ADAPTIVE DATA COMPRESSION FOR EFFICIENT SEQUENTIAL TRANSMISSION AND CHANGE UPDATING OF REMOTE SENSING IMAGES

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ABSTRACT

In this paper, a selective data compression scheme is developed to combine the need for efficient data transmission and the receivers' interest in changes presented in the data by taking the advantage of previous data.

Remote sensed images, especially hyperspectral images, require considerable storage capacity and transmission bandwidth, which continues to challenge the capabilities of available technologies. Therefore, the research on data compression has been conducted widely including various coding techniques, fractal image compression methods and wavelet domain analysis. However they are mainly individual data processing and there are few compression schemes that make use the historical data as an extra data source. In this paper, we address the cases where images are collected over a regular period (perhaps every day or every week) for a given scene in order to identify changes associated with applications such as land-cover mapping, and environmental modelling and monitoring. The feature of our work is to make use of the historical data and treat them as a reference data. Consequently, change detection compared with the existing data is integrated with data compression.

Three-step of pre processing is introduced in this paper. Firstly we separate the unchanged areas (the majority) of the image from the changed areas between successive images of the same area. Secondly, the bands which are sensitive to the changes are identified with the aid of statistical measures. Finally, a binary index image of each band is generated to indicate the two categories. Following the pre-processing, compression of the unchanged area and changed area is conducted separately. In this way, different compression algorithms can be applied to each case. The changes are some time too small that we propose to use lossless compression. For the unchanged areas, lossy

compression is possible. As the majority data will be unchanged and only a subset of bands reflects the changes, high compression rate can be achievable.

The changed pixels can be identified by linear regression between the previous data and current data using the first degree of polynomial to model the majority unchanged data, in which significant differences induced by sensor noise, illumination variation, or atmospheric effect can be taken into account. Alternatively, a principal component transform is applied to assist in change detection. The sensitive bands for individual changes are selected by using statistical measures including correlation, variance and entropy. The Huffman coding is used in data compressions. Experiments were conducted with Landsat ETM images of Canberra, Australia. The effectiveness of the proposed scheme is demonstrated.