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K-Nearest Neighbor Algorithm based Classification of Cauliflower Pest for Pest Identification in Vegetation

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***Abstract*:**

Agriculture is meant for producing sufficient food for the growing population. But today the agriculture is widely affected by change in climatic conditions, Pest and Diseases. Pest problem is the major problem in agriculture. Pesticides are utilized to control the pest in the fields. These pesticides are dangerous which not only affects the harmful pests but also affects the useful pest. It also makes the farm infertile. Therefore, a technique which inspect and eradicate the pest without harming the environment has been identified. In this paper the pest infecting the cauliflower are identified by using image processing technique. More than 100 images of pest infecting the cauliflower are gathered from various farms of cauliflower in real time for the analysis. Enormous factual highlights are extricated from the pictures which will improve the precision in recognition of pest. The effective testing and training has been done. The K Nearest Neighbor classifier is used in this work for pest classification. This technique detects the pest in its initial stage. Hence the control action has been taken in time without damaging the crops. The MATLAB is the simulation tool which is being used in this paper for validation of results.

Keywords: Pest, Pest detection, Pest Identification, KNN, Neural Network

1.INTRODUCTION

The quick rise of growing population rises the demand of food (Agnihotri,et.al,2019) [1].Research in agriculture is intended in the direction of rise in profitability and nourishment quality at decreased use and with expanded benefit, which has gotten significance in late time (Bhadane,et.al,2013) [2]. Colossal measures of yields are destroyed every year because of pest. (ApurvaSriwastwa, et.al, 2018) [3]. Pest detection is crucial to secure crops and ensure food quality (Yogesh Kumar, et.al, 2017) [4].Nowadays non chemical method of pest identification and control has been preferred in many countries for supplying good nutrients to the growing population. Automatic detection of pest detection must give the exact location pest. Video processing involves the easiest method for finding the exact location of the pest (Wadhai, et.al, 2015) [5].

Manual observation is a typical utilizing strategy to recognize the pest. In any case, it is tedious procedure. (Preetha, et.al, 2016)[6]. The right creepy crawly species distinguishing thickness find out gives the vital premise to bugs avoidance and control (Ting, et.al,2011) [7].Hyperspectral or Multispectral machine vision arrangements have indicated pay for proficient and exact location and recognizable proof of certain invertebrate pest.(Liu, et.al, 2017).

Monitoring the farmland are very important to safeguard the crops from pest which is being done by colour feature extraction and thresholding techniques. (Jing, et.al, 2018) [9]. The internet-based technology has been implemented to identify the diseases in corn. The corn plant pest are identified by calculating the probability value by Bayes’s theorem. In the example test the information of the manifestations of the ailment

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demonstrated that yielded a precision of 90%. (Ikorasaki, et.al, 2018) [10].

The insect migrations can be taken into the account Radar is suggested to detect the insect migrants (Kong, et.al, 2019) [11]. The early inspection of pest on the crops prevents the spreading of pest to other farms. Smart phones are used as the inference engine to meet up the challenges of the farmer in pest detection (Diego et.al, 2016).[12]. The multi layered neural network for the classification of pest can gives the exact identification of pest which are affecting the apple orchards. Order neural model utilizing advanced learning sets obtained based on the data encoded as computerized pictures of chosen bugs (Boniecki, et.al,2015) [13].

A method of segmentation and picture partition was concocted to recognize basic nursery bugs, whiteflies, aphid and outings. At first, the watershed calculation was utilized to portion creepy crawlies from the foundation (i.e., clingy trap) pictures.Colour features of the bugs were in this manner extricated by Mahalanobis separation for distinguishing proof of bug species. Precision and computational expenses were assessed crosswise over various picture goals. (Xia, et.al, 2015) [14].

There are lots of technologies which replaces the manual observation in fields but they are having some limitations like high cost, adaption of technology, Time consumption everything. In this paper the Image based pest identification has been narrated. The image-based pest identification is the non-destructive form of pest identification. This technology will not harm the environment and farmer. This improves the quality of crops cultivated. It not only identifies the pest but also detects the exact location of the pest. The location of pest investigation helps the farmer to take effective corrective action. This can also prevent the fast spreading of pest to other regions of farming.

