IMAGES	PSNR VALUE	MSE VALUE
1	Soybean Leaf	33.22	31.21
2	Soybean Root	29.08	0.88
3	Soybean Seed	27.36	101.39
4	Cabbage Leaf	27.61	113.39
5	Tomato Leaf	27.33	121.09
6	Soybean Root	29.31	76.77
7	Wheat Leaf	34.44	23.56
8	Cabbage leaf	29.66	70.80
9	Soybean Stem	31.89	42.36
10	Tomato	28.81	86.03

It shows that the method proposed in the paper is effective for biologist in digital image processing. With this it will have high visual effect under image enhancement approaches such as sharpening, histogram.

V. CONCLUSION

In this paper, the various image enhancement techniques are experimented and analyzed. The knowledge on various image enhancement techniques such as Unmask Sharpening Technique, Image Sharpening using Gaussian technique and Color Histogram Equalization is gained. Comparing their results finding which image enhancement technique is best. Image enhancement techniques are used to improve the quality of an image. This helps us to give the good quality image to further process such as seed and leaf disease detection.

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