**CMSE492 Lab 3. EMD method**

31.03.2019

**Task:**

1. Implement EMD algorithm [1] in any programming language/operating system available in CMPE-134
2. Test your implementation using Seminar 14.03.2019 examples: “Consider EMD method [1] with n=3

Consider the grayscale image, I, below having 2 rows and 8 columns:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Col1 | Col2 | Col3 | Col4 | Col5 | Col6 | Col7 | Col8 |
| Row1 | 0 | 100 | 105 | 10 | 21 | 31 | 255 | 121 |
| Row2 | 251 | 136 | 19 | 22 | 21 | 20 | 159 | 183 |

Let secret bit stream , bs, in hexadecimal is as follows: A0 B1 C2 D3 A1 B1 C1 D1 A2 B2 C2 D2 A B3 C3 D3. Convert the binary stream, s, into (2n+1)-ary digit stream, ds, using (1) from [1] assuming L=16. Embed ds into I getting stego image, SI. Extract secret data from SI, and convert them into binary. Check that the data extracted match the data embedded”.

1. Test your implementation on 4 host 512x512 images (Mandrill, Peppers, Jet, and Lena) and 4 secret 256x256 images (Mandrill, Peppers, Jet, and Lena) used in [2]
2. For each of 16 variants of embedding secret into the covers, calculate embedding capacity, RMSE, and PSNR, and compare your results versus [Table 2, p. 1622]. In the case of discrepancies, fix your problems, or prove that your results are correct.
3. **Defend the Lab on May 8, 2019, Wednesday, 16.30-18.20, CMPE-134 (hand in your report to Evaluator, run your program, and explain your work done).**
4. Report shall have
	1. Cover page (University, Department, Course, Semester, Year, City, Country, Lab subject, Team members, Lecturer, Lab assistant)
	2. Outline
	3. Problem definition (see items 1-4 above)
	4. EMD method description
	5. Description of EMD method implementation in your programming language/operating system
		1. Description of the host/secret images you use and their sources
		2. Description of the secret (2n+1)-ary data stream obtainng
		3. Description of embedding using extraction function
		4. Description of embedding if falling-off-boundary happens [1, p. 782, right column, 2nd paragraph]
		5. Description of extraction implementation using extraction function
		6. Description of RMSE, PSNR, and embedding capacity calculation
	6. Description of the tests conducted and their results, **screenshots** of them
	7. Comparison of your results versus [Table 2, p. 1622].
	8. Conclusion
	9. References
	10. Appendices with the code developed
	11. CD with all Lab related materials (report, images used, test results, sources, executables). CD shall be runnable (it is possible to install your program from the CD, run it on your examples, and view results you got).

**References**

1. X. Zhang and S. Wang, Efficient Steganographic Embedding by Exploiting Modification Direction, IEEE COMMUNICATIONS LETTERS, VOL. 10, NO. 11, NOVEMBER 2006, pp. 781-783, <https://staff.emu.edu.tr/alexanderchefranov/Documents/CMSE492/Spring2019/main%20reference%20for%20EMD.pdf>
2. S.-J. Wang, Steganography of capacity required using modulo operator for embedding secret image, Applied Mathematics and Computation, 164 (2005), 99-116, doi:10.1016/j.amc.2004.04.059, <https://staff.emu.edu.tr/alexanderchefranov/Documents/CMSE492/LSB%20modulo%20AMC2005.pdf>

**Grading policy: report – 50%, explanations – 50%**