International Journal of Enhanced Research in Management & Computer Applications
ISSN: 2319-7471, Vol. 5 Issue 7, July-2016, Impact Factor: 1.544

A Study Work on Agricultural Image Processing and Characterization

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ABSTRACT

Agricultural data and image processing is one of the essential field to perform the object identification or the disease recognition. But, this field suffers from various issues because of real time image processing and capturing. In this paper, the scope and the characterization of agricultural image processing is discussed. The paper has identified the different work areas and the characterization to provide the solution to the agricultural image processing. The paper also characterize the different process stages associated to the image processing in different related domains.

Keywords: Agricultural Image Processing, Plant, Disease Prediction

I. INTRODUCTION

Agriculture image processing is one of the core research area defied to provide the automated solution based on visible features of agricultural products. As the farming is wide spread in all regions and it is not possible to setup the region based labs, the agricultural data processing provide the online solution of this problem. The data or the image can be submitted to the research center online, and can obtain the relative decision. The decision can be relative to soil test, disease test in plants, fruits, flowers etc. Today, image processing can process the real time textural feature of plant components to identify the disease. The scope of image processing exists in different forms with correlated data processing. Some of the common sub-application areas relative to agricultural image processing are discussed in this section.

A) Soil and Land Processing

The soil or the land type can be analyzed to identify the possibility of the crop or the crop type. This kind of processing basically depends on the internal characterization that can be done only using data processing. But image processing can be applied to take the high level decision such as the identification of the damaged land, damaged crop area during some environmental hazard. These kind of images generally captures from the satellite and based on the region mapping, the particular critical region can be identified. The major requirement of such kind of image processing is the high resolution images[1][2][3][4][5]. These images called remote sensing images and provided the geographical and the geospatial characterization to take the effective decision.

B) Plant Species Identification

Another common research area comes under the image processing is to identify the species of the quality of the agricultural products. This is one of the complex and the product specific image processing method because each of the product and component having its own specialized features. The number of quality grades can be different for different agricultural products. In some products, the difference between the quality grade is minor and sometimes it cannot be recognized from naked eyes. The image processing requires capturing the features and relatively providing the solution to recognize the plant images. There is the requirement of larger training process of each species type and grade type to extract the distinguished features. These features can be used to perform the disease classification accurately. The disease feature identification and the classification is critical for some of such images[6][7][8][9]10]. The feature set generated for one product cannot be applied on other similar product.

C) Disease Recognition

The main requirement of agricultural image processing is to identify the disease plants. The disease can infect different components of the plant including the leaves, fruit, seed, flower, stem, root etc. The feature specific analysis can be

applied to distinguish the healthy and the disease instances of plant. The multi-factor analysis can be applied to perform disease identification. The feature factor observation is applied relative to the component specification. The textural and the geometrical constraints can be analyzed to identify the ideas. At the higher level, the disease are identified as the categorization of disease component or the healthy component. But, at the lower level the disease categorizes are defined. Each disease category defines the particular disease class specific features. Based on these features, the identification of disease is done. The rules are formulated with disease class specification. The number of disease classes, more difficult is to recognize the disease[11][12][13][14].

In this paper, a study work is provided for agricultural image processing is provided. The paper has defined the scope of agricultural image processing in different areas as well as provided the characterization.

II. RELATED WORK

Image processing is having its valuable importance in the agricultural applications. These applications include the crop identification and classification, fruit classification, fruit and crop disease identification, land identification and classification etc. The work already done by different researchers in this area is discussed in this section.

Parveiz Zeaiean has defined work on crop acreage estimation by performing the supervised learning approach. Author presented the scene analysis to identify and estimate the crop area and its classification. Author has used the maximum likelihood classification algorithm along with parallelepiped algorithm to estimate the crop area. Author performed the accurate size and shape identification of different crop areas[1]. Another work on the crop land identification and classification was performed by Wilbert long. Author defined the work on satellite captured images and performed the structural analysis. Author identified the vegetation and manmade structures to identify different land areas. Author defined a parametric learning under supervised learning approach for the classification process. The obtained results are showing the effective classification of the land area[2]. A work on the remote sensing images for the land classification was defined by Jinguo Yuan. Author performed the main work on preprocessing stage to improve the land areas by performing the atmospheric correction and the reformation of satellite images so that Hyperion image can be obtained. Author has defined the unsupervised learning approach to improve the classification accuracy and to perform the effective image classification. Author obtained the accuracy level up 99.3%. In this work, author perform the hybrid classification using the biophysical characteristics along with PCA approach[3].

A multiscale analysis along with improved classification and segmentation was proposed by Y.Lanthier. Author defined the pixel oriented as well as object centric approach for the classification. Author integrated the maximum likelihood algorithm with hierarchical segmentation to identify the cluster members. Author defined the ground area based analysis approach for the identification of the similar land areas. The analysis was performed under multiple vectors such as size, shape, color etc[4]. Heather McNairn has defined a crop classification approach using multi-polarization and polarimetric data. Author defined the phased array based analysis using L-band polarization method so that different kind of crops would be identified. The classification is here defined to achieve the 70% accuracy rate. Author defined the decomposition using three main approaches called Cloude-Pottier, Freeman-Durden and Krogager approach. This work is based on the linear polarization along with parametric analysis to perform the crop classification to improve the diverse capability so that crop classification. The satellite captured images were processed to identify different crop types. The analysis was done using the intensity diversity analysis. The obtained results shows the crop classification increasing viable[5].

