

Supplementary material for the paper:

“A Non-convex Gradient Fidelity-based Variational Model for Image Contrast Enhancement”

- Comparison on test images from refs. [1, 2] pages 2 - 24
- Comparison on test images from ref. [3] pages 25 – 50
- Extension by combining detail enhancement and comparison with WLS [4] and EAW [5] pages 51 - 55

Remarks:

[1] WWW/<http://sipi.usc.edu/database/>.

[2] WWW/<http://r0k.us/graphics/kodak/>.

[3] D. Martin, C. Fowlkes, D. Tal, J. Malik, A database of human segmented natural images and its application to evaluating segmentation algorithms and measuring ecological statistics. In *Proc. of ICCV*, 2: 416–423, 2001.

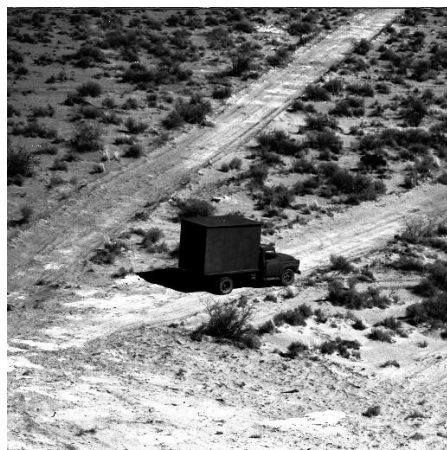
[4] Farbman, Z., Fattal, R., Lischinski, D., Szeliski, R. Edge-preserving decompositions for multi-scale tone and detail manipulation. *ACM Trans. Graph.* 27(3):67-77. 2008.

[5] R. Fattal, Edge-avoiding wavelets and their applications, *ACM Trans. Graph.* 28 (3):1–10, 2009.

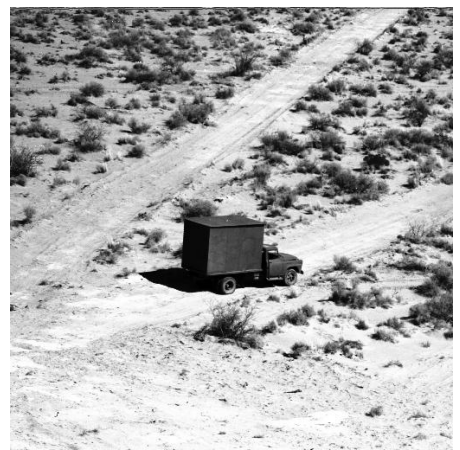
● Comparison on test images from refs. [1, 2]



(a) Original image



(b) HE



(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 1. Contrast enhancement results for image 7.1.01.tiff.



(a) Original image



(b) HE



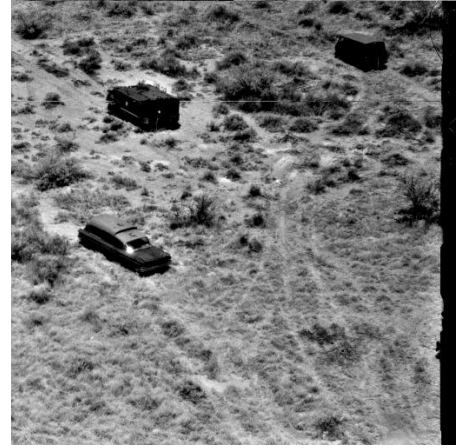
(c) 2DHE



(d) AR



(e) MCE



(f) NGF

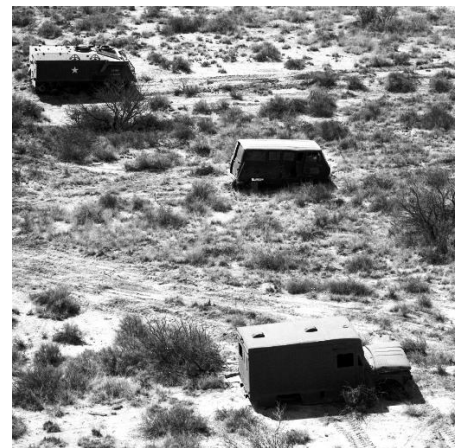
Figure 2. Contrast enhancement results for image 7.1.04.tiff.



(a) Original image



(b) HE



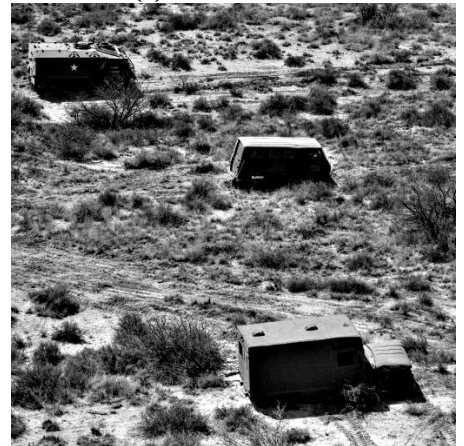
(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 3. Contrast enhancement results for image 7.1.05.tiff.



(a) Original image



(b) HE



(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 4. Contrast enhancement results for image 7.1.07.tiff.



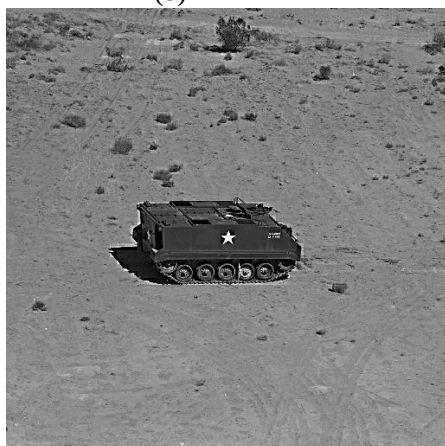
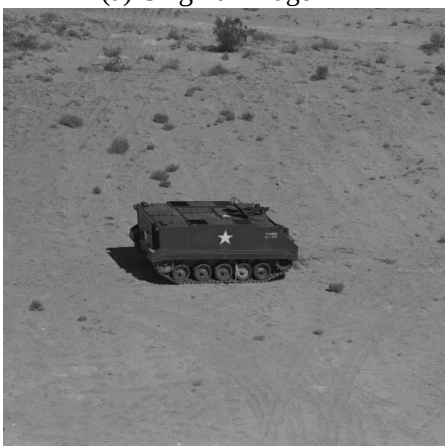
(a) Original image



(b) HE



(c) 2DHE



(d) AR

(e) MCE

(f) NGF

Figure 5. Contrast enhancement results for image 7.1.08.tiff.