2.KNN BASED PEST IDENTIFICATION

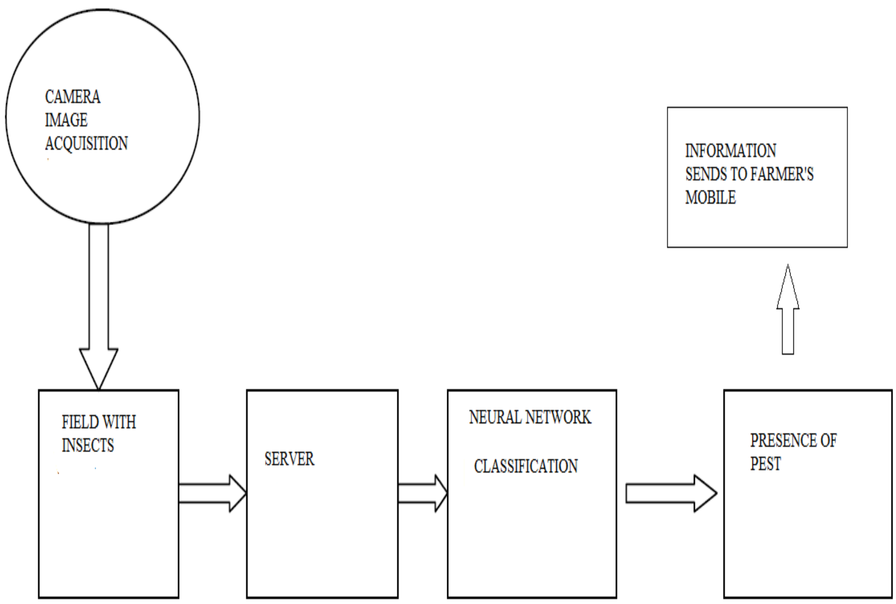

Fig: 1 Block Diagram of Proposed Work

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Cauliflower is the vegetable which is vulnerable to pest. Cauliflower bugs can destroy the crop and make the flower head unfit to eat. Therefore, its necessary to have a technology which detects the pest automatically. In this fig.1 the block diagram of proposed methodology has shown.

The picture sensor AH5020B23-S1-2Z1 is a USB Video Class (UVC) pleasant camera module with video incorporate, proposed for helpful diary PC picture applications. The photos are acquired from the cauliflower farms. Every 60 sec the photos are send to the server for taking care of which is inbuild with the request instrument. The KNN classifier fragments the picture to locate the contaminated zone. When the vermin is available the data needs to pass on the base station.

Image segmentation algorithm categorized into two types basically such as, supervised and unsupervised [15]. The unsupervised technique called K-Means and supervised version called K-Nearest.

2.1 K-Means segmentation method

K-Means for the most part works dependent on the parameters bunching and apportioning. Further, the pixels are same which is utilized in different groups. K-Means is a strategy to shape K-bunches. Its an iterative technique to for the bunches called K-Clusters. Based on the Euclidean distance metric few steps are classified as follows,

- As the first stage, K-Type clusters are selected depends on the predefined variables or randomly.
- In second stage, the assumed distance from the pixel and cluster centre is very minimum to the requirement
- On the consequently, the average size of the pixels are recomputed

2.2 K-nearest neighbour segmentation

In regard of K-Nearest segmentation method, it is an ideal and simple method used to obtain the good accuracy. By considering the k points, nearest neighbours found in the majority of the k neighbours. The class x usually witnessed in most of the k neighbours. There are some decision boundaries classified based on the steps highlighted below

- Introduction of K positive integer in the new sample
- The selection of new sample in the K-entries
- The new samples are classified based on the existing entries

In the K-nearest neighbour segmentation of the pixel is carried by the color marker and the pixel of the image. The distance between the colour markers and pixel called as pixels which signifies the matches. The figure 2 explains K-Means for the most part works dependent on the parameters bunching and apportioning. Further, the pixels are same which is utilized in different groups. K-Means is a strategy to shape K-bunches. Its an iterative technique to for the bunches called K-Clusters..

From above discussion I is evident that these tools are simple and easy to implement. Since it does not require any learning and training phases with god accuracy.

2.3 K-Nearest neighbours Algorithm

This is usually used for machine learning and classification for new data points.