A study oriented work based on multisensor fusion for crop classification was defined by Zhengwei Yang. This paper includes the study on different image fusion approaches such as PCA(Principal Component Analysis), Intensity Hue Saturation (IHS) and image band stacking (IBS). Author performed the spectral information decomposition along with multispectral transformation for fusion process. Author improved the classification assessment along with temporal combination analysis to improve the classification results[6]. Jianhoung Liu also work on the multi-spectral analysis based image classification for cropland parcels. This paper involves the texture analysis along with neighbor pixel scaling and analysis to perform the classification. Author defined the spectral variation analysis under different noising so that image observation will be done effectively and the inner boundary based crop differentiation will be obtained. A work on the agricultural land cover classification was defined by B. Erdenee to perform the land cover classification so that effective area segmentation will be done.

Author improved the work by performing the vector analysis on agricultural land to handle the ground truth data with supervised learning analysis. Author defined the reflective methods to perform the agricultural data monitoring and the ground checking of the images[7]. Multi-temporal adaptive work on agricultural land classification was proposed by Giuseppe Satalino. Author defined the work by performing the activity analysis along with image polarization and low incidence angle acquisition. Author has used the maximum likelihood algorithm along with temporal dataset processing to improve the work accuracy. Author has improved the work based on reference map to improve the spot data based classification [8]. A statistical method was adapted by Umberto Amato to perform the agricultural land classification.

Author used the discriminant analysis approach to perform the analysis on intensity diversity. The method adapted by the author combined the spectral band analysis along with segmentation and classification process. Author defined a multiclass SVM to derive the effective results. The presented work obtained the accuracy level more than 95%[9]. A study on application of remote sensing in agricultural images was presented by Mustafa Teke. Author defined the hyper spectral analysis approach to perform the classification. Author used the observation to maximize the resource usage and to handle the farming practices. Author defined the plant disease classification and identification of pest in crop[10]. Fruit image segmentation is one of the growing research area in agricultural image processing. A work on fruit segmentation using multi-spectral feature analysis was presented by Calvin Hung. Author defined the conditional analysis along with pervised feature learning. Author defined the variance analysis using caopy tree to improve robustness and accuracy[11].

III. CHARACTERIZATION OF AGRICULTRAL IMAGE PROCESSING

Agricultural image processing can be applied in different sub domains and in different processing methods to provide the predictive results. Different objects and the associated components can be processed under different feature generation methods, classifiers and the rectification methods to provide the predictive results. A series of operations can be applied over these images to generate the predictive results. The predictive results related to the object identification and disease classification majorly depends on different feature generation methods. The effectiveness of the feature generation ensures the accuracy in the recognition and classification methods. In this section some of the common features for feature generation are presented and discussed.

A) Feature Generation

The feature generation is the process defined to provide the effective exploration of the image characterization that can explain the image effectively. The accuracy of feature generation and the method selected ensures the accuracy in the prediction or classification. The feature can be generated in different forms including the geometric features, visibility specific features, color associated features, structural features, textural features etc. These features can be processed in different forms under different component forms. These feature forms includes the end point identification, distinctive point extraction, gravity point generation, edge feature extraction etc. Some of the common approaches for feature generation are

a) Region Features

Region features are the boundary specific features used to divide the single object in multiple regions. The regions can be tagged also to generate the effective features. The rotational angle formation, the region formed analysis can be applied to generate the effective image feature. The region features are also having the significance to provide the distinctive feature formation. The region features can be explored and identified sepearately as per requirement. These features can be explored to tuneup the segmentation process and to provide the feature driven formation. The region size and other geometrical constraints are also mapped with these features to generate the effective region formation. In soil and land recognition methods such kind of features are having higher significance.

b) Textural Features

Textural features are the pattern specific or the contour specific features used to obtain the actual visible characterization. To recognize the plant quality, crop grade such kind of features can be used. The depth of the colorization can be explored to obtain the inclusive image features. The feature formation, the content formation can be defined relative to the textural features.

c) Point Feature

These features are the lowest level of features that identify the specific points over the image such as end point, intensity specific point, discontinuity identify, structural points etc. The edge formation, structure generation or the curvature formation can be done using these kind of features. The featured framed analysis can be applied on different grade of images so that the exploration of the relatively effective features will be done.

B) Feature Matching

Once the features are generated, the next work is to map these features on the source and the database images to identify the object type or the disease type. The feature mapping can be done under different forms and methods. These methods are based on the region size, window formation and the featured characterization. Some of such inclusive methods are defined here under

a) Area Based Matching

The region is the identification and matching of the input object image with the referenced image. This work includes the matching of distinctive information along with local image shape and structure. The leaf shape and size identification is such kind of recognition process to identify the plant or tree type. The similarity analysis between source and the referenced image is performed to identify the similarity level.

b) Feature Based Matching

The second aspect to perform the effective recognition is the structural local feature based matching. This matching includes the intensity analysis. The matching based on the feature descriptors is used to optimize the matching process. The feature vectors includes the centroid matching, corner point matching, edge based matching etc. Feature extraction is defined the matching based on the image sample instead of whole image. This image part based recognition is effective to perform the effective recognition.

C) Transform Model Estimation

Another mapping function definition and extraction on the agriculture source image relative to the referenced image is performed. Here the mapping is performed based on the function based analysis. The transformation to the input image to result image is performed. The image pair or the distance analysis employs the effective model generation and evaluation. Better the mapping, more effective the results will be. The classification of the agricultural images is done using the model estimation.

CONCLUSION

In this paper, the exploration to the agricultural image processing scope and characterization is provided. The application areas of agricultural image processing as well as the major processing stages and methods are discussed in this paper. The paper is helpful to identify the research direction and the method for agricultural image processing.

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