(a) Original image



(b) HE



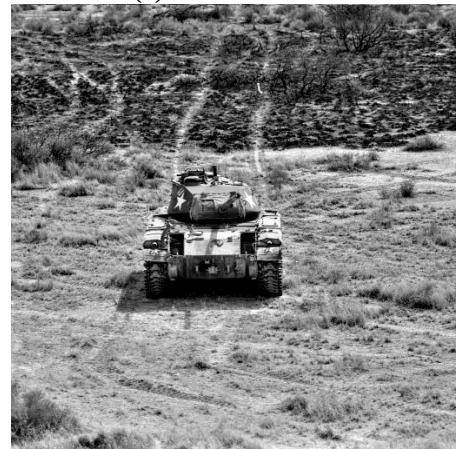
(c) 2DHE



(d) AR



(e) MCE

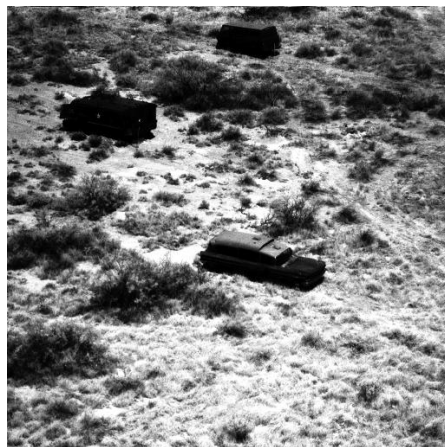


(f) NGF

Figure 6. Contrast enhancement results for image 7.1.09.tiff.



(a) Original image



(b) HE



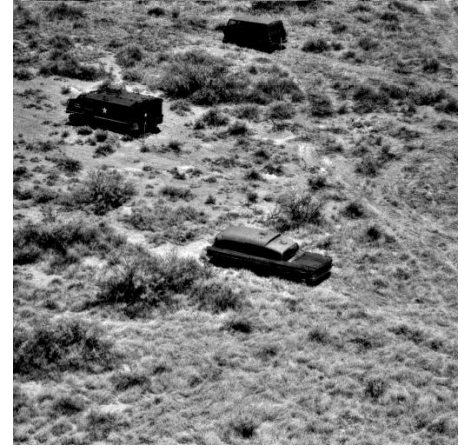
(c) 2DHE



(d) AR

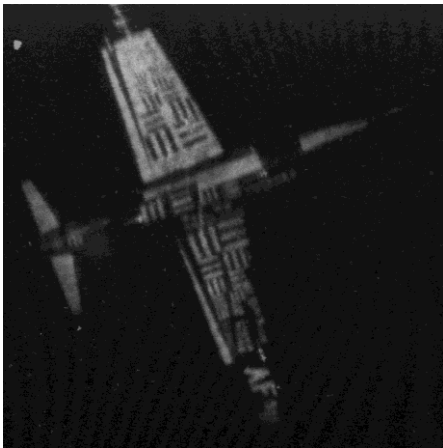


(e) MCE



(f) NGF

Figure 7. Contrast enhancement results for image 7.1.10.tiff.



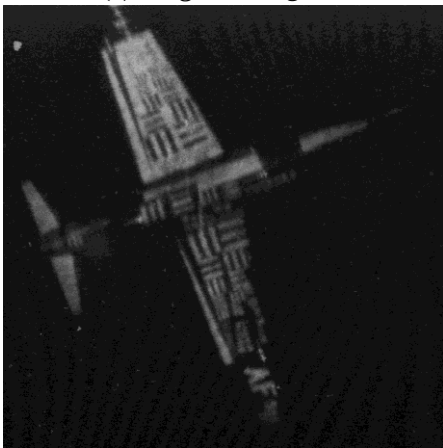
(a) Original image



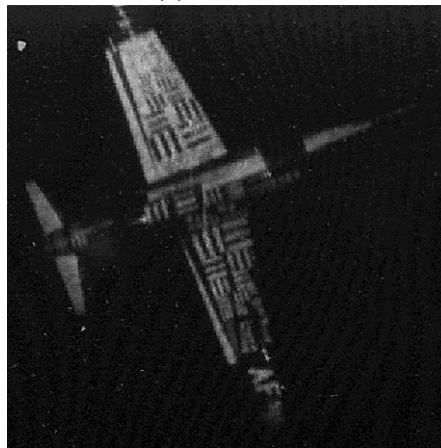
(b) HE



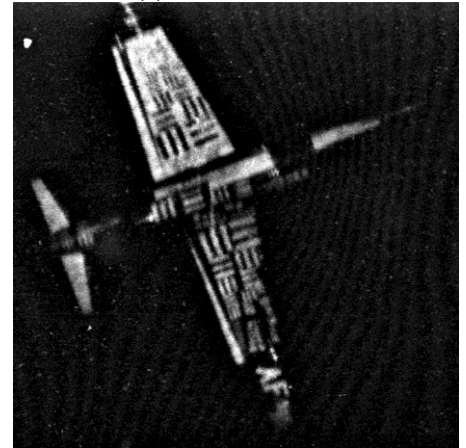
(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 8. Contrast enhancement results for image 7.2.01.tiff.



(a) Original image



(b) HE



(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 9. Contrast enhancement results for image boat.512.tiff.



