

# Improved Lossless Data Hiding Mechanisms based on Block-based Hiding Algorithm, Double Hiding Strategy and Variable Control Technique

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**Abstract.** The lossless information hiding technique is to embed secret message into multi-media to generate stego multi-media. Due to the stego media is very similar to the cover media, it is difficult for illegal users to detect that there are some secret message concealed on the cover media. Jin et al. proposed a lossless information hiding technique in 2007. Their method is simple and the quality of the stego image is nice. However, the hiding capacity of their method is low. Therefore, we apply three mechanisms to improve Jin et al.'s scheme. The mechanisms include block-based hiding algorithm, double hiding strategy, and variable control technique. Six systems are implemented to test the performances of the mechanisms. The experimental results show that the hiding capacities of the proposed schemes are better than that of Jin et al.'s scheme. In addition, the performance of the proposed scheme is better than that of Coltuc et al.'s RCM-based scheme. We also compare Ni et al.'s histogram-based method with the proposed schemes. Although the image quality of Ni et al.'s scheme is better than that of the proposed scheme, the hiding capacity of the proposed scheme is several times of that of Ni et al.'s scheme.

**Keywords:** lossless information hiding technique, sort technique, block-based hiding technique, double hiding technique, variable

## References

- [1] T. C. Lu, C. M. Lu, C. C. Chang, *Multimedia Security Techniques*, CHWA, Taiwan, 2007.
- [2] J. Tian, "Reversible Data Embedding and Content Authentication Using Difference Expansion," *IEEE Transactions on Circuits and Systems for Video Technology*, Vol. 13, No. 8, pp. 831-841, 2003.
- [3] D. Coltuc and J. M. Chassery, "Very Fast Watermarking by Reversible Contrast Mapping," *IEEE Signal Processing Letters*, Vol. 14, No. 4, pp. 255-258, 2007
- [4] H. L. Jin, M. Fujiyoshi, H. Kiya, "Lossless Data Hiding in the Spatial Domain for High Quality Images," *IEICE Transactions on Fundamentals*, Vol. E90-A, No. 4, pp. 771-777, 2007.
- [5] Z. Ni, Y. Q. Shi, N. Ansari, W. Su, "Reversible Data Hiding," *IEEE Transactions on Circuits and Systems for Video Technology*, Vol. 16, No. 3, pp. 354-362, 2006.

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