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田间作物杂草识别的最优遥感测量尺度

Optimal spatial scale for crop-weed discrimination

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中文摘要:

遥感分类识别精度受测量尺度的制约。为克服现有最优测量尺度选择方法存在的问题，该文提出一种基于光谱角匹配的最优测量尺度选择方法。该方法将每个像元的光谱看作其所属地物类别参考光谱叠加混合像元与光谱变异性的净效应的总和，计算不同空间分辨率下像元光谱与其所属地物类别参考光谱的光谱角，用以衡量混合像元与光谱变异性净效应的大小，当光谱角最小时说明混合像元与光谱变异性的净效应最小，此时的遥感测量尺度即为最优尺度，并在1幅实例数据中实现了该方法，利用基于光谱角匹配的尺度选择方法得到了最优遥感测量尺度，通过试验证明在该尺度下进行分类识别时精度优于比其更大或更小的尺度，验证了本研究提出的最优空间分辨率选择方法的可靠性。将该实例数据中的目标地理实体对象化，从理论上分析了目标对象的面积和形状指数与最优遥感测量尺度之间的关系。该研究为田间作物杂草遥感识别提供了一种有效的最优测量尺度选择方法，可为当前变量作业中田间数据获取工作提供参考，对于推动遥感测量尺度选择研究也具有积极意义。

英文摘要:

Abstract: In recent years, remote sensing images obtained by different types of optical sensors from a ground platform are applied to crop-weed discrimination and serve variable-rate technology in precision agriculture. Classification accuracy in remote sensing is influenced by spatial scale, so choosing the optimal spatial scale can be helpful for field data acquisition. Influences of spatial scale on classification accuracy in remote sensing are mainly originated from two factors: one factor is mixed-pixel and the other factor is spectral variability. Both aggravated mixed pixel caused by a larger spatial scale and aggravated spectral variability caused by a smaller spatial scale will result in classification accuracy reduction in remote sensing. For geographic entities in remote sensing images have inherent spatial attribute and spectral attribute, a spatial scale exists which can minimize the net effect of both mixed-pixel and spectral variability. Under this spatial scale, pixels can have optimal spectral identifiability. An approach for the selection of optimal spatial scale using a spectral angle mapper to measure the net effect of both mixed-pixel and spectral variability was proposed for crop-weed discrimination. The basic thinking of optimal spatial scale selection based on spectral angle mapper is as follows: using the average spectra calculated from a great amount of pure pixels belonging to one kind of ground object as the reference spectra for this kind of ground object, the spectra of each pixel could be regarded as the sum of its reference spectra and the net effect of mixed-pixel and spectral variability. Then, the spectral angle between the pixel spectra under different spatial resolutions and its reference spectra might be calculated to measure the net effect of mixed-pixel and spectral variability. The pixel will have optimal spectral identifiability when the net effect is least, and in this case, the spatial scale is the optimal scale. The proposed approach was realized in one field image. The geographic entities in the image were objectified. The optimal spatial scale was 0.48 cm by using the spatial scale selection method based on a spectral angle mapper. The relationship between the area and shape indexes of the target object and its optimal spatial scale was analyzed theoretically. For other field scenes, the finding can provide a reference for optimal spatial scale selection by calculating the area and shape indexes of plant objects.

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