

Modular Digital Watermarking and Corresponding Steganalysis of Images on Publicly Available Web Portals

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Keywords: Image Processing, Data Hiding, Digital Watermarking, Steganalysis, Security

Topic: Signal and Image Processing

1 Extended Abstract

The protection of images made available on public web portals on the Internet can be implemented only through technical mechanisms intrinsic to the images themselves. A Digital Watermarking service can be used in an automated way to provide such a mechanism without human involvement beyond the initial setup of the service and its integration with the web portal software. Images are published only after they pass through the service which supplies them with a proper signature identifying the copyright holder and the terms of use. A complementary steganalysis service identifies the presence of the digital watermarking data and, depending on its usage, retrieves the embedded copyright information. One possible usage of the steganalysis service is to scan portals of interest based on the clients' profiles to identify any images containing digital watermarking data. The scan takes into consideration the specific modular digital watermarking method used by a client of the digital watermarking service and may use correlation-based methods to identify copyrighted images used by competitors. The service then notifies the copyright holder. An alternative use of the steganalysis service is to provide an answer to the needs of creative professions for qualitative images, e.g. for web design purposes, product marketing, presentations, user-interfaces, etc. A professional interested in the fair use of an image can pass it to the service to get information about the terms of use. The major advantage in both use cases is the integral connection between the digital watermarking data and the image which prevents their separation, i.e. the data describing the image remains with the image throughout its use on the Internet. The modularity of the digital watermarking methods allows flexibility and tweaks the use of digital watermarking according to the specific needs of the client.

Fig. 1 illustrates the principal integration of the digital watermarking service with the web portal server software. The details depend on the specific software technology, p. 1, 2011.

gy used by the web server, e.g. PHP, ASP.NET, Java, etc. After an employee uploads an image, the web portal server automatically forwards it to the digital watermarking service which marks it with the respective copyright information associated with the profile of the web portal server. The service then passes the image back to the web portal server, which makes it available to end users together with the other content.

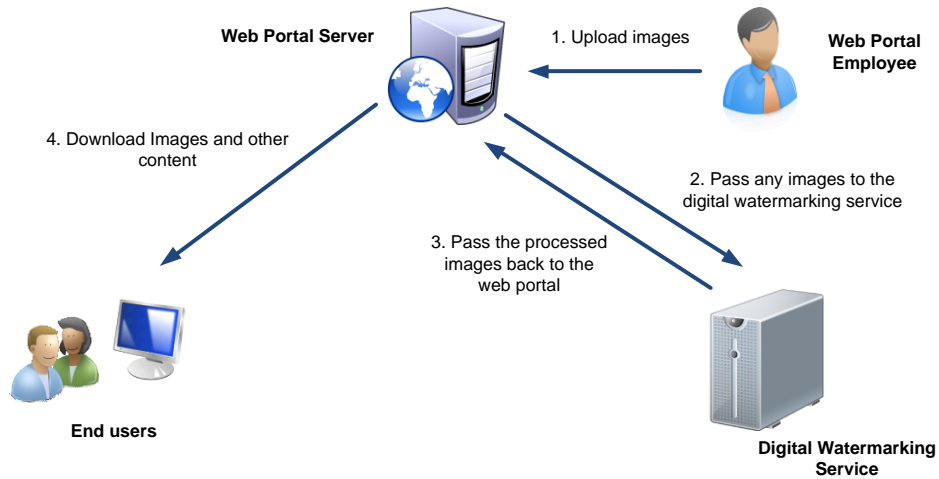


Fig. 1. Automated Digital Watermarking Workflow

The digital watermarking service has a profile for each web portal server, which contains the desired copyright and licensing models for different classes of images. The profile also defines the desired level of protection for each image class. This level of protection is interpreted by the service which uses it to select a combination of digital watermarking modules which are then assembled into a customized digital watermarking method. The end goal is to provide a different digital watermarking method for each image class with the best possible characteristics for the needs of the web portal.

Other important data associated with the individual web portals includes the priority of image processing and the charging model – by number of processed images, by flat-rate subscription or a combination of both.

One specific innovation in this service is the modular structure of the digital watermarking methods. A digital watermarking method consists of modules which can be combined on two levels to form the complete method. For any class of applications, specific modules are created which can be reused later in combinations chosen by the digital watermarking service. This flexibility in the provision of digital watermarking protection is difficult to achieve with classic digital watermarking.

The complementary steganalysis service processes images on the web with the purpose of finding out and extracting digital watermarking data. We will focus on the use case of image producers that seek to maximize the popularity of their images for

non-commercial use and minimize the commercial use without paid commercial license. Examples are photographers, artists (incl. computer-generated art). Digital watermarking is ideal for this purpose because it does not impede the distribution of images but instead it provides means for tracking and identification which serves both the copyright holder and any potential users.

Fig. 2 shows the workflow of the general use case outlined above. Before publishing the image, the copyright holder passes it to the digital watermarking service which embeds the licensing information. Then, the image is made available on the Internet free of charge for non-commercial distribution. A commercial user downloads the image and decides to use it for business purposes. The embedded license provides the necessary details for the payment.

The payment process is automated so that when the commercial user is registered with the steganalysis service, the image analysis and the money flow are handled in an automated way saving time for both the copyright holder and the business user. The copyright holder receives the payment through the steganalysis service in a previously arranged manner.

The innovation in this case is the use of the digital watermarking and steganalysis services as escrow and gatekeeper services which automate the workflow concerning commercial use of already published images. They also gather statistics about the most popular images of each copyright holder and give expert recommendations on price and marketing venues depending on the profiles of commercial users that have shown interest in the images.

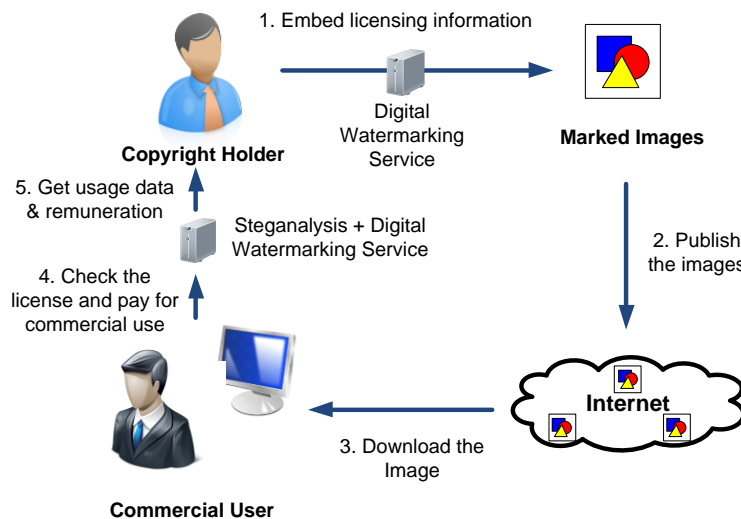


Fig. 2. Digital Watermarking and Steganalysis

When applied on a large scale – with many customers and images - both services can be employed as business intelligence instruments to conduct large-scale analysis of image preferences, image uses and copyright violations.

In conclusion, the modular digital watermarking service coupled with steganalysis, has the potential of alleviating an important problem on the Internet for most of the creative professions: how to gain popularity and distribute the works in a way so that they reach a maximum number of viewers while at the same time preserving the right to obtain license fees for any commercial use. Classic security technologies are not a suitable mechanism because they impede the process of popularization and distribution. Digital watermarking, on the other hand, allows unhindered distribution and it can still provide a degree of control over the images. The modularity and the service orientation of our own methods make possible the automation of these processes for a wide selection of different clients.