ABSTRACT

Geospatial information gathered through different sensors and geographic objects is generally indistinct, vague and uncertain. This ambiguity turns out to be obvious due to the multi-granular formation from the multi-sensory satellite images that cause error accumulation at each stage. Remote sensing and related techniques such as geographic information systems have a profound impact in real-time applications.

Satellite images are often corrupted by noise in their acquisition and transmission process. Removal of noise from the image by attenuating the high frequency components removes some important details as well. In order to improve the visual appearance and retain the useful information in images, this research concentrates on image denoising as the first initiative to remove additive noise while retaining as many important signal features as possible. For denoising, many researchers exploit the directional correlation in either spatial or frequency domain. However, the orientation estimation for directional correlation becomes inefficient and error prone in noised circumstances. This work proposes a new Hybrid Directional Lifting (HDL) technique for image denoising that involves pixel classification and orientation estimation. A small amount of noise is added to improve the performance of the technique. Experimental results show that the HDL
technique improves both Peak Signal to Noise Ratio (PSNR) and visual quality of images.

During image preprocessing, another important initiative is resolution enhancement which preserves the edges and contours of an image, such that the resultant image is similar to the original image. The Discrete Wavelet Transform (DWT) based interpolation is developed for enhancing the resolution of the denoised image. This operation decomposes an image into four sub-bands namely low-low (LL), low-high (LH), high-low (HL) and high-high (HH). The high frequency sub-bands of the image and the low resolution image are then interpolated by a factor of two to produce a resolution enhanced image. Interpolation technique is used to increase the number of pixels in an image. This produces a sharper image that preserves the edge information. The final resolution enhanced image is then obtained by Inverse Discrete Wavelet Transform (IDWT). This technique approximates the high frequency sub-band by subtracting the interpolated LL sub-band from the denoised image. DWT has been employed to preserve the high frequency components of the image. The quantitative performance measure, PSNR shows the significance of the proposed resolution enhancement technique.

Classification is a supervised learning technique to categorize the data. It is a two step process of building the classifier model from the training data, and using it to predict the data labels. This work focuses on classifying the
image into two classes namely water body and non-water body regions. The image is classified using Support Vector Machine (SVM), which is well suitable for image classification compared to other neural network classifiers. The training input to the classification technique is texture features. The texture features are extracted using Gray Level Co-occurrence Matrix (GLCM). The basis of GLCM is assigning the relationship between two neighbouring pixels in one offset as the second order texture. The texture features extracted for classification are energy, entropy, contrast, inverse difference moment and directional moment. The SVM is trained using these texture features as input and to classify the image as water body and non-water body regions.

Efficiency of the classifier is analyzed based on the error rate which can be described by the terms: true positive, false positive, true negative and false negative. The resolution enhanced image gives better classification accuracy compared to the denoised image.

The environment related bodies around the globe are highly benefited from the valuable images provided by Land Remote-Sensing Satellite (LANDSAT) imagery. This analysis helps to strategize different methods for environment protection such as land cover mapping and monitoring, detecting and updating the changes, preventing the consequences of global warming in specific.