Abstract

Remotely sensed data is an effective source of information for monitoring changes in land use and land cover. With the advent of increasingly higher resolution remote sensing images, it is possible to precisely monitor changes in an urban area. In an automatic change detection process, radiometric normalization and geometric registration of temporal images are first two operations that must be performed on images. Both these operations affect the final accuracy of change detection.

We proposed automated radiometric correction process that identifies the subset of non-changing pixels automatically by using correlation. It uses a parametric smoother in order to minimize the effects of influences of radiometric differences on image interpretation. Normalization by means of ordinary least squares regression is compared with normalization by polynomial regression up to order 5.

A novel approach has been introduced for radiometric correction of multitemporal satellite imagery in frequency domain using Fourier and Wavelet transforms. Wavelet transform is applied to each band of multispectral images taken at different time. Each band is decomposed into four subbands. Subbands of subject image are regressed against analogous subbands of reference image using linear least squares regression. After regressing wavelet coefficients of subject image, inverse Wavelet transform is applied to obtain corrected image.

A method, Pseudo-Invariant Feature regression, has been developed in frequency domain. This method identifies landscape elements such as vegetation, whose reflectance values are not constant over time. Spatial frequency of vegetation being high, can be removed by low pass filter. In spatial domain, Pseudo-Invariant Feature set is determined from band ratio near-infrared/red and normalized image look very different from reference image. Some floating objects in the river with reflectance similar to nonvegetation area may be included in Pseudo-Invariant Feature set.

A novel transform domain algorithm for haze correction using Fourier transform is presented. Water bodies being low frequency region, can be extracted using low pass filter in frequency domain. Fourier coefficients of filtered reference image
are subtracted from Fourier coefficients of filtered subject image. Inverse Fourier transform of difference of coefficients gives haze distribution. Haze correction in spatial domain method uses dark object subtraction, assumes a constant haze value throughout the entire image. The proposed technique considers frequency dependance of haze effect so Fourier domain method is a powerful approach.

A technique for correction of cloudy images is presented. Cloud detection is achieved by using Average Brightness Threshold (ABT) algorithm and detected cloud is removed and replaced with pixels predicted by regression. No patches are seen in place of cloud. The earlier techniques where the detected cloud is removed and replaced with data from another images of the same area, patches are observed in place of cloud.

For change detection, a method is recommended using Radon transform. Radon transform is applied on Near Infrared band of multispectral images taken at different times. Projections are taken for $\theta = 0$ to $180$. Projections of one image are subtracted from projections of another image. Inverse radon transformation is applied on difference of projections. The resultant is observed with high brightness in the direction for changed land area. Threshold is applied for detecting boundaries of the changed area. The proposed method is compared with Image Differencing technique and Image Regression method. We found that this technique works well for finding change in boundaries of water bodies; and direction of change can be detected. No other method detects direction of change.

The visual inspection and statistical assessment show that proposed transform domain techniques have overcome many limitations of spatial domain techniques and have given improved results.