2.4 PseudocodeForKnn

Let (X_i, C_i)

Where, X_i symbolizes feature values and

C_i signifies labels for X_i

Undertake i = 1, 2………. n be data points.

Further, pretentious the number of classes as ‘c’

$c_i \in \{1, 2, 3, \ldots\ldots, c\}$ for all values of i

2.5 KNN Algorithm Pseudocode:

1. Calculate “d(x, x_i)”
2. Find n Euclidean distances
3. k is a +ve integer
4. Find those k-points
5. If $k_i > k_j$ $\forall i \neq j$

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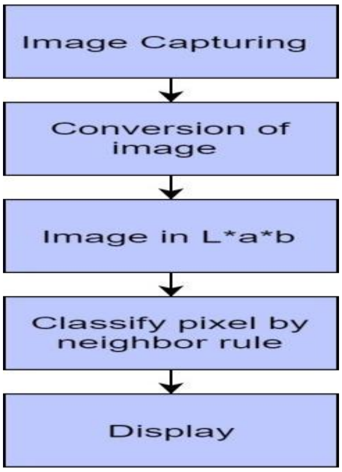

Fig: 2 K Nearest Neighbor Methodology

3. RESULTS AND DISCUSSION

The experimentations on the pest recognition agreed out in the cauliflower farms. The real time images are collected from the cauliflower farms. The image acquisition is done by using a smart phone. The specification of camera in the smart phone is front camera 16 MP and rear camera is 13 MP.

The major pest of Cauliflower is diamond back moth. In cauliflower the pupation occurs in the florets. These larva feed on the floret as well as the leaves. This is the most destructive pest in cauliflower.

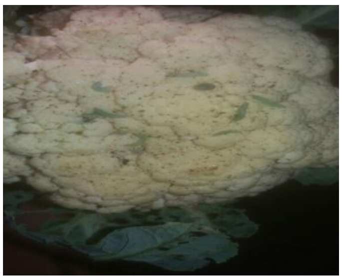

Fig:3 Real time image of cauliflower pest

The eggs of the diamond back moth are pale yellow 0.5 mm long. The larva grows 12 mm in length. The female lays more than 150 eggs during her life time.

The database is created with 100 real time images of pest 50 images of cauliflower with no pest. Totally it is created with 150 images.This strategy includes preparing and testing stages. In preparing, the shape, surface, shading, connection coefficient, power are the highlights separated from the picture. These separated highlights are utilized to prepare the KNN classifier. In the arrangement stage, the cauliflower pictures are pre handled and message highlights are extricated for order.The steps done in processing the images are given below. Fig 4 explains about the response of image processing algorithm in MATLAB

3.1 Pre processing

In this stage the information picture is changed over into the dark scale picture and the picture tends for clamor expulsion. The most significant strategy for the evacuation of obscure in the picture is utilizing wiener filter. The Wiener filter is one of the settled straight separating techniques and is generally known for its superb presentation in denoising the background noise. This channel is answer for the reclamation issue dependent on the guessed utilization of a liner channel and least mean square error (MMSE) paradigm [16].

3.2 Feature Extraction

The goals of highlight extraction is to decrease the one of a kind informational index by processing certain assets of highlights that segregate on input design from another. The features which are extracted meant for training the neural network. These features are saved into library for training. Shape, size,color,texture, correlation coefficient, homogeneity,centroid are the features extracted from the images in the database.

3.3 Edge Detection

In this work the Prewitt edge detection technique is used for detecting the region of interest. While the edge is in a plurality of directions [17]., The goals of highlight extraction is to decrease the one of a kind informational index by processing certain assets of highlights that segregate on input design from another. [18].

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3.4 Classification

The KNN is the traditional regulated classifier. It has great execution for ideal estimation of K. K-NN calculation includes following stages [19]

1. Decide a reasonable separation metric.
2. In the preparation Stage: Stores all the preparation informational collection P two by two (as indicated by the chose highlights) P = (yi; ci), I = 1. In this yi is spoken to as the preparation design in the preparation informational index, ci is its relating class and n is the measure of preparing designs.
3. During the testing stage: Computes the Distances between the new element vector and all the put away highlights (preparing information) [19].

