Abstract

Classification and interpretation of satellite images are complex processes and that may be affected by various factors. Most fuzzy based soft classification techniques have been used to provide a more appropriate and accurate area estimation when fine, medium and coarse spatial resolution data are being used. Spatial resolution determines the spatial details on the Earth surface and greatly reduces the problem of mixed pixel. This paper examines the effect of weighting exponent $m$; parameter of fuzzy c-means (FCM) and possibilistic c-mean (PCM) classifiers with respect to entropy, an uncertainty indicator for different extracted classes. This paper measures uncertainty variations across spatial resolution for different class extraction. Uncertainty can be defined as skepticism wherein entropy is an absolute indicator of an uncertainty. In this research work, fuzzy c-means (FCM) and possibilistic c-mean (PCM) classifiers have been used and entropy is computed to visualize the uncertainty. For this research work Resourcesat-1 (IRS-P6) data sets from AWIFS, LISS-III and LISS-IV sensors of same date have been used. Accuracy assessment of a classified image is an integral part of image classification and in this research two things were involved first optimization of weighting exponent $m$; and computation of entropy. From the resultant Table 1, 2, 3, 4, 5,
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6, 7 and 8 shows that the optimum values of \( m \) for FCM classifier on homogenous land cover classes are 2.9 and for heterogeneous classes are 2.7 where the membership values are varying from 0.8 to 0.9 with lesser entropy values, i.e. 0.35. Similarly for PCM classifier the optimum value of \( m \) for homogenous land cover classes are 3.2 and for heterogeneous classes are 3.0 where the membership values are varying from 0.8 to 0.9 with lesser entropy values, i.e. 0.78. In the second phase of study, to analyze the effect of uncertain pixels in FCM and PCM classifiers, Euclidean norm has been chosen for both the classifiers whereas the values of weighting exponent \( m \) varies from 1.1 to 4.0 for Sal forest, Eucalyptus plantation, water bodies, agriculture land with crop, agriculture moist land without crop, and agriculture dry land without crop. It is observed from the result Table 1, 2, 3, 4, 5, 6, 7 and 8, that uncertainty ratio is almost equal to referential value 2.585, for FCM and PCM classifiers using Euclidean norm. This reflects that fuzzy based soft classifiers FCM and PCM are producing higher classification accuracy with minimum level of uncertainty.

References

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Index Terms

Computer Science Fuzzy Systems
Keywords
Fuzzy c-Mean (FCM)  Possiblistic c-Mean (PCM)  Entropy