UAV-based Crops Classification with joint features from Orthoimage and DSM data

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ABSTRACT:

Accurate crops classification remains a challenging task due to the same crop with different spectra and different crops with same spectrum phenomenon. Recently, UAV-based remote sensing approach gains popularity not only for its high spatial and temporal resolution, but also for its ability to obtain spectra and spatial data at the same time. This paper focus on how to take full advantages of spatial and spectrum features to improve crops classification accuracy, based on an UAV platform equipped with a general digital camera. Texture and spatial features extracted from the RGB orthoimage and the digital surface model of the monitoring area are analysed and integrated within a SVM classification framework. Extensive experiences results indicate that the overall classification accuracy is drastically improved from 72.9% to 94.5% when the spatial features are combined together, which verified the feasibility and effectiveness of the proposed method.

1. INTRODUCTION

Information on crop sowing type and yield is an important basis for the country to formulate scientific agricultural policies and economic plans, and is also an important part of the core indicators of agricultural statistics in countries around the world. Timely understanding and mastering crop types has important practical significance for accurately estimating and predicting crop yields, strengthening crop production management, adjusting agricultural cropping structure, and ensuring national food security. In addition, the acquisition of high-precision crop acreage has gradually become one of the most important scientific issues in agricultural land system research (Cao Weibin et al, 2004a; Huang Qing et al, 2009a; Yang Bangjie et al, 1997a).

For a long time, China's agricultural crop sowing types, sown area, planting quantity and other important agricultural statistics have been obtained mainly through comprehensive statistical methods or sample surveys those have been reported step by step. Agricultural survey teams distributed throughout the country regularly collect planting areas and types of crops. Crops growth and disaster-affected situations are reported step by step or reported directly to the Ministry of Agriculture as the basis for analysing the state of agricultural structure planting and taking countermeasures. The traditional method is to manually measure the ground sample or use GE images to assist in the investigation of crop classification (Liu Jia et al, 2015a). Because the surveyors' abilities to investigate are different and cannot be objectively standardized, there are lags in the collection, processing, and reporting process. Differences in the information, and this method has many defects such as huge investigation workload, high financial and material costs, and long investigation period (Yang Bangjie et al, 1997a).

In recent years, remote sensing technology has played an important role in dynamic information extraction of crop areas and crop distribution mapping (Zhang Jiankang et al, 2012a). Satellite remote sensing information has the characteristics of large coverage area, short detection period, abundant data, low cost, and provides new technical means for quickly and accurately obtaining crop types (Chen Zhongxin et al, 2016a). However, due to the long period of high-resolution satellite re-entry cycle, the data for a given area at a given time cannot be guaranteed. The accuracy of crop land area monitoring using satellite remote sensing cannot meet the requirements and must be supplemented by ground sample surveys and ground sample survey data. Using the ground sample survey data to calculate the deduction coefficient of linear and fine features, to achieve the fine extraction of crop planting areas extracted by remote sensing. The emergence and development of UAV remote sensing technology has provided new ideas for the collection of crop information (Freeman et al, 2015a; Mesas-Carrascosa et al, 2014a; Rokhmana et al, 2015a). At the small and medium scale, UAV remote sensing can play a greater role and can obtain more accurate crop distribution information, which is of great significance to the development and application of crop monitoring technology. UAV remote sensing has features such as high resolution, simple operation, fast data acquisition, and low cost. It can quickly perform image collection for a certain area and combine ground actual measurement data to quickly and accurately complete the crop planting information monitoring task. It can be used as a useful complement to satellite remote sensing and aerial remote sensing, and provides accuracy verification for large-scale remote sensing (Del Pozo et al, 2014a)

At present, many scholars have done a lot of research on the classification of crops based on drones, and put forward many techniques and methods. Pena used object-oriented methods based on the obtained six-band multispectral images to achieve weed mapping during early corn growth (Pena et al, 2013a). Gini used the maximum likelihood method and used the obtained multispectral images to classify different trees (Gini et al, 2016a). Sona used multi-spectral images for soil and crop mapping to realize the application of multi-spectral data in precision agriculture (Sona et al, 2016a). Rypochi Doi performed color synthesis of multi-spectral images, and found that this method can increase the distinguishability of similar pixels (Rypochi Doi et al, 2015a). Oumer used multi-spectral images and RGB images to achieve land cover and crop classification using Random Forest Algorithm (Oumer et al, 2017a). Xiuliang Jin used an optical camera mounted on a drone to acquire RGB images and used the SVM algorithm to estimate the planting density of winter wheat. The maximum likelihood method and SVM

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