Evolutionary Computation Methods for Extracting Geospatial Intelligence from Remote Sensing Image

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ABSTRACT

A common challenge faced by many organizations is how to convert large volumes of raw imagery into geospatial intelligence in a timely, consistent, and cost-effective fashion. The difficulty resides in the information extraction methods available. Human analysts have the necessary tools to extract geospatial intelligence through analysis of image cues (color, texture, shape, and context), combined with their *generalization* ability and *experience*. However, human analysis of imagery covering large areas and multiple images is costly and time consuming. Traditional pixel-based classification methods evaluate pixels individually to assign them to themes based solely on spectral information (color). The difference between the high-level information extracted by a human analyst and low level information extracted by pixel-based classification algorithms is often referred to as *semantic gap*. Research is being conducted to address the semantic gap by investigating the use of evolutionary computation to extract geospatial intelligence from imagery. Evolutionary computation systems derive solutions from a small set of positive and negative examples through optimized combinatorial search, rather than being explicit programmed. This property offers the capability of solve complex problems involving high-level information extraction from imagery. This presentation provides a summary of the recent developments in the use of evolutionary computation to extract high-level geospatial intelligence. The strengths and limitations of evolutionary computation are described through analysis of different experiments such as integration of spectral and textural information (timber versus natural forests) and multi-temporal identification of single family residential buildings using spectral and image object information. Based on our results and literature investigation we propose future areas of research to reduce the semantic gap through the development of contextual classifiers evolved by evolutionary computation.