

# Depth from defocusing using local standard deviations of images = 利用局部灰階標準差來獲得影像深度資訊之技術探討

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## 摘要

以二維的影像轉作成三維立體的模型，作為後續處理與應用的技術已被研究多年，近年來所發表的論文，大都是將影像轉換到空間域、頻域以及時頻域等，再利用光學的預先分析，找出影像變化與距離的關係，再做立體化的處理。本論文與其他研究論文不同的地方，在於本論文首例嘗試利用統計的標準差來分析影像的紋理，藉由兩張不同照相機參數的影像會產生不同的紋理，再比對這兩張影像的紋理後，就可以求出距離的相對比例並形成立體物件，以下本論文將個人所研究的範圍，詳細描述其不同的地方及運算形成的方法。

關鍵詞：局部灰階標準差

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## 參考文獻

[1] Pentland, A. "A New Sense for Depth of Field," IEEE Trans. Pattern Analysis and Machine Intelligence, vol. 9, pp. 523-531, 1987.

[2] Paolo Favaro and Stefano Soatto, "A Geometric Approach to Shape from Defocus," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol.27, no.3, pp.406-417, 2005.

[3] Muhammad Asif, Aamir Saeed Malk and Tae-Sun Choi, "3D Shape Recovery from Image Defocus using Wavelet Analysis," IEEE Conf. on Image Processing, I-1025-8, 2005.

[4] Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, Digital Image Processing using MATLAB, Pearson Prentice Hall, 2004.

[5] Surya, G. & Subbarao, M. "Depth from defocus by changing camera aperture: a spatial domain approach," IEEE Conf. on CVPR, pp. 61 – 67, 1993.

[6] Subbarao, M. & Wei, T. C. "Depth from Defocus and Rapid Autofocusing: a Practical Approach," IEEE CVPR, pp 773 – 776, 1992.

[7] Subbarao, M. "Parallel Depth Recovery by Changing Camera Parameters," In. Proc. IEEE Intl. Conf. on Computer Vision, Florida, USA,

pp 149-155, 1988.

[8] Subbarao, M. and Natarajan, G. "Depth recovery from blurred edges", CVPR, Ann Arbor, Michigan, pp. 498-503, June 1988.

[9] Xiong, Y. & Shafer, S.A. "Depth from Focusing and Defocusing," IEEE Computer Society Conf. on CVPR, pp 68 – 73, 1993.

[10] Ens, J. and Lawrence, P. "An Investigation of Methods for Determining Depth from Focus," IEEE PAMI, vol. 15, no.2, pp. 97-108, 1993.

[11] Swain, C., Peters, A., and Kawamura, K., "Depth estimation from image defocus using fuzzy logic," IEEE conf. on computational Intelligence, vol. 1, pp. 94-99, June 1994.

[12] Xiang-cheng Chen, Sheng Yang, and Ya-jun Wang, "Research on 3D Shape reconstruction using Uneven Defocusing Model," IEEE Conf. on Mechatronics and Automation, August 2007.

[13] M. Potmesil and I. Chakravarty, "Synthetic image generation with a lens and aperture camera model," ACM Trans. Graphics, vol. 1, no. 2, pp. 85-208, Apr. 1982.