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研究论文

基于分类知识利用神经网络反演叶面积指数

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摘要 叶面积指数(LAI，Leaf Area Index)是陆面过程中一个十分重要的输入参数，其遥感反演方法研究一直是国内外遥感应用研究的热点问题。基于统计的遥感反演方法由于缺乏物理基础，其可靠性和普适性差。基于物理的冠层反射模型的LAI反演方法克服了上述弊端，但是由于反演过程是病态的，模型反演结果一般不唯一。神经网络算法的介入可在一定程度上改善这一问题，但是模型反演的病态问题至今仍无法很好地解决。在PROSAIL模型敏感性分析的基础上提出了一种基于影像分类的神经网络反演方法，引进了土壤反射指数用于替代原模型中难以确定的土壤背景反射参数，分别针对不同植被类型建立各自的神经网络，对经过大气纠正后的Landsat ETM+影像进行了模拟实验并同野外实测LAI数据进行比较。结果表明，对于LAI小于3的植被区该方法的反演精度比较可靠，而LAI大于3的植被区，反演的LAI偏小，原因归结为密植被的冠层反射在LAI大于3以后趋于饱和而无法敏感地表征LAI的变化所导致的。

关键词 叶面积指数；神经网络；冠层反射模型；PROSAIL

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Retrieving leaf area index using a neural network based on classification knowledge

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Abstract As an important ecological parameter in land surface processes, Leaf Area Index (*LAI*) and its inversion with remotely sensed data are hot topics in quantitative remote sensing, both domestically and internationally. Empirical-relationship-based statistical algorithms, owing to their shortcomings in physical mechanism descriptions, lack reliability and feasibility in application. Physically-based algorithms, such as those developed with the canopy reflectance model, overcome the abovementioned shortcomings; however, *LAI* inversion with canopy the reflectance model is usually ill-posed, which makes the inversion not unique. Employment of a neural network in *LAI* reversions can improve such issues to a certain extent, but the ill-posed nature for canopy reflectance model inversion is yet to be resolved. On the basis of sensitivity analyses using the PROSAIL model, the present study demonstrates an approach that uses a neural network based on image classification incorporated in PROSAIL for accurate retrieval of *LAI*. By including the soil reflectance index in the original PROSAIL model to take the place of soil background reflectance parameters that are difficult to determine, specific neural networks are constructed corresponding to individual types of vegetation cover. Experiments with Landsat ETM+ data indicate that the retrieval accuracy is higher for vegetation with a *LAI* less than three, and as *LAI* increases, retrieval accuracy decreases accordingly. The primary reason is attributed to canopy reflection no longer being sensitive to *LAI* when the vegetation is too densely populated (*LAI*>3).

Key words Leaf Area Index _ neural network _ canopy reflectance model _ PROSAIL

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