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修士論文題目	Lawn weed detection methods using image processing techniques for automatic weed control systems

This thesis aims to study about lawn weed detection methods using image processing techniques for automatic weed control systems. Three gray-scale based methods, i.e., Bayesian classifier based method (BC), support vector machine based method (SVM), and morphological operations based method (MO), are proposed for detecting weeds in all seasons. Also, a fast and simple color information based weed detection method is proposed. It is designed for detecting weeds when the color of weeds and lawns are clearly different, especially in winter. Moreover, this thesis proposes a winter image discrimination method for deciding from an input image whether the color information based method should be employed. This enables to make a hybrid method, i.e., a combination between the gray-scale based detection method and the color based method, can be realized.

Performances of the proposed detection methods are evaluated by using two types of simulated automatic weeding systems, i.e., chemical based and electrical spark discharge based systems, and are compared with the gray-scale uniformity analysis method which was proposed by Ahmad et al. The weed image database used in the experiments consists of four datasets taken from four different seasons in Japan.

To compare all gray-scale based methods, the experiments are done in two ways, i.e., testing all four datasets as one big dataset and testing each dataset separately. In the case of testing one big dataset, the MO method gives the best performance for the chemical based system while the SVM method can be considered as the most appropriate methods for the electrical spark discharge based system. In the case of separately testing each dataset, the results are different from the previous case. The BC method seems to be more appropriate method than the others. It is better than the other methods for two datasets in the case of chemical based system and for three datasets in the case of electrical spark discharge based system.

In the case of testing by using only winter image dataset, the proposed color information based method gives better results than the other gray-scale based methods for both chemical based and electrical spark discharge based systems. Its computational complexity is also less than those of the other methods. To test the proposed winter image discrimination method, all images from four datasets are used. The result shows that the method can completely discriminate the images of winter dataset from the images of the other seasons.