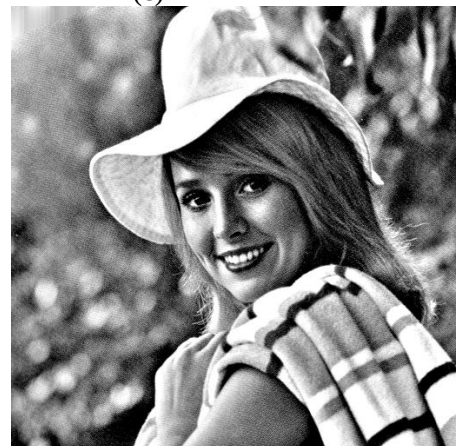
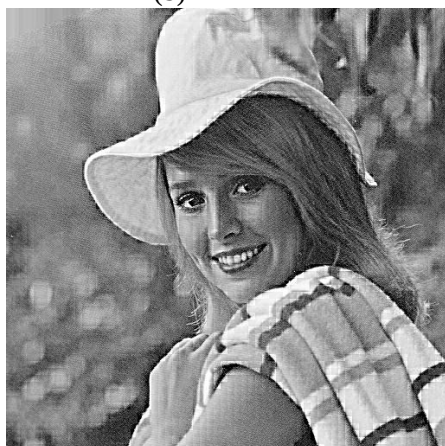
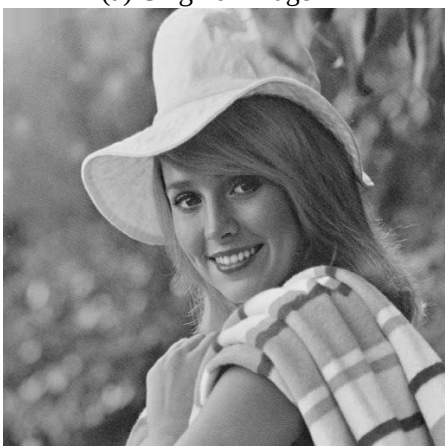
(a) Original image



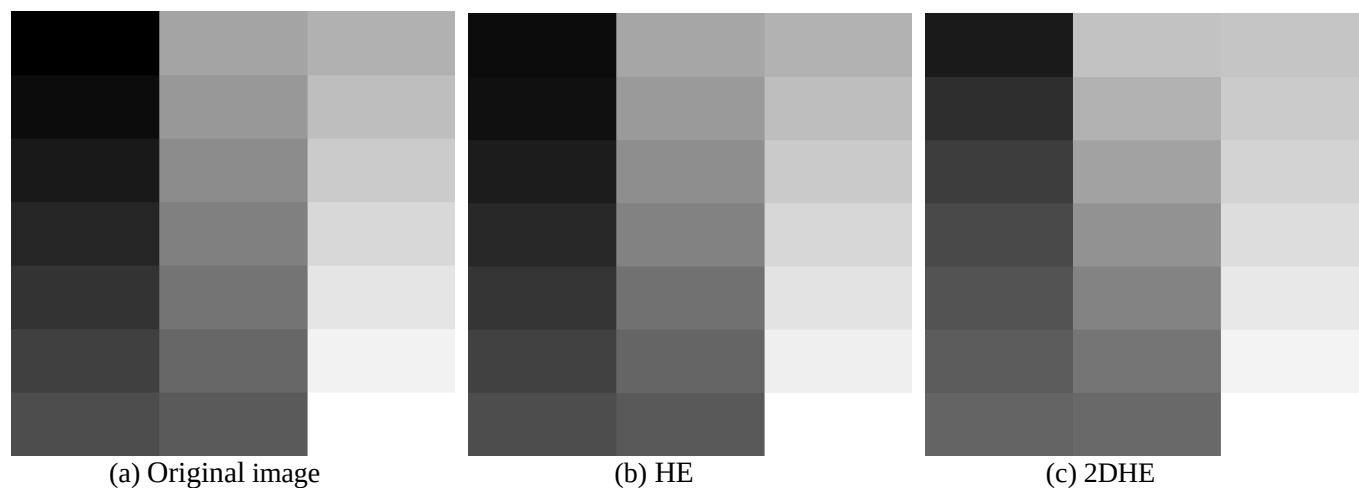
(b) HE



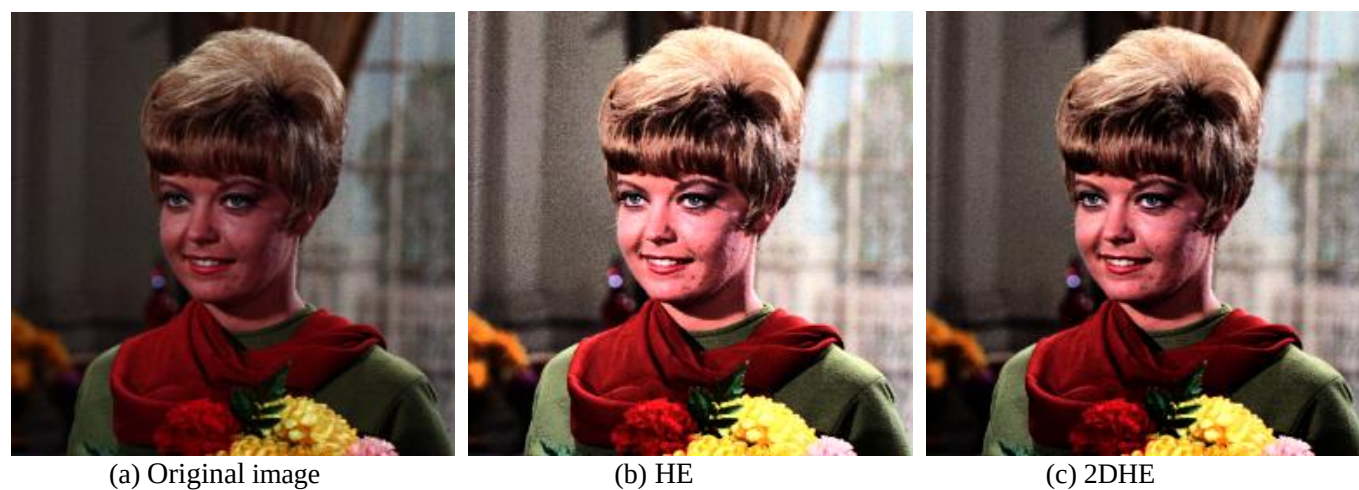
(c) 2DHE



(d) AR
Figure 10. Contrast enhancement results for image elaine.512.tiff.



