Identification and Processing of Cloud Images from Geostationary Satellite

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ABSTRACT

This research focuses on improving the performance of cloud identification and classification from satellite images. We first extract localized images of size from the original satellite images of size . The cloud identification process is concentrated on the local areas. The sub-images are then divided into small blocks for feature extractions. Methods of SVD and DCT are used to observe the textural feature of each block. The extracted-featured are fed into Kohonen SOM classifier for unsupervised classification. An decision making process is then applied for identifying clouds and background. Since the results of the previous processing steps are blockwised , a high order correlation edge detection scheme can be utilized for removing background remained in blocks that contain clouds. This process is called smoothing, which can make the visualization more apparent. Simulation results will be presented to demonstrate the effectiveness of this research.

Keywords : SVD ; DCT ; Feature Extraction ; SOM ; Cloud Identification ; Cloud Classification

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REFERENCES

參考文獻 [1] G.S. Pankiewicz, “ Pattern recognition techniques for identifi- cation of cloud and systems, ” Meteorol.Appl.,vol.2,pp.257-271,Sept.1995.

[2] W.E. Shenk and R.J. Holub, “ A multispectral cloud type identifi- cation method developed for nimbus 3 mrir measurements, ” Mon. Weather Rev.,vol.104,pp.284-291,Mar.1976.

[3] M. Desbois and G. Szejwach, “ Automatic classification of clouds on meteosat imagery:Application to high-level clouds, ” J.Clim.Appl.Meteorol.,vol.21,pp.401-412,1982.

[4] D.W. Reynolds and T.H. Vonder-Haar , ” Bispectral method for cloud parameter determination , ” Mon.Weather Rev.,vol.105.pp. 446-457,Mar.1977.

[5] J. Parikh and A. Rosenfeld, ” Automated segmentation and classification of infrared meteorological satellite data, ” IEEE Trans.Syst. Man.Cybern,vol.8,pp.736-743,1978.

[6] N.Lamei et al., “ Cloud-type discrimination via multispectral textural analysis, ” Opt.Eng.,vol.33,pp.1303-1313,Apr.1994.

[7] R.M. Haralick et al., ” Textural features for image classification , ” IEEE Trans.Syst.,Man,Cybern.,vol.SMC-3,pp.610-621,Mar.1973.

[8] R. M. Welch, K. S Kuo, S. K. Sengupta, and D. W. Chen, “ Cloud field classification based upon high spatial resolution textural feature (I): gray-level cooccurrence matrix approach, ” J.Geophys. Res.,vol.93,pp.12, 663-12681,Oct.1988.

[9] K. S. Kuo, R. M. Welch, and S. K. Sengupta, “ Structural and textural characteristics of cirrus clouds observed using high spatial resolution Landsat imagery, ” J.Appl. Meteorol., vol.27,pp.1242-1260,Aug.1988.

[10] L. Garand, “ Automatic recognition of oceanic cloud patterns. Part I:Methodology and application to cloud climatology, ” J.Climate, Jan.1988,pp.20-39.

[11] Z. Gu and C. Duncan, “ Texture and spectral features as an aid to cloud classification, ” J.Remote Sensing, vol. 12, no. 5, pp.953-968, 1991.

[12] L. J. Du, “ Texture segmentation of SAR images using localized spatial filtering , ” Proc.Int.Geosci. Remote Sensing Symp., Washington, D.C.,1990, pp. 1983-1986.

[13] J. M. Zurada, “ Introduction to Artificial Neural Systems ”, NY:WEST,1992.

[14] S.T. Welstead, “ Neural Network and Fuzzy Logic Applications in C/C++ ”, NY: John Wiley & Sons,1994.

[15] L. N. Hambrick and D. R. Phillips, “ Earth Locating Image Data of Spin-Stabilized Geosynchronous Satellites. ” NOAA Tech. Memo.

NESS III, No.49 National Earth Satellite Satellite Service /NOAA, Sliver Spring, (Washington DC),North America.1980.
[16]T. Maters, “ Practical Neural Network Recipes in C++ ”, NY: Academic Press,1993.
[17]A. N. Netravali , J. O. Limb, “ Picture Coding : A Review ”, Proceedings of the IEEE,Vol,68, PP.366-406, 1980.
[18] T. Kohonen ,"Self-Organization and Associated Memory", NY : Springer-Verlag, Second Edition, 1987 . [19] R. Hecht-Nielsen, “ Theory of the Backpropqgation Neural Network, ” IEEE IJCNN (Washington DC), vol.1, pp.593-611,1989.
[20] T. Kohonen, “ An Introduction to Neural Computing ”, Neural Network, vol.1, pp.3-16, 1988.
[21] T. Kohonen, “ The Self-Organizing Map, ” Proceedings of the IEEE, vol.78, No.9, pp.1464-1480,1990.
[22] A. K. Jain, "Fundamentals of Digital Image Processing" , NJ: Prentice- Hall, 1989 . [23] R. Vaccaro, “ SVD and Signal Processing II Algorithms,Analysis and Applications ”, NY:Elsevier Science Publishers B.V.,1991.
[24] Z.Wang and B. R. Hunt, “ The discrete cosine transform—a new version , ” in Proc.1983 IEEE Int. Conf. Acoust.,Speech,Signal Processing (Boston,MA), Apr.1983, pp.1256-1259.
[25]J.Parikh, “ A Comparative Study of Cloud Classification Techiques ”, Remote Sensing of Environment, Vol.6,pp.67-81,1977.
[26] J. A. Freeman and D. M. Skapura, “ Neural Networks , Algorithms, Applications and Programming Techniques, ” NY:Addison-Wesley,1991.
[27] A. Margalit, I. S. Reed and R. M. Gagliardi , “ Adaptive optical target detection using correlated images , ” IEEE Trans. on Aerospace and Electronic Systems, vol. 21, pp. 394-405, May 1985.
[28] R. J. Liou and M. R. Azimi-Sadadi, “ Dim target track detection using high order correlation , ” IEEE Trans . on Aerospace and Electronic System , Vol. 29, no. 3, July 1993.
[29] R. J. Liou and M. R. Azimi-Sadadi and R. Dent, “ Dection of Dim targets in high cluttered background using high order correlation neural network, ” In Proceedings of the IJCNN, Seattle, WA, pp. 701-706,July 1991.
[30] E. A. SMITH and DENNIS R. PHILLIPS, “ Automated Cloud Tracking Using Precisely Aligned Digital ATS Pictures, ” IEEE Trans. on computers, Vol. 21, No. 7,July 1972.
[31] 曾忠一，"大氣衛星遙測學"，渤海堂文化事業公司、1988。
[32] 林文智， “ 雲與天氣 ”，渡假出版社有限公司、1996。
[33] 楊武智，"最新影像數位信號處理基礎"，全華科技圖書公司、1993。
[34] 劉晟志、黃煥超，"數位影像處理"，儒林圖書公司、1988。