PICTURE WATERMARKS SURVIVING GENERAL AFFINE TRANSFORMATION AND RANDOM DISTORTION

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Abstract. *Surviving geometric transformation is essential for picture watermarks because geometric transformation is common during legitimate content distribution and is easily done by illegal copiers. However, no previous method of watermarking works against both of affine transformation and random distortion, which are common and easy to perform. No method works against combinations of these transformations. This paper describes a method that creates picture watermarks that can survive general affine transformation, random distortion and their combinations as well as a clipping attack. The effectiveness of the proposed method was demonstrated by experimental evaluation.*
Keywords: Watermark, Affine transformation, StirMark

1. **Introduction.** Digital content such as music, pictures and video is widely distributed through the Internet, digital broadcasting and DVD media because of its advantages over analog content. It requires less space, is easier to process, and is not degraded by age or repeated use. However, the copyrights for digital pictures and videos are widely violated because the content can be easily copied and sent illegally over the Internet. Picture watermarking, which helps protect the copyrights by embedding copyright information, is one of the countermeasure, and various watermarking techniques have been proposed such as reversible watermarking [3-5], multiple watermarking [6,18], and fragile watermarking [13,19].

Although there are various requirements for picture watermarking, surviving geometric transformation is essential because geometric transformation is common during legitimate content distribution and is easily done by illegal copiers. Various watermarking methods immune to rotation, scaling and translation (RST) [1,8-10,14,15,17,21] or random distortion [2,7,11,20] have been reported. However, a method has not been reported that works against both of affine transformation and random distortion, which are common and easy to perform. Moreover, previous methods do not work against combinations of these transformations, which are also common and easy to perform. This paper describes a method that creates picture watermarks that survive general affine transformation, random distortion, and their combinations as well as a clipping attack. It is an extension of a previously reported method [20].

2. **Previous Work.**