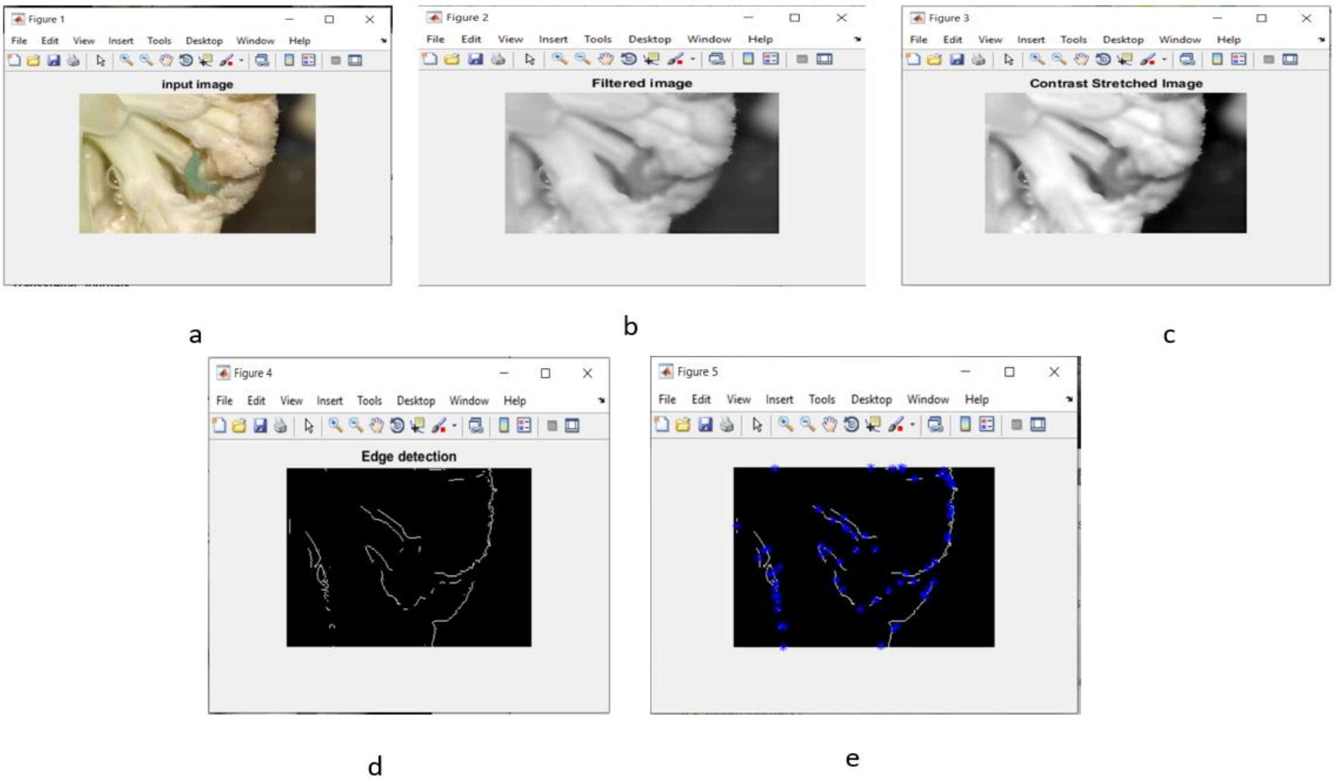

Fig.4: Results of Image processing Techniques

a) Original image b)Filtered image c)Contrast Stretching Image d)Edge detection e) Segmentation

