

Identification of digital images with the Adobe™ eXtensible Metadata Platform

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Abstract

Metadata is data about data that describes the content or characteristics of a file. With Adobe's XMP (eXtensible Metadata Platform) system application, information about an image is captured automatically during the content-creation process. Critical information such as titles, keywords, shutter speed, ISOs, camera model, date, author, copyright information, and so on can be easily retrieved and understood by users. The system utilizes XML (eXtensible Markup Language) which has options for web compatibility and standardization. XMP metadata can also be edited and updated in real time during the workflow. In this research, we verify the extensibility of XMP and its ability to keep track of images. This facility provides the possibility for web applications to protect content creators' rights and also to provide image content information to related industrial fields. As an open-source web-based technology, it is freely available to users; therefore, it can be an attractive solution enabler.

Introduction

Metadata is stored whenever a digital camera captures an image, and this conveys valuable content unless it is deleted. But current metadata systems are not inter-compatible. Users are also slow to recognize or utilize image metadata. This leads to misuse in using and sharing images from websites without copyright or license. In particular, images from news media are frequently manipulated and forged in a way that can distort the facts of current affairs. In this research, we focus on whether metadata can track information, modifications, and copyright data of images and web-based content. Once metadata is exposed to users and makes veracity and copyright status easily accessible, users will be better able to trust media images delivered through the web. Therefore, to prove and confirm copyright and any modifications in terms of forgery and manipulation, we set out to test the hypothesis that the history recording option in Adobe XMP can detect changes, usages, storages location, forgeries and manipulations. Proof of this hypothesis will demonstrate that we can verify primary copyright and track changed history in the original image.

Metadata in Digital Photography

As mentioned above, an image taken by a digital camera generates metadata automatically. IPTC (International Press Telecom Communication Council) guarantees the copyright of photo journalists and asks them to use accurate metadata. Also, most digital cameras manufactured in Japan contain EXIF (Exchangeable Image File Format) metadata since JEITA (Japan Electronics and Information Technology Industries Association) established the rule in 1995. EXIF metadata contains information such as exposure mode, focal length, lens, aperture, flash, metering

mode, white balance, date created, date file modified, file size, resolution, color mode, copyright, and more. With this information, EXIF metadata summarizes the image contents in a way that allows easy file management in text format. In spite of its convenience in accessing the information, EXIF has various schemas and different formats to standardize them within its current system. Moreover, for the digital imaging area, there are only a few metadata systems.

Adobe™ XMP (eXtensible Metadata Platform)

Since 2001, Adobe has used an XMP system for images that are mostly used within Adobe's publication, design, new media, and photography applications, such as Acrobat, InDesign, Illustrator, InCopy, GoLive and FrameMaker. The XMP is readable, therefore providing easy access to effective searching and location of information. Adobe's XMP is based on the, XML (eXtensible Markup Language) standard of web language, and the indispensable EXIF data adopted by IPTC. From the time of its generation within a digital system, the history of image modification can be recorded and the originality of copyright can be guaranteed in the XMP history section (Note that this is available in versions of Adobe Photoshop above CS2 by setting the options: edit > preferences > general > history log > both > detailed). There are also fields for photographer's information, information about who has modified images, copyrights, categories for additional section information, Adobe Stock photo information, and so on. Therefore, the source image's XMP is useful to confirm and verify EXIF data, copyright, and modification history. XMP is an open-source system and freely available to image users, providing a practical web application and guaranteeing the user's copyright.

Proposed Approach

The purpose of this research is to present the practical application of Adobe's XMP when it is adopted for images which are saved and sent electronically. We therefore focus on XMP's history option in Photoshop, which can verify images' modifications and metadata information. We recognize that many images and other contents used on the web do not entail copyright considerations. However, we suggest that metadata should be easily accessible to the public user so that image use is clearly guaranteed to be copyright-free and legal.

Test procedure

In this research, we made an assumption that modifications of an original image may be verified through Adobe's XMP and history option, and we proved the process. See Figure 1. (Note that the option is available in Adobe Photoshop versions above CS2.



Figure 1. Test images, CRW_5066.jpg (left), sky.jpg (middle), and sky_1.jpg (right)

Set the option via: edit > preferences > general > history log > both > detailed).

(1) First, we modified the original image, 'CRW_5066.jpg' making it more contrasty and colorful. This work was done on the A computer. After changing the file name to 'sky.jpg', we uploaded it to the web.

(2) We then downloaded 'sky.jpg' file to the B computer, and then retouched and modified it. We renamed it as 'sky-1.jpg', and then uploaded it to the web.

