

PARALLEL COMPUTING OF HIGH ORDER ANOMALY DETECTION IN HYPERSPECTRAL IMAGERY

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Anomaly detection is to detect small targets with unknown and distinct spectrum from the background. For hyperspectral images with hundreds of co-registered bands, it is a great challenge to search for small targets in this huge amount of data. A previously proposed anomaly detection algorithm based on high-order statistics has been proved to be an effective method for surveillance problems. Since image background is homogeneous, anomalies or small man-made targets can be viewed as outliers and detected with maximum skewness or kurtosis criteria. But limited by its operation procedure, the algorithm needs to wait for one anomaly to be found before it can search for the next one. But in our preliminary experiments, different initial projectors will lead to local maximums and they all indicate different anomalies. Therefore, in this study, a parallel version of the high-order statistic algorithm for anomaly detection is developed.

The initial projector of the proposed algorithm can be generated randomly or systemically. Both methods can be implemented in parallel computation. For random version, each process unit will generate random projector independently. In order to efficiently cover the whole possible directions, the systemic version take the advantage of the Givens rotation, and each unit will rotate the initial projector with preset angle in different coordination. In this case, all units can be assigned to process different projectors simultaneously, and the proposed algorithm can search for more than one anomaly at the same time. The block diagram of the parallel algorithm is shown in Figure 1 and a better computational performance can be expected.

Keyword — Parallel Computing, Anomaly detection, High-order statistics, Hyperspectral imagery, Skewness, Kurtosis.

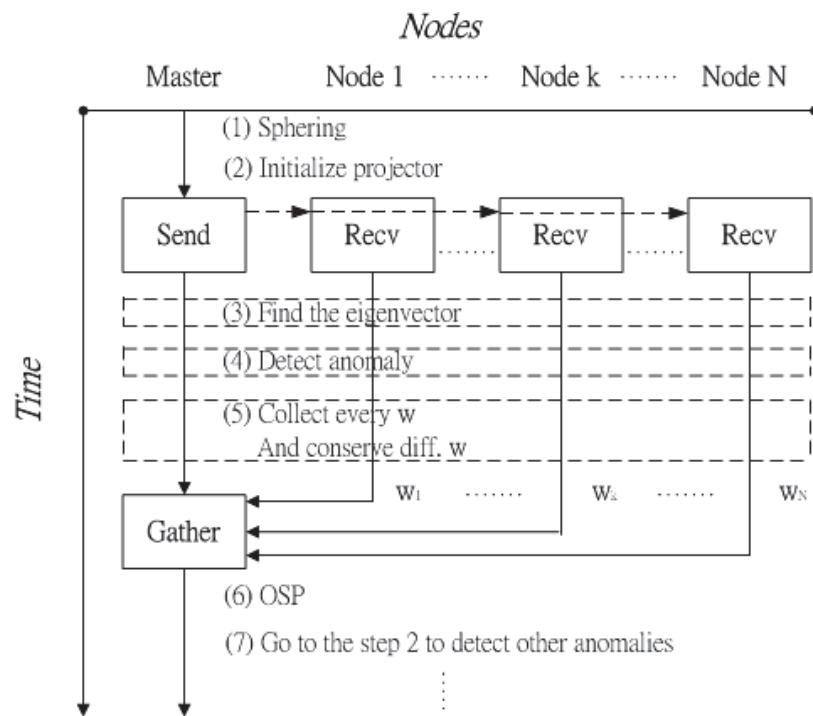


Fig.1 The MPI parallel mechanism of proposed parallel high-order statistic algorithm