(d) AR
Figure 11. Contrast enhancement results for image gray21.512.tiff.





(d) AR



(e) MCE



(f) NGF

Figure 12. Contrast enhancement results for image 4.1.01.tiff.



(a) Original image



(b) HE



(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 13. Contrast enhancement results for image 4.1.03.tiff.



(a) Original image



(b) HE



(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 14. Contrast enhancement results for image 4.1.04.tiff.



(a) Original image



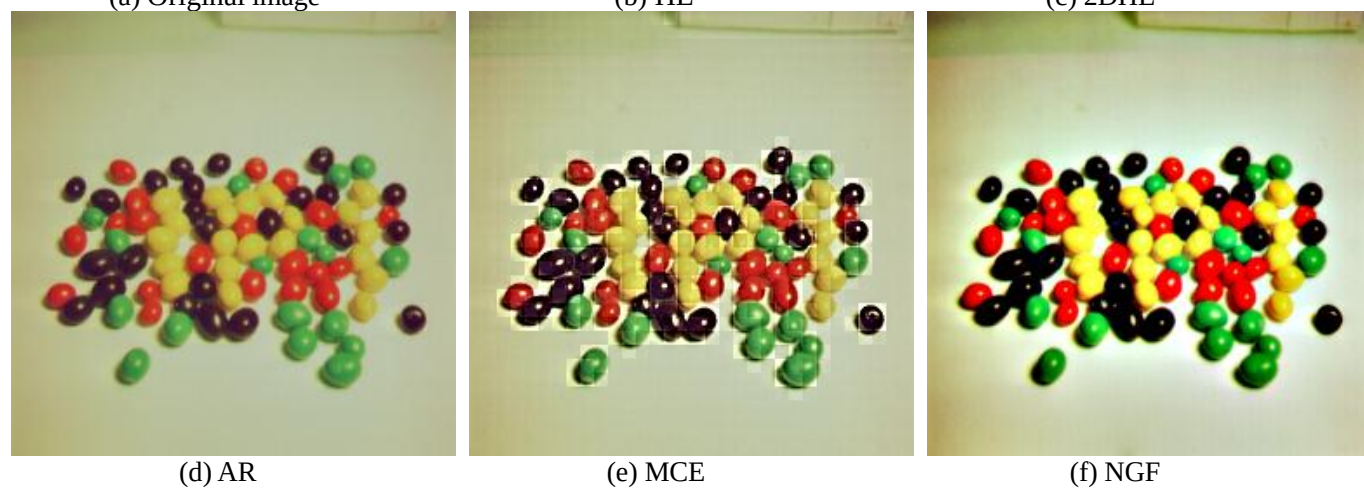
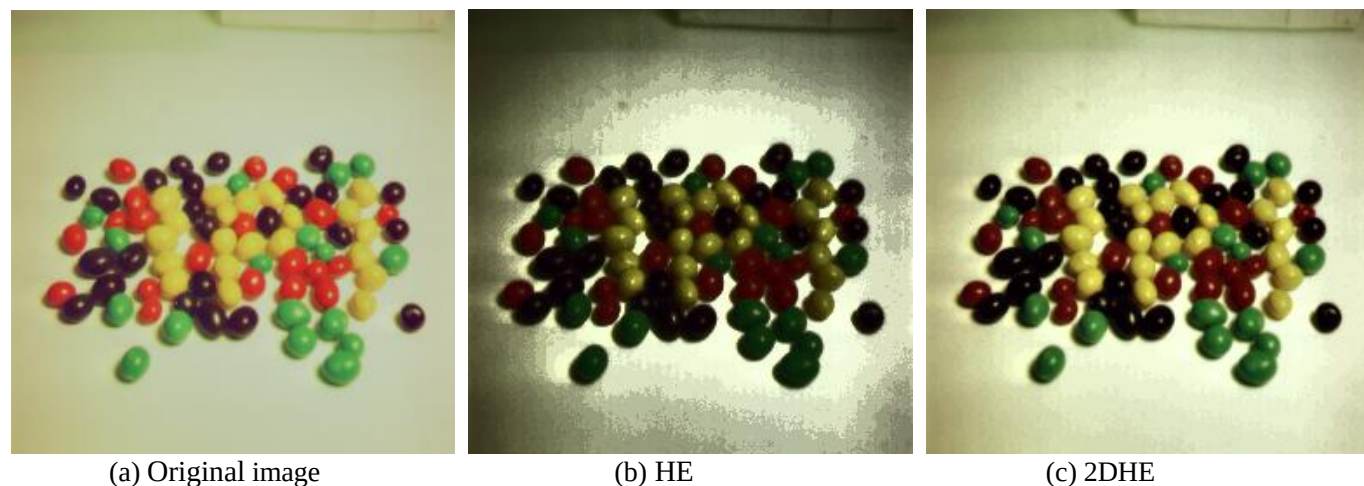
(b) HE



