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Response of fuzzy clustering on different threshold determination algorithms in spectral change vector analysis over Western Himalaya, India

SINGH Sartajvir[1*] http://orcid.org/0000-0002-4451-4949; e-mail: sartajvir.singh@chitkarauniversity.com

TALWAR Rajneesh[2] http://orcid.org/ orcid/0000-0002-2109-8858; e-mail: rtphdguidance@gmail.com

** Corresponding author*

1 Department of Electronics and Communication Engineering, Chitkara University, Himachal Pradesh, 174 103, India

2 Chandigarh Group of Colleges, Technical Campus, Jhanjeri 140 307, India

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Abstract: Change detection is a standard tool to extract and analyze the earth's surface features from remotely sensed data. Among the different change detection techniques, change vector analysis (CVA) have an exceptional advantage of discriminating change in terms of change magnitude and vector direction from multispectral bands. The estimation of precise threshold is one of the most crucial task in CVA to separate the change pixels from unchanged pixels because overall assessment of change detection method is highly dependent on selected threshold value. In recent years, integration of fuzzy clustering and remotely sensed data have become appropriate and realistic choice for change detection applications. The novelty of the proposed model lies within use of fuzzy maximum likelihood classification (FMLC) as fuzzy clustering in CVA. The FMLC based CVA is implemented using diverse threshold determination algorithms such as double-window flexible pace search (DFPS), interactive trial and error (T&E), and 3×3–pixel kernel window (PKW). Unlike existing CVA techniques, addition of fuzzy clustering in CVA permits each pixel to have multiple class categories and offers ease in threshold determination process. In present work, the comparative analysis has highlighted the performance of FMLC based CVA over improved SCVA both in terms of accuracy assessment and operational complexity. Among all the examined threshold searching algorithms, FMLC based CVA using DFPS algorithm is found to be the most efficient method.

Keywords: Change vector analysis (CVA); Fuzzy maximum likelihood classification (FMLC); Double-window flexible pace search (DFPS); Interactive trial and error (T&E); Pixel kernel window (PKW)

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Introduction

Change detection analysis plays a significant role in observing land use and land cover (LULC) earth surface variations with the help of remotely sensed multispectral imagery. Since past few decades, different change detection techniques have been developed and summarized for qualitative as well as quantitative measurement of spatial variations over multi-temporal scale (Lu et al. 2004; Singh & Talwar 2014). Amongst various algorithms, a conceptual extension of image differencing, termed as change vector analysis (CVA) algorithm is preferred due to existence of unique advantage of describing change