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Machine Learning Model for Weed Detection in Agriculture Using Image Processing (Review)

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ABSTRACT: *The Agriculture is the about 70% of the population depends on agriculture. Agricultures (Weeds) are among the main factors that could harm crop yields. With advances in electronics and information technologies, machine vision combined with image processing techniques has become a promising tool for accurate real-time detection of weeds and crops in the field, providing valuable detection information for specific sites. Weed management this review summarized advances in weed detection using machine vision from the ground. And image processing techniques. Specifically, the four procedures, that is, preprocessing, segmentation, feature extraction and sorting, for weed detection were presented in detail. To separate the vegetation from the background land, different color indices and grading approaches such as color index based, threshold based and learning-based ones were developed. The difficulty in detecting weeds lies in discriminating between crops and weeds that often have similar properties. Generally, four categories of characteristics, i.e. biological morphology, Spectral features, visual textures and spatial contexts, were used for the task, which are discussed in this revision. Application of newly developed machine learning-based and deep learning-based mainstream applications. Approaches to weed detection were also presented. Finally, the challenges and solutions provided by researchers to detection of weeds in the field, including occlusion and overlapping of leaves, variable and different lighting conditions growth stages, discussed the plant's growth.*

I. INTRODUCTION

In order to control weeds, different operations have been attempted, among which manual weeding by hand or using simple hand tools has been used for centuries and is still being used in small scale fields nowadays. The agricultural industry is related to the development of rural economic and social stability. The issues about the quality of vegetables have aroused the concern in the public. In the year 2010, the notice of "about meat and vegetables circulation tracing system construction pilot instruction opinion", from the ministry of commerce and finance claimed that put more effort to resolve the problem of tracing the resource of meat and vegetables can reduce the customers' anxiety to the quality of food. The most frequently used ground-based real-time sensors are spectrometric, opto electronic and RGB-NIR imaging sensors. Spectrometric sensors measure the reflection intensities for multiple wave-lengths and provide sufficient information to discriminate vegetation from soil, but they can hardly discriminate between species, especially in early growth stages when crops and weeds have similar reflectance characteristics.

II. LITERATURE SURVEY

part from the features mentioned above, some other features were also developed for discriminating between crops and weeds. The leaves of different plant species have different vein morphological patterns, which therefore can be used for discrimination. The vein-related features were extracted by vein segmentation, central patch extraction and vein measures, and these features were used as the input of a deep CNN for classification. Ishak et al. utilized a combination of a Gabor wavelet and gradient field distribution techniques to extract a new set of feature vectors based

on the directional texture properties for classifying weed types. GW was to enhance the directional feature of images, followed by GFD to produce histogram gradient orientation angles. A curve fitting procedure was then conducted to estimate the histogram envelope, and the curvature value of the fitted quadratic polynomial equation was extracted and used as a single input feature vector for classification. Compared with another method that used features obtained via GW only, the proposed method yielded better classification accuracy of 94%. Learning-based methods were investigated for extracting features from images. To overcome the weak generalization ability in feature extraction based on manual designed features, Tang et al. (2018) used K-means clustering algorithm to construct feature dictionary, which was used for feature mapping through nonlinear and convolutional approaches. The mapped features were fed to a single-layer network to construct an identification model. Hall et al. extracted the deep and abstract features with deep convolutional neural networks. A pre-trained ConvNet framework called Caffe and a powerful inception architecture known as Google Net were used in their studies. Results confirmed the effectiveness of the deep learned features.

III. PROPOSED

overall detection performance raised from 97.29% to 99.34%. Ahmadet found that the optical threshold value for segmentation could be computed for each image dynamically using the mean intensity value of the image being observed to minimize the effect of illumination, which was named adaptive segmentation and proved to be effective. Instead of improving the image processing algorithm alone, another idea to alleviate lighting effect is to improve the image quality when acquiring images. Sujaritha et al. fixed a special light ring at the camera to avoid the interference of shadows and other illumination related obstacles, thus improving the image quality. Different growth stages of plants change morphological, textural and spectral properties of leaves, reducing performance of classification models. This remains a big challenge and few research was focused on solving this issue. One general and commonly adopted approach is to train the classification model with samples of different growth stage. This approach is straightforward and simple, but compromises on classification accuracy and often needs large amount of samples. Another similar concept is to retrain the classification model with new samples when its accuracy is unacceptable. This method produces higher accuracy, but the retraining process is tedious and time-consuming. Lottes et al. Developed a sequential FCN-based classification model with an encoder-decoder structure and incorporated spatial information for pixel-wise semantic segmentation of back-ground, crops and weeds. The model learned plant arrangement information from image sequences representing a part of the crop row and fused the information with visual features, which improved the performance and generalization capabilities of the classification model

IV. CONCLUSION

In this paper, overall, machine vision with appropriate image processing algorithms is a very promising tool for precise real-time weed and crop detection in the field, which provides valuable sensing information for SSWM. Accurate crop detection is also beneficial to site-specific management of specialty crops, such as automatic harvest of cauliflower.

Though there are still remaining challenges, the future is promising as there are many researchers concentrate their efforts on the task.

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