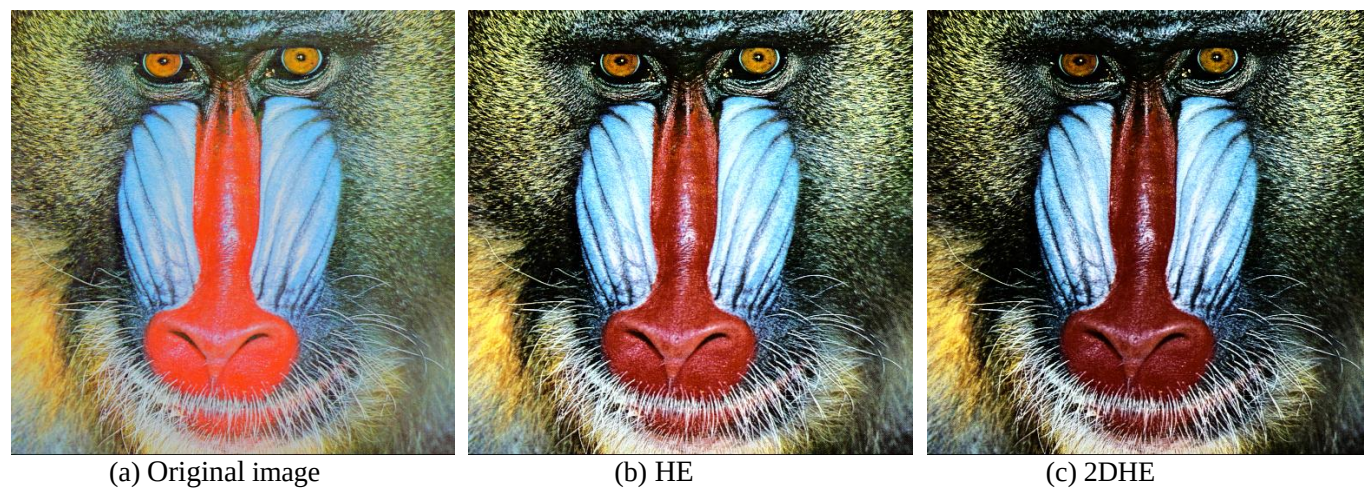
(c) 2DHE

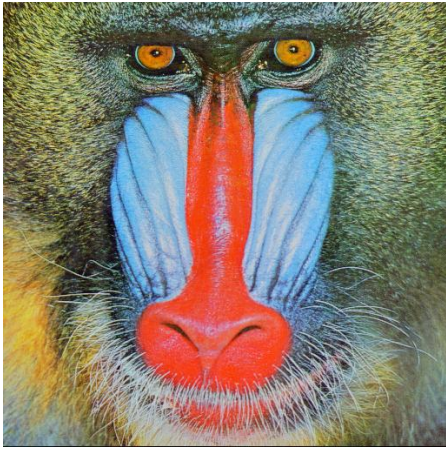


(d) AR (e) MCE
Figure 15. Contrast enhancement results for image 4.1.07.tiff.

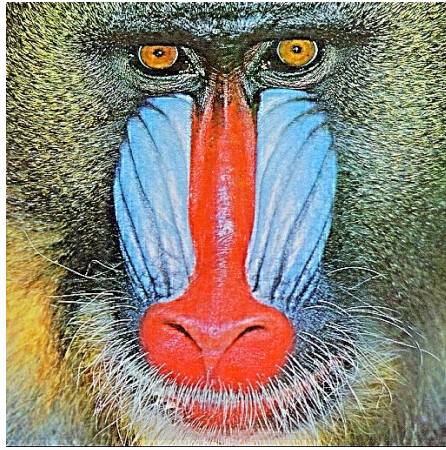


(d) AR (e) MCE (f) NGF
Figure 16. Contrast enhancement results for image 4.1.08.tiff.

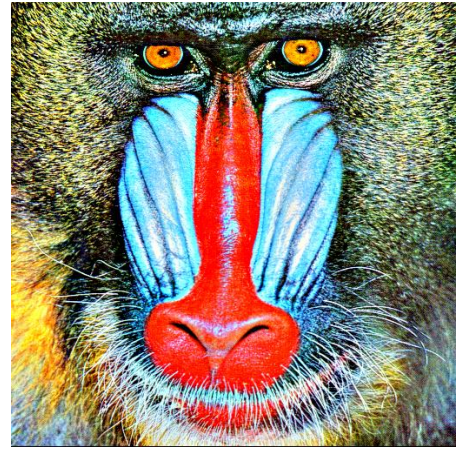




(d) AR



(e) MCE



(f) NGF

Figure 17. Contrast enhancement results for image 4.2.03.tiff.



(a) Original image



(b) HE



(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 18. Contrast enhancement results for image 4.2.05.tiff.



(a) Original image



(b) HE



(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 19. Contrast enhancement results for image kodim02.png.



(a) Original image



(b) HE



(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 20. Contrast enhancement results for image kodim03.png.



(a) Original image



(b) HE



(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 21. Contrast enhancement results for image kodim04.png.



(a) Original image



(b) HE



(c) 2DHE



(d) AR

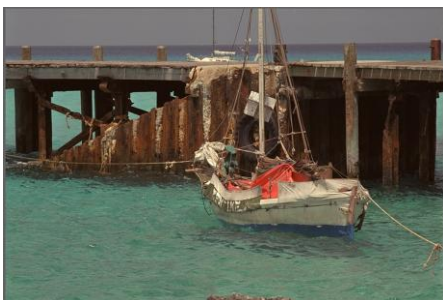


(e) MCE

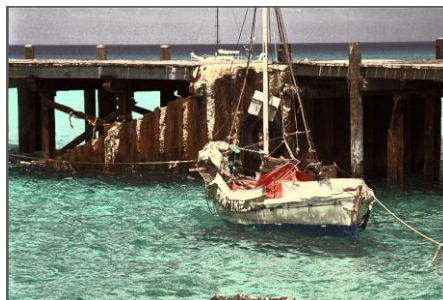


(f) NGF

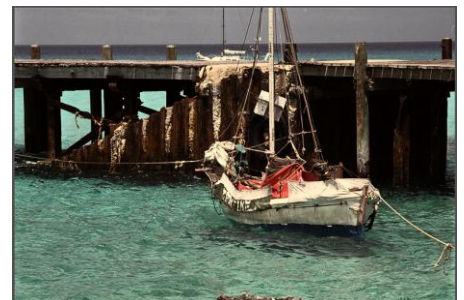
Figure 22. Contrast enhancement results for image kodim07.png.