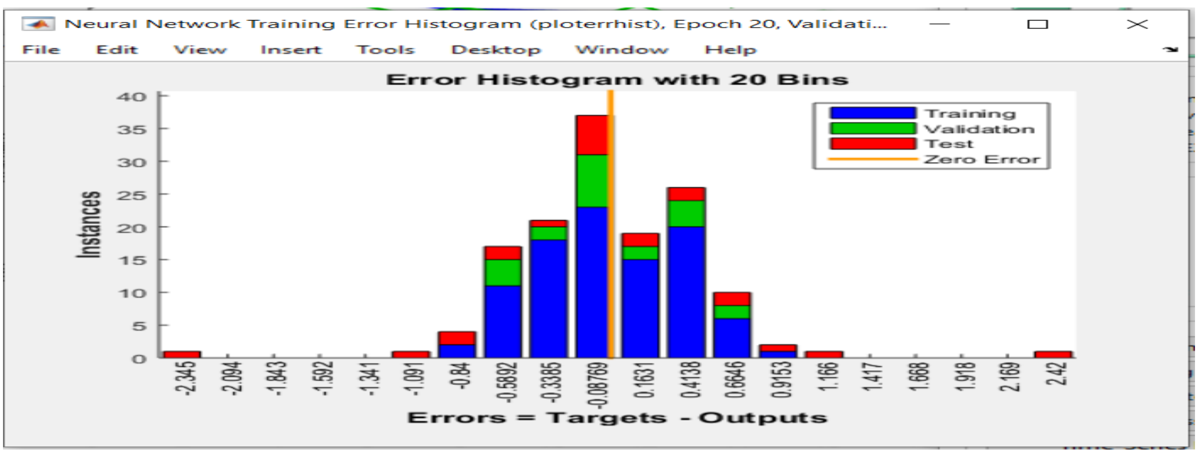

Fig.5: Error Histogram of Testing, Training and Validation

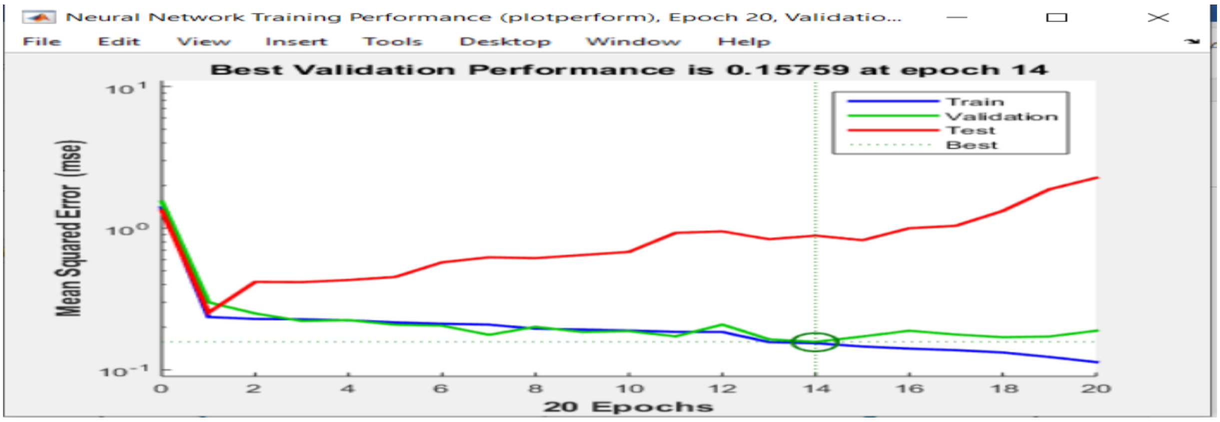

Fig.6: Validation of mean square error

Table 1: An analysis of Classification Using KNN for different values of k

KNN			
K values	K=9	K=11	K=13
Classification Rate	98.34%	95.37%	93.33%

The best validation performance obtained in epoch 14 with the validation performance done in 0.15759 Fig.6. The error histogram for testing and training is shown in Fig.5.

The KNN gives the accuracy of 98 % in pest detection .Cauliflower is the vegetable which is rich in antioxidants but the nourishments of the crops is reduced by using enormous pesticides. The proposed automatic pest identification Methodology Saves the time, cost and crops of the farmer. This gives the high quality prodct.

4. CONCLUSION

In this paper, an automatic detection of pest using image processing was presented. The early detection of pest is more important in order to take effective control action. The Pest are distinguished dependent on the highlights removed and to prepare the neural network. The presented technique is very simple and effective. The insect's pest images are captured, wiener filter is utilized for the removal of blur in the images. The image was scanned in different directions to get the accurate results. As per the analysis it is inferred that KNN is an effective tool for classifying the pest. But when the database size increases it becomes slow in processing the data. Therefore, in future work it should be incorporated with the soft computing technique which can do the process easier. The image processing-based pest identification is the non-destructive form of detecting the pest without harming the environment. The early detection of pest reduces the use of pesticides and increases the quality of crops.

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