ABSTRACT

This poster presents an algorithm for automated extraction of multi-scale interest points in hyperspectral images. Interest points are features of the image that capture information from its neighbors that are distinctive and stable under transformations such as translation and rotation. Interest-point operators for monochromatic images were proposed more than a decade ago and have since been studied extensively. They have been applied to diverse problems in computer vision, including image matching, recognition, registration, 3D reconstruction, change detection, and content-based image retrieval. An interest operator seeks out points in an image that are structurally distinct, invariant to imaging conditions, stable under geometric transformation, and interpretable. Interest points are helpful in data reduction, and reduce the computational burden of various algorithms (like registration, object detection, 3D reconstruction etc.) by replacing an exhaustive search over the entire image domain by a probe into a concise set of highly informative points. Our approach combines and extends ideas from Lowe's keypoint operator that uses local extrema of Difference of Gaussian (DoG) operator at multiple scales. In this paper, a modification to Lowe's approach is studied; the multiscale representation of the image is generated by anisotropic diffusion that should leads to improved detection since it better preserve edges in the image. In addition, a vectorial approach of this operator is proposed to manage multispectral and hyperspectral images. Experiments with multispectral and hyperspectral images show the potential of the approach however work is still ongoing in trying to develop appropriate assessment tools.

STATE OF THE ART

Lowe's Approach for Grayscale Images:

- Original Image
- Scale Increase
- Generation of Scale Space Gaussian Smoothing
- Difference-of-Gaussians
- Threshold
- Interest Points

Mukherjee's Approach for Hyperspectral Images:

- Original Image
- PCA projection
- Generation of Scale Space Gaussian Smoothing
- Difference-of-Gaussians
- Feature Extraction by Band Subset Selection
- Scale-space Representation by Vector-Anisotropic Diffusion
- Local Maxima Pixel-vector by Lexicographical Ordering
- Accurate Maxima Localization and elimination of unstable points
- Interest Points

REFERENCES


EXPERIMENTS

Experiment with RGB Image:

- Original Image taken from Matlab library (Image Processing Toolbox)
- 3405 Interest Points
- Anisotropic Diffusion Vector Ordering and Second Fundamental Form
- Experiment with hyperspectral Images:

- True Color Composition of Hyperspectral Image taken by AUSA Eagle Sensor of southwestern of Puerto Rico Island (La Parguera)
- 4380 Interest Points
- Anisotropic Diffusion Vector Ordering and Second Fundamental Form

FUTURE WORK

Continue carrying out experiments with different spatial resolution hyperspectral images to determine how distinctive and stable are the interest points that our approach detects. Use these interest points for feature matching and image registration.

STRATEGIC RESEARCH PLAN

This work will contribute to Image Understanding and Multispectral Discrimination (RG). SeaBED data is being used for testing and validation of the proposed approach.

ACKNOWLEDGEMENTS:

Dr. Velez-Reyes and Ms. Dorado were supported primarily by the Department of Defense. All participants received partial support from the Bernard M. Gordon Center for Subsurface Sensing and Imaging Systems, under the Engineering Research Centers Program of the National Science Foundation (Award Number EEC-9986821).