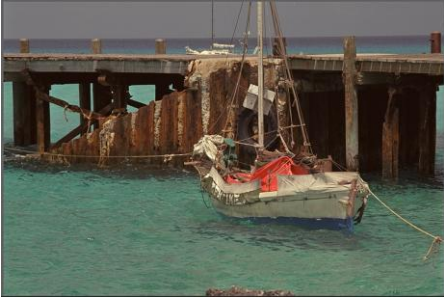
(a) Original image



(b) HE



(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 23. Contrast enhancement results for image kodim11.png.



(a) Original image



(b) HE



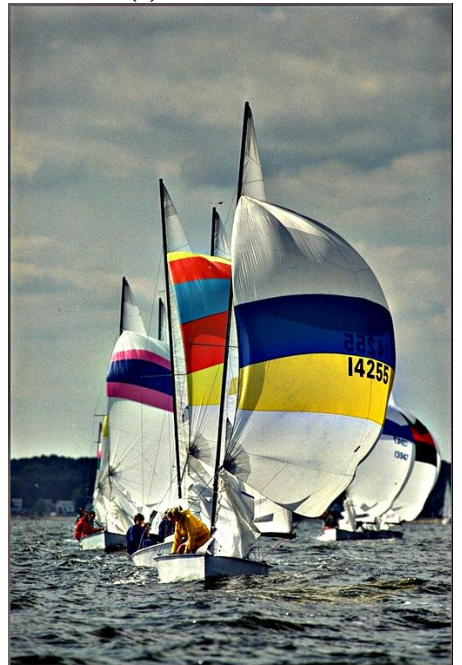
(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 24. Contrast enhancement results for image kodim09.png.



(a) Original image



(b) HE



(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 25. Contrast enhancement results for image kodim16.png.



(a) Original image



(b) HE



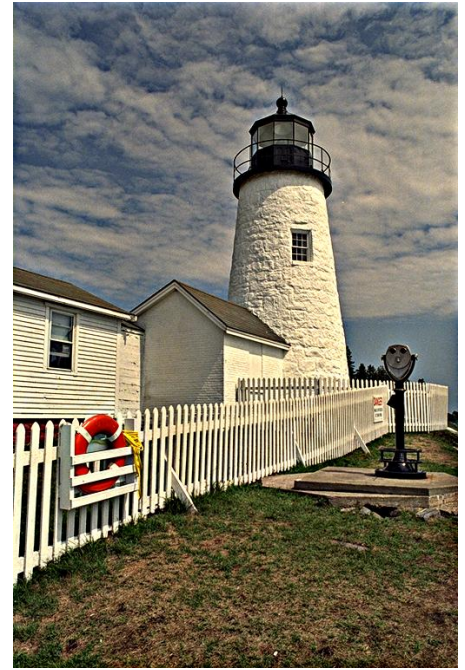
(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 26. Contrast enhancement results for image kodim19.png.



(a) Original image



(b) HE



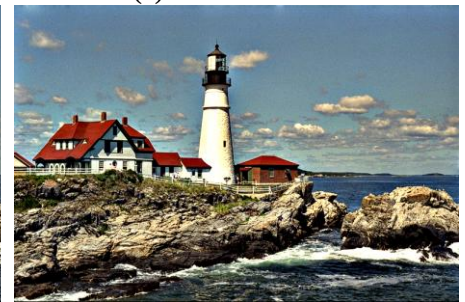
(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 27. Contrast enhancement results for image kodim21.png.



(a) Original image



(b) HE



(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 28. Contrast enhancement results for image kodim22.png.



(a) Original image



(b) HE



(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 29. Contrast enhancement results for image kodim23.png.



(a) Original image



(b) HE



(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 30. Contrast enhancement results for image kodim24.png.



(a) Original image



(b) HE



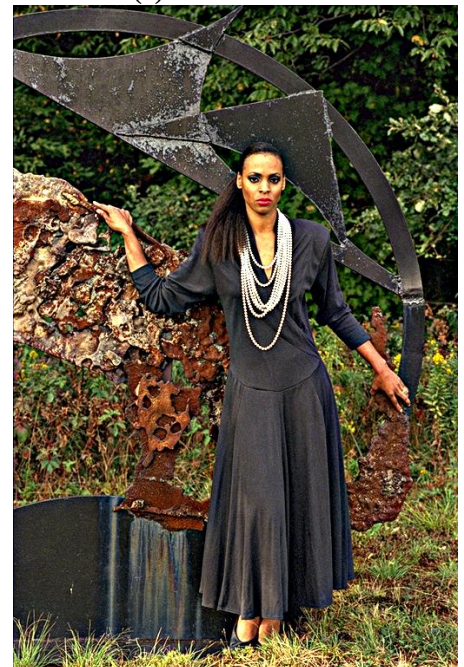
(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 31. Contrast enhancement results for image kodim18.png.



(a) Original image



(b) HE



(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 32. Contrast enhancement results for image kodim15.png.



(a) Original image



(b) HE



(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 33. Contrast enhancement results for image kodim17.png.



(a) Original image



(b) HE



(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 34. Contrast enhancement results for image kodim14.png.



(a) Original image



(b) HE



(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 35. Contrast enhancement results for image kodim13.png.



(a) Original image



(b) HE



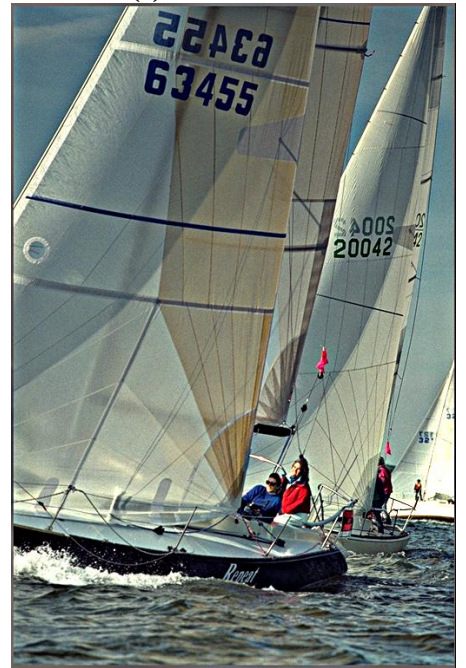
(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 36. Contrast enhancement results for image kodim10.png.



