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Spectral decorrelation (transformations) methods have long been used in remote sensing. Transformation of the image data onto eigenvectors that comprise physically meaningful spectral properties (signal) can be used to reduce the dimensionality of hyperspectral images as the number of spectrally distinct signal sources composing a given hyperspectral scene is generally much less than the number of spectral bands. Determining eigenvectors dominated by signal variance as opposed to noise is a difficult task. Problems also arise in using these transformations on large images, multiple flight-line surveys, or temporal data sets as computational burden becomes significant. In this paper we present a spatial-spectral approach to deriving high signal quality eigenvectors for image transformations which possess an inherently ability to reduce the effects of noise. The approach applies a spatial and spectral subsampling to the data, which is accomplished by deriving a limited set of eigenvectors for spatially contiguous subsets. These subset eigenvectors are compiled together to form a new noise reduced data set, which is subsequently used to derive a set of global orthogonal eigenvectors. Data from two hyperspectral surveys are used to demonstrate that the approach can significantly speed up eigenvector derivation, successfully be applied to multiple flight-line surveys or multi-temporal data sets, derive a representative eigenvector set for the full image data set, and lastly, improve the separation of those eigenvectors representing signal as opposed to noise. (C) 2013 Elsevier B.V. All rights reserved.

General information
State: Published
Organisations: National Space Institute, Geodesy, German Remote Sensing Data Centre, University of Alberta
Contributors: Rogge, D., Bachmann, M., Rivard, B., Nielsen, A. A., Feng, J.
Number of pages: 12
Pages: 387-398
Publication date: 2014
Peer-reviewed: Yes

Publication information
Volume: 26
ISSN (Print): 0303-2434
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SJR 1.591 SNIP 1.846
Web of Science (2017): Impact factor 4.003
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.14 SJR 1.477 SNIP 2.028
Web of Science (2016): Impact factor 3.93
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 4.17 SJR 1.68 SNIP 2.034
Web of Science (2015): Impact factor 3.798
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 3.95 SJR 1.526 SNIP 2.16
Web of Science (2014): Impact factor 3.47
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.5 SJR 1.074 SNIP 1.778
Web of Science (2013): Impact factor 2.539
ISI indexed (2013): ISI indexed no
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.81 SJR 1.126 SNIP 2.116
Web of Science (2012): Impact factor 2.176
ISI indexed (2012): ISI indexed no
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.49 SJR 0.968 SNIP 1.687
Web of Science (2011): Impact factor 1.744
ISI indexed (2011): ISI indexed no
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.963 SNIP 1.871
Web of Science (2010): Impact factor 1.557
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.913 SNIP 1.596
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.518 SNIP 2.444
Scopus rating (2007): SJR 0.809 SNIP 1.479
Scopus rating (2006): SJR 0.707 SNIP 1.474
Scopus rating (2005): SJR 0.431 SNIP 0.783
Scopus rating (2004): SJR 0.395 SNIP 0.491
Scopus rating (2003): SJR 0.169 SNIP 0.347
Scopus rating (2002): SJR 0.134 SNIP 0.234
Scopus rating (2001): SJR 0.158 SNIP 0.268
Scopus rating (2000): SJR 0.197 SNIP 0.49
Scopus rating (1999): SJR 0.246 SNIP 0.52
Original language: English
Keywords: REMOTE, Hyperspectral imaging, Spatial and spectral processing, Eigenvector transformations
DOIs: 10.1016/j.jag.2013.09.007
Source: FindIt
Source-ID: 255354667
Research output: Research - peer-review › Journal article – Annual report year: 2014