A New Approach to Polarimetric SAR Image Classification

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In this paper, a Generalized Optimization of Polarimetric Contrast Enhancement (GOPCE) is employed for supervised polarimetric synthetic aperture radar (SAR) image classification. The GOPCE introduced by the authors [1] is the extension of Optimization of Polarimetric Contrast Enhancement (OPCE), and it includes three optimal coefficients associated with the Cloude entropy and two special similarity parameters [2] in addition to the optimal polarization states. For classification, we first classify a polarimetric SAR image into several sets: $C_1, C_2, \ldots C_m$ and the mixed sets $C_{1,2}, C_{2,3}, \ldots C_{m-1,m}$ by some parameter (e. g., span), based on the polarimetric SAR data of the training areas. Then a mixed set is divided into two classes by using the GOPCE for several times. For comparison, we also use the Maximum Likelihood (ML) classifier, based on the complex Wishart distribution [4]. The classification results of a NASA/JPL AIRSAR L-band image over San Francisco by two approaches are listed in Table 1 and Table 2, respectively, demonstrating the effectiveness of the GOPCE based classifier.

Table 1: Classification results by the proposed method.

GOPCE	Sea area	Quasi-natural surface	Woods area	Urban area
Sea area	**96.89%**	3.11%	0%	0%
Quasi-natural surface	0.75%	**98.43%**	0.82%	0%
Woods area	0%	4.56%	**95.41%**	0.03%
Urban area	0	0	9.00%	**91.00%**

Table 2: Classification results by the Maximum Likelihood classifier.

ML	Sea area	Quasi-natural surface	Woods area	Urban area
Sea area	**98.30%**	1.57%	0.05%	0.08%
Quasi-natural surface	0.35%	**96.74%**	2.21%	0.7%
Woods area	0%	5.6%	**92.17%**	2.24%
Urban area	0%	6.84%	2.8%	**90.36%**

REFERENCES

1. Yang, J., G. Dong, Y. Peng, et al., "Generalized polarimetric contrast enhancement," *IEEE Geosci. Remote Sensing Lett.*, Vol. 1, No. 3, 171–174, 2004.
2. Yang, J., Y. N. Peng, and S. M. Lin, "Similarity between two scattering matrices," *Electron. Letters*, Vol. 37, No. 3, 193–194, Feb. 2001.
3. Yang, J., Y. Yamaguchi, W.-M. Boerner, and S. M. Lin, "Numerical methods for solving the optimal problem of contrast enhancement," *IEEE Trans. Geosci. Remote Sensing*, Vol. 38, No. 2, 965–971, 2000.
4. Lee, J. S., M. R. Grunes, and R. Kwok, "Classification of multi-look polarimetric SAR imagery based on complex Wishart distribution," *Int. J. Remote Sensing*, Vol. 15, No. 11, 2299–2311, 1994.