(a) Original image



(b) HE



(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 37. Contrast enhancement results for image kodim08.png.



(a) Original image



(b) HE



(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 38. Contrast enhancement results for image kodim06.png.



(a) Original image



(b) HE



(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 39. Contrast enhancement results for image kodim05.png.



(a) Original image



(b) HE



(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 40. Contrast enhancement results for image kodim01.png.

- Comparison on test images from ref. [3]



(a) Original image



(b) HE



(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 1. Contrast enhancement results for image 37073.jpg.



(a) Original image



(b) HE



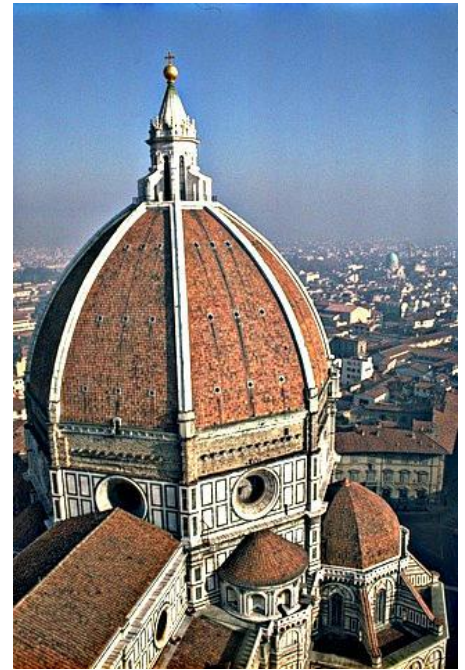
(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 2. Contrast enhancement results for image 24004.jpg.



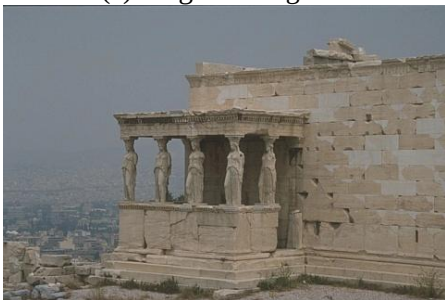
(a) Original image



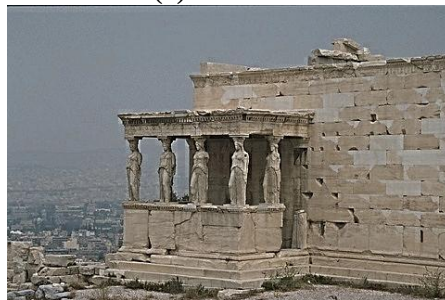
(b) HE



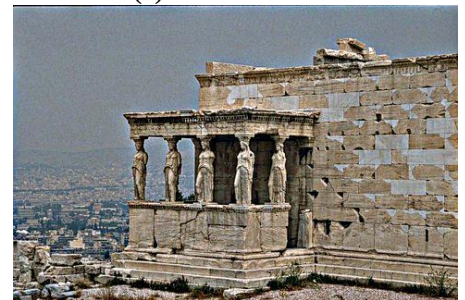
(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 3. Contrast enhancement results for image 227040.jpg.



(a) Original image



(b) HE



(c) 2DHE



(d) AR



(e) MCE

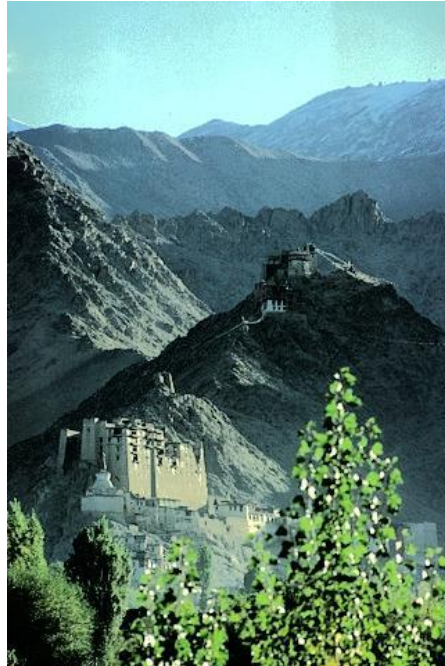


(f) NGF

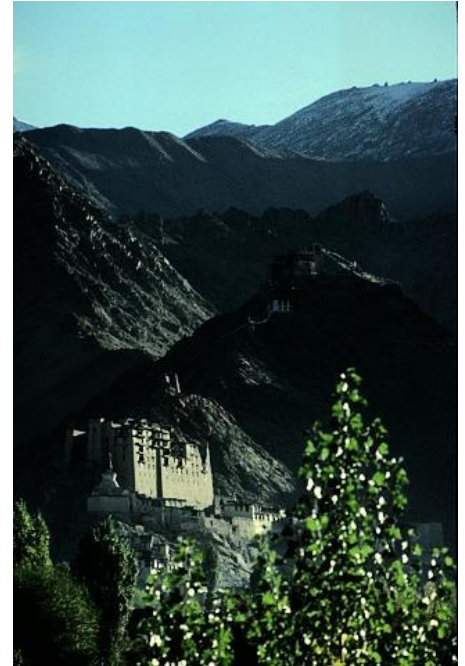
Figure 4. Contrast enhancement results for image 370036.jpg.



