Color Feature Extraction of Tomato Leaf Diseases

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ABSTRACT- **In addition to environmental parameters like rain, temperature; diseases on crop is major factor which affects production quality & quantity of crop yield. Hence disease management is key issue in agriculture. For management of disease, it needs to be detected at early stage so as to treat it properly & control spread of the disease.. Because of advances in the technologies now a days it is possible to use the images of diseased leaf to detect the type of disease. This can be achieved by extracting features from the images which can be further used with classification algorithms or content based image retrieval systems. In this paper Color of the image is used to extract the features of images by calculating the 1st ,2nd & 3rd moment of Color. Tomato leaves are used for experimentation.**

Keyword: **Image Retrieval, Classification, Color**

I.INTRODUCTION

India is an agricultural country wherein most of the population depends on agriculture. And agriculture is one of the major domain which decides economy of the nation. The quality & quantity of the agricultural production is affected by environmental parameters like rain, temperature & other weather parameters which are beyond control of human beings. Another major parameter which affects productivity of the crop is the disease where human beings can have control to improve the productivity for quality as well as for quantity.

The diseases can be controlled by proper Disease management which is a challenging task. This challenge can be converted to easiest task by using image processing for detecting diseases of leaf, stem, root & fruit. With image processing it is possible to detect the affected area , type of disease & severity of the disease. Mostly diseases are seen on the leaves or stems of the plant. Because of the complexity of visual patterns of the diseases there has been increasing demand for development of more specific and sophisticated image pattern understanding algorithms which can be used for studies like classifying lesion, scoring quantitative traits, calculating area eaten by insects, etc. Now a days almost all of these tasks are processed manually or with distinct software packages. It is not only tremendous amount of work but also suffers from two major issues: i)excessive processing time and ii) subjectiveness rising from different individuals.

Hence to conduct high throughput experiments, plant biologist need efficient computer software to automatically extract and analyze significant features .

As far as the leaf of the plant is considered , the significant features can be obtained by ;
1. Color of the leaf
2. Texture of the leaf
3. Shape of the leaf
4.

Color is one of the most widely used features[1]. Color features can be obtained by various methods like Color histogram[2,3], Color correlogram [4], Color R moment [1,5,6], Color structure descriptor[7]. The Color moment method has the lowest feature vector dimension and lower computational complexity. Hence it can be considered as suitable parameter to generate feature vectors which can be further used for classification purpose or for image retrieval.

For the study proposed in this paper , Color of the diseased leaf of the tomato is used to generate the features. Tomatoes are the most popular & widely grown vegetable food crops in the World. Crops of tomatoes have socioeconomic importance to families, gardeners, farmers, laborers, marketers,

retailers, chefs and other workers and services in the food and restaurant industries. Tomatoes rank as the 10th most valuable agricultural commodity[8]. Hence tomato leaves are selected for experimentation.

Many diseases and disorders can affect tomatoes during the growing season of tomatoes. the most common which are considered in this paper are[9] :

1. Early Blight : the tomato leaves will have one or two spots per leaf, approximately ¼ to ½ inch in diameter. Spots have tan centers with concentric rings in them and yellow halos around the edges

2.Late Blight : Spots that start out pale green, usually near the edges of tips of foliage, and turn brown to purplish-black. In humid conditions, a fuzzy mold appears on the undersides of leaves

3. Septoria Leaf Spot: Numerous brown spots appear on the leaves, approximately 1/16 to 1/8 inch in diameter. The spots lack a yellow halo, and, upon close inspection, have black specks in the center.

II.COLOR MOMENTS

Color moments are very effective for Color-based image analysis. The information of Color distribution in a image can be captured by the low order moments. The first & second order moment has been proved to be efficient and effective in representing Color distribution of image[10].

Let P_{ij} is the ith Color channel at the jth image pixel. Then three Color moments can be defined as :

Moment 1: It is called Mean. It provides average Color value in the image. It is calculated using following statics:

$$Mean(\mu) = \sum_{N}^{j=1} \frac{1}{N} P_{ij} \qquad (1)$$

Where N is the total number of pixels in the image.

Moment 2: It is called Standard Deviation. The standard deviation is the square root of the

variance of the distribution.It is calculated using following statics:

$$Std.Deviation(\sigma) = \sqrt{(\frac{1}{N} \sum_{j=1}^{N} (P_{ij} - E_i)^2)} \quad (2)$$

Moment 3: It is called Skewness. It gives measure of the degree of asymmetry in the distribution. It is calculated using following statics:

$$Skewness(s) = \sqrt[3]{(\frac{1}{N} \sum_{j=1}^{N} (P_{ij} - E_i)^3)} \qquad (3)$$

III.EXPERIMENTS RESULTS

The experiment is implemented using MATLAB image processing tools & statistical tools. For the experiment 10 different leaves of the tomato affected by late blight, early blight & Septoria Leaf Spot diseases are used. Figure 1 shows the leaf images used for experimentation.

Each of the image is separated in to red, green & blue image components by implementing following commands in MATLAB[11].

red=rgb_image(:, :, 1)
green=rgb_image(:, :, 2)
blue=rgb_image(:, :, 3)

Then for each of the Color component three Color moments(CM) are calculated. Hence for each image total 9 features of Color moment are obtained which are tabulated in table 1.

| 1.Early Blight | 2. Early Blight | 3. Late Blight | 4. Late Blight | 5. Late Blight |
| 6. Late Blight | 7. Late Blight | 8. Early Blight | 9.Leaf Spot | 10. Leaf Spot |

Figure 1: Images of tomato leaves

IMAGE	CM1 (Red)	CM2 (Red)	CM3 (Red)	CM1 (Green)	CM2 (Green)	CM3 (Green)	CM1 (Blue)	CM2 (Blue)	CM3 (Blue)
1	0.4378	0.1845	0.2259	0.4937	0.1770	0.2081	0.4259	0.1907	0.2153
2	0.4674	0.1712	0.2109	0.4842	0.1957	0.2273	0.3107	0.1539	0.1843
3	0.3095	0.2446	0.2807	0.4713	0.2338	0.2656	0.2956	0.2268	0.2587
4	0.2706	0.2609	0.3045	0.4767	0.2480	0.2766	0.1664	0.1652	0.1920
5	0.5249	0.2228	0.2493	0.5707	0.2430	0.2791	0.4148	0.1922	0.2117
6	0.4283	0.2150	0.2429	0.5098	0.2006	0.2269	0.2425	0.1922	0.2293
7	0.3411	0.1783	0.2119	0.4816	0.1931	0.2138	0.1970	0.1639	0.2072
8	0.2649	0.1535	0.1903	0.5803	0.1285	0.1643	0.2469	0.1354	0.1630
9	0.3527	0.2574	0.2813	0.6569	0.3442	0.3836	0.4498	0.2680	0.2948
10	0.4872	0.1681	0.1985	0.4999	0.1847	0.2150	0.3127	0.1858	0.2274

Table1 : Color moment features of all images

IV.CONCLUSION

The features obtained from Color moments can be further used for indexing images based on Color. This can be further used for classification of leaves in to respective diseases using various clustering algorithms. Also   can be used as one of the parameters for content based image retrieval systems.

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