Guest Editorial
Introduction to Special Section on Modern Reversible Data Hiding and Watermarking

THE rapid development and growing of 4G and 5G mobile networks allow people all over the world to efficiently transmit and share data and information while bringing an increasing demand on information security. Data hiding is a general technique to embed secret messages to be protected in an imperceptible way into a cover media like an image, a video stream, or a document. Traditional data hiding intends to achieve high embedding capacity and imperceptibility of hidden secret messages for secure communication. However, it introduces permanent damage or distortion to the cover media when receiver extracts the secret messages from the cover media. To address this problem, reversible data hiding (RDH) was developed to allow the receiver completely extract the hidden secret messages while fully recovering the original cover media without any distortion. RDH has been widely used for many military and medical applications like the access authentication of reconnaissance images and the sharing of medical images in remote diagnosis. According to the format of cover media, RDH can be done in both plaintext and encryption domains. RDH in plaintext domain intends to embed the secret messages into the original cover media in a way that the marked media (the cover media with embedded secret messages) is visually the same as the original cover media and able to withstand the potential analysis. RDH in the encryption domain embeds the secret messages into the encrypted cover media (e.g., encrypted images) such that secret messages and cover media are protected in a high security level during transmission and completely reconstructed in the receiver side.

As a branch of data hiding, digital watermarking is to embed a watermark (e.g., a signature or copyright information) into the cover media in an imperceptible way for authentication and copyright protection. Using only the correct secret key, the user is able to extract the embedded watermark. Similar to RDH, reversible watermarking allows the authorized user to completely recover the embedded watermark and original cover media without distortion.

This special section consists of nine articles on reversible data hiding and watermarking with six reversible data hiding articles and three reversible watermarking articles.

Among the reversible data hiding articles, "Optimal reversible data hiding scheme based on multiple histograms modification" by W. Qi *et al*. uses multiple histograms modification (MHM) to achieve RDH for high capacity embedding. Moreover, the authors propose a computationally efficient algorithm to solve the optimization problem. "Multiple histograms-based reversible data hiding: Framework and realization" by J. Wang *et al*. provides a novel RDH general framework based on multiple histograms modification. Compared with MHM_RDH, the proposed method can considerably increase the payload. "High capacity reversible data hiding based on multiple histograms modification" by B. Ou *et al*. extends the MHM scheme to achieve RDH. In detail, they select multiple pairs of bins instead of one pair of expansion bins in each prediction-error histogram (PEH). "Reversible data hiding in JPEG images with multi-objective optimization" by Z. Yin *et al*. considers both the rate-distortion and the file size expansion for JPEG RDH. And multi-objective optimization is used to gain the optimized combination of parts for embedding data. "Fully homomorphic encryption encapsulated difference expansion for reversible data hiding in encrypted domain" by Y. Ke *et al*. proposes a fully homomorphic encryption encapsulated difference expansion (FHEE-DE) scheme for reversible data hiding in encrypted domain (RDH-ED). The proposed method is superior to existing RDH-ED methods and achieves fully separability without reducing the security of encryption. "A high-capacity reversible data hiding in encrypted images employing local difference predictor" by A. Mohammadi *et al*. employs a local difference predictor method to achieve a high-capacity RDHEI. In detail, a local difference predictor is used to calculate the prediction errors between follower pixels and leader one, and determine a label for block embedding capacity.

The reversible watermarking articles have been selected to be representative among those that were assessed as being the best performing. "Towards optimal prediction error expansion-based reversible image watermarking" by A. Roy *et al*. uses Integer Linear Programming formulations to find the optimal performance metric values for a given image. In this way, the proposed method can calculate the performance metric limits without assuming any particular prediction scheme. "Separable robust reversible watermarking in encrypted 2D vector graphics" by F. Peng *et al*. designs a robust reversible watermarking (RRW) scheme in both plaintext and encrypted domains. RRW can effectively resist normal operations such as rotation, scaling, translation (RST) and entity reordering. "Independent embedding domain based two-stage robust reversible watermarking" by Wang *et al*. proposes an independent embedding domain (ED) to achieve RRW. They first transform a cover image into two independents EDs, and then embed the robust and reversible watermarks into each domain, separately.

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This special section opens a gateway for many leading researchers in modern reversible data hiding and watermarking further identifying the principle methods and associated critical limitations. It examines and encourages the futuristic extension to security enhancement at various domains with real-time implementation.

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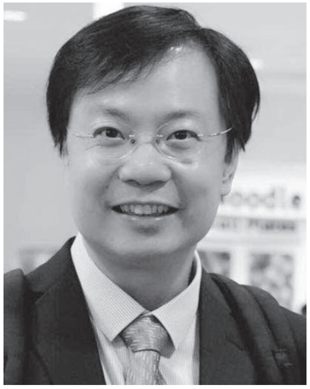

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