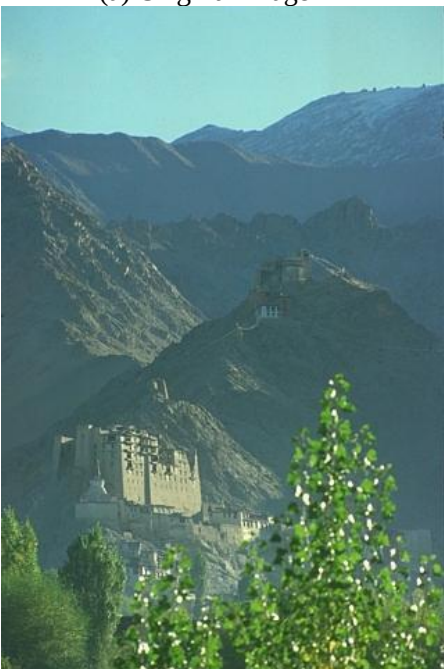
(a) Original image



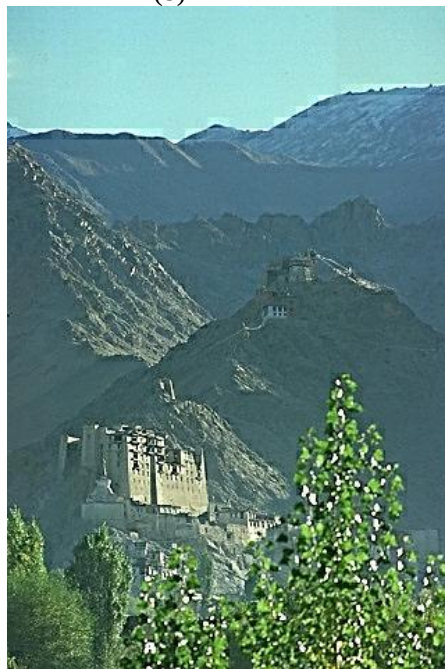
(b) HE



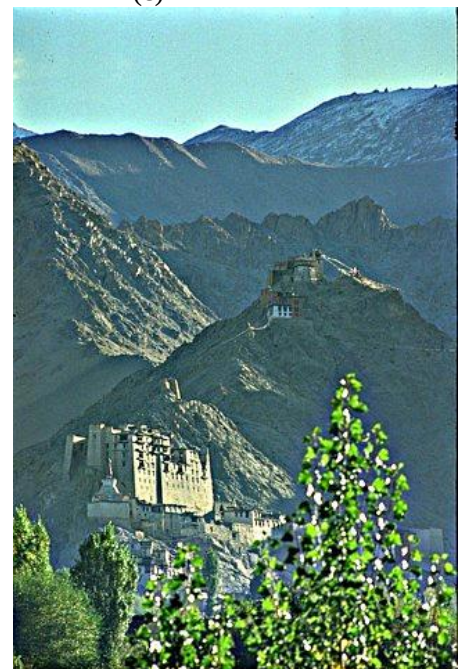
(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 5. Contrast enhancement results for image 20008.jpg.



(a) Original image



(b) HE



(c) 2DHE



(d) AR



(e) MCE



(f) NGF

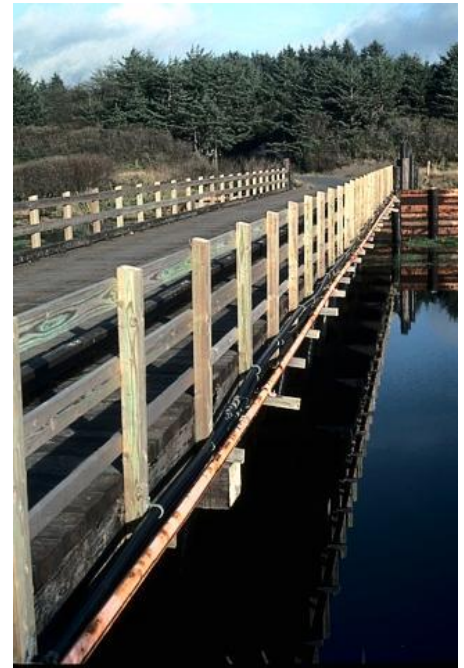
Figure 6. Contrast enhancement results for image 8049.jpg.



(a) Original image



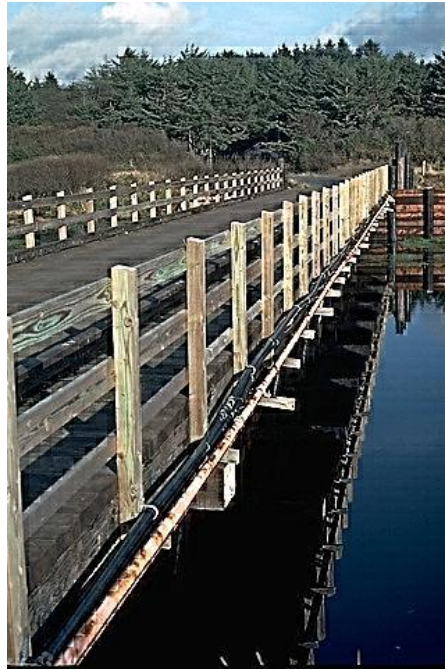
(b) HE



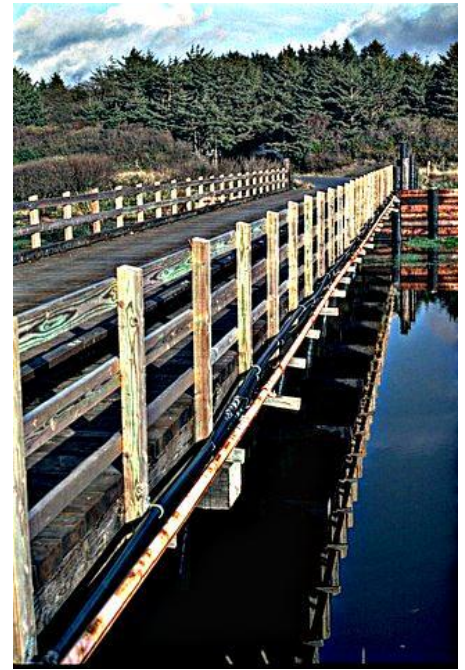
(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 7. Contrast enhancement results for image 22013.jpg.



(a) Original image



(b) HE



(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 8. Contrast enhancement results for image 23025.jpg.



(a) Original image



(b) HE



(c) 2DHE



(d) AR



(e) MCE



(f) NGF

Figure 9. Contrast enhancement results for image 23084.jpg.