REAL-TIME PROCESSING OF SIMPLEX GROWING ALGORITHM

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Abstract

A new growing method for simplex-based endmember extraction algorithms (EEAs), called simplex growing algorithm (SGA) [1], was recently developed as an alternative to the N-finder algorithm (N-FINDR) which is shown to be a promising endmember extraction technique. SGA is a sequential algorithm to find a simplex with the maximum volume every time a new vertex is added. In order to terminate this algorithm a recently developed concept, virtual dimensionality (VD), is implemented as a stopping rule to determine the number of vertices required for the algorithm to generate. The SGA improves one commonly used EEA, the N-finder algorithm (N-FINDR) developed by Winter [2], by including a process of growing simplexes one vertex at a time until it reaches a desired number of vertices estimated by the VD, which results in a tremendous reduction of computational complexity. SGA also judiciously selects an appropriate initial vector to avoid a dilemma caused by the use of random vectors as its initial condition in the N-FINDR where the N-FINDR generally produces different sets of final

endmembers if different sets of randomly generated initial endmembers are used. This paper extends the SGA to a versatile real-time processing algorithm, referred to as Real-Time SGA (RT-SGA) that can effectively address four major issues arising in practical implementation for SGA, (1) use of random initial endmembers which causes inconsistent final results, (2) very high computational complexity which results from an exhaustive search for finding all endmembers simultaneously, (3) requirement of dimensionality reduction because of enormous data volumes to be processed and (4) lack of real-time capability due to the fact that when a given set of endmember is not optimal the replacement must be conducted based on the entire data set. According to experimental results, the RT-SGA performs as we expect and as well as its original version does.

REFERENCES

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