A Visible Watermarking with Automated Location Technique for Copyright Protection of Portrait Images

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SUMMARY A visible watermarking technique to provide copyright protection for portrait images is proposed in this paper. The proposal is focused on real-world applications where a portrait image is printed and illegitimately used for commercial purposes. It is well known that this is one of the most difficult challenges to prove ownership through current watermark techniques. We propose an original approach which avoids the deficiencies of typical watermarking methods in practical scenarios by introducing a smart process to automatically detect the most suitable region of the portrait image, where the visible watermark goes unnoticed to the naked eye of a viewer and is robust enough to remain visible when printed. The position of the watermark is determined by performing an analysis of the portrait image characteristics taking into account several conditions of their spatial information together with human visual system properties. Once the location is set, the watermark embedding process is performed adaptively by creating a contrast effect between the watermark and its background. Several experiments are performed to illustrate the proper functioning of the proposed watermark algorithm on portrait images with different characteristics, including dimensions, backgrounds, illumination and texture, with the conclusion that it can be applied in many practical situations.

key words: visible watermarking, copyright protection, portrait images, human visual system

1. Introduction

Digital watermarking has emerged as a way to claim the ownership of an image through embedding copyright data such that this information remains on the host image even after a variety of attacks have been performed [1]–[3]. Digital watermarking techniques can be broadly classified into invisible approaches, which have yielded a lot of interesting proposals in the last decade [4]–[6]; and visible approaches where in contrast, little work has been done [7]–[10]. In invisible watermarking approaches, the copyright data is robustly embedded as a secondary signal that remains imperceptible to human vision. Since the human eye is unable to differentiate between the original and watermarked image, auxiliary modules are deployed to retrieve the embedded information and thus prove the image ownership [11]. There are some major problems that may affect the success of the above operation: the possibility to embed a counterfeit watermark into the already protected data [12] and the lack of an appropriate legal framework for a digital environment [13]. Since these issues have not been resolved, visible watermarking techniques are chosen in practical scenarios. In these approaches a secondary image is embedded such that it is intentionally perceptible to human observers, thus helping to prevent or at least discourage unauthorized use of copyrighted images. Contrary to what happens with invisible approaches, in visual watermarking the claim of ownership can occur immediately [13]. Nevertheless, the visible watermark inevitably alters the visual content thus reducing the readability and commercial value of the original image.

In this paper we propose an original visible watermarking approach that improves the above mentioned deficiencies for both visible and invisible watermarking methods in practical scenarios. This research is focused on providing copyright protection when a portrait image is severely edited with the misled aim to be printed for commercial purposes. With this purpose, we introduce a smart process to automatically detect the most suitable region of the portrait image where the visible watermark can be embedded by passing unnoticed to the naked eye of a viewer and being robust enough to remain visible after printing process. Our proposal is based on a detailed analysis of the spatial information of the portrait image and considering the Human Visual System (HVS) properties. HVS properties such as luminance and texture are often utilized in invisible watermarking approaches [14], [15]. Hence, the location of such regions within an image may help to adapt the distortion caused by the watermarking embedding process and permits to take advantage of the reduced capability to detect such changes by the human eye. Please note that even though our proposal is based on HVS properties, its approach is substantially different. As will be shown later, to consider HVS properties within a traditional approach may result insufficient to provide a suitable watermark location that satisfies the issues raised in this proposal. Instead, a detailed analysis of the portrait image content is performed and the final watermark location must meet with several conditions to ensure their proper operation. Once the most suitable position has been found, the visible watermark is adjusted and then embedded in the original image by creating a contrast effect with its background. Since there is no formally defined process in the literature to determine the presence of a visible