



UNIVERSITEIT VAN PRETORIA  
UNIVERSITY OF PRETORIA  
YUNIBESITHI YA PRETORIA

Engineering, Built Environment and IT  
Department of Computer Science

COS791

Image Analysis and Understanding

Assignment Two

Due: 6 October 2024

## Instructions

1. This is an individual assignment.
2. Plagiarism is not allowed.
3. The use of libraries is permitted, you may use any programming language of your choice.
4. The assignment consists of one question to be answered as follows. The code, input-output image files, and a readme file specifying how to run your code should be placed in a folder labelled Ass2 zipped and uploaded. Additionally, a report (PDF) detailing the configuration of the experimental setup and the results should be submitted.
5. Assignment image files are provided. There are 5 images.
6. This assignment is worth 25 Marks (Report is 10 Marks)

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1. This assignment compares the effectiveness of two algorithms namely, *Simulated Annealing*[5] and the *Variable Neighbourhood Search*[4] for multilevel thresholding. Thresholding should be performed at levels  $k=2,3,4,5$  for each of the 5 images. The objective functions are the Otsu and Kapur methods. The Table provided below is an extract that outlines the values and quality metrics to be used and presented. For each image present at least 1 level of the Otsu and Kapur pair as shown in Figs 2.

Image	Level		Otsu		Kapur		SSIM		PSNR	
			SA	VNS	SA	VNS	SA	VNS	SA	VNS
T22	2	Th								
		Values								
	3	Th								
		Values								
	4	Th								
		Values								
	5									

Th - threshold values, Values - objective function values

Figure 1: Results Table.

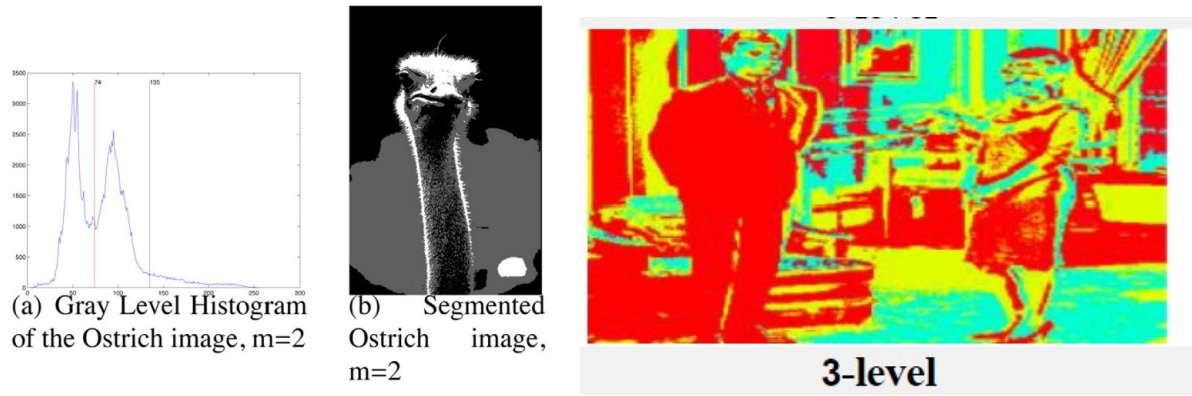


Figure 2: Segmented Image with Histogram and a coloured image with a different colour for each level

1. Otsu, N. (1975). A threshold selection method from gray-level histograms. *Automatica*, 11(285-296), 23-27.
2. Kapur, J. N., & Kesavan, H. K. (1992). Entropy optimization principles and their applications. In *Entropy and energy dissipation in water resources* (pp. 3-20). Dordrecht: Springer Netherlands.
3. Pare, S., Kumar, A., Singh, G. K., & Bajaj, V. J. I. J. O. S. (2020). Image segmentation using multilevel thresholding: a research review. *Iranian Journal of Science and Technology, Transactions of Electrical Engineering*, 44(1), 1-29.
4. Mladenović, N., & Hansen, P. (1997). Variable neighbourhood search. *Computers & operations research*, 24(11), 1097-1100.
5. Van Laarhoven, P. J., Aarts, E. H., van Laarhoven, P. J., & Aarts, E. H. (1987). Simulated annealing (pp. 7-15). Springer Netherlands.