



## **REVERSIBLE VISIBLE WATERMARKING WITH LOSSLESS DATA EMBEDDING BASED ON DIFFERENCE VALUE SHIFT**

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**ABSTRACT**—This paper first proposes a novel lossless data-hiding method, in which the magnitudes of gray level differences in pixel pairs are slightly increased so that the region of differences with small magnitudes can be used to carry the hidden message. Overflow is avoided by prohibiting modifications to certain pixel pairs, and a small number of labels marking these exceptions are also embedded for perfect recovery of the host. Since this method avoids embedding any compressed data of location map or original data, the payload-distortion performance is very high. The lossless data-hiding method is then applied to implement a reversible visible watermarking scheme. After semi-transparently embedding a binary watermark image, some additional data about the mark and the host image are also inserted in the lossless manner. When the visible watermark is extracted from the marked version, the original host image can be completely restored without any error.

**Key Words:** lossless data hiding, visible watermarking, difference value shift