(3) We downloaded 'sky-1.jpg' file to the A computer and reviewed metadata history to test its originality.

Our hypothesis suggests that when the original image, 'CRW_5066.jpg', on the A computer is renamed and changed to a more vivid image as 'sky-1.jpg', and is then uploaded to the web, even after many subsequent anonymous modifications we can still track the modifications and verify the identification of the original image's copyright through XMP history and EXIF metadata. Figure 1 shows sky.jpg in the middle and sky-1.jpg on the right. Although they have different names and configurations it is hard to recognize whether they are identical or not. Figure 2 shows how we can detect that the two images are identical. Even though the two file names are not identical, we can confirm document title, author, description, keywords, copyright status etc. from the

Description section of Photoshop File Information. The description metadata gives the name of image author as 'Hyung Ju Park' and the original file name is 'CRW_5066.jpg'. We can also examine the EXIF information in Figure 2. Camera data 1 shows the identical model, date, time, shutter speed, exposure program, F-stop, aperture, focal length etc. It shows furthermore that sky and sky-1.jpg files were taken by Canon EOS REBEL, T 13:50:48+9:00, June 24th 2007. Other data is also identical, and enables us to conclude that these two files are the same file. Moreover, once we compare their history of modification we can verify all image modifications and forgeries.

Figure 3 presents the history of the sky_1.jpg file. In the first box we can observe that the sky.jpg file was opened at 2008-04-07T15:40:49 because there was an action to download the sky.jpg file to a third party computer in C:\Documents and Settings\Guest\Download\sky.jpg. Also, we know the stored route. In the second, third and fourth boxes, we see critical modifications recorded, using the crop tool, free transform and adjusting the contrast. The sky_1.jpg file is now black and white and resembles infrared photography. Therefore, critical changes in its history may be understood through tracked modifications. Additionally, in the last box note an important factor of renaming. This tells us that the sky_1.jpg file is stored at 2008-04-07T15:43:57+9:00 in C:\Documents and Settings\Guest\Download folder. We can confirm the fact that the sky.jpg image has been modified to

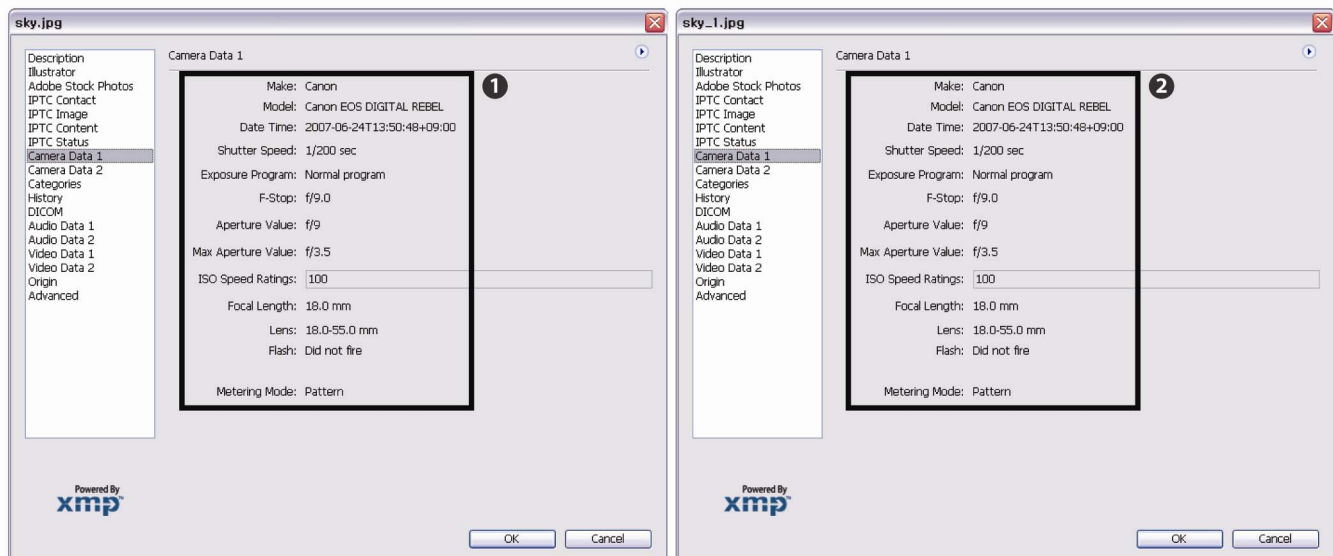


Figure 2. sky.jpg and sky_1.jpg file EXIF metadata in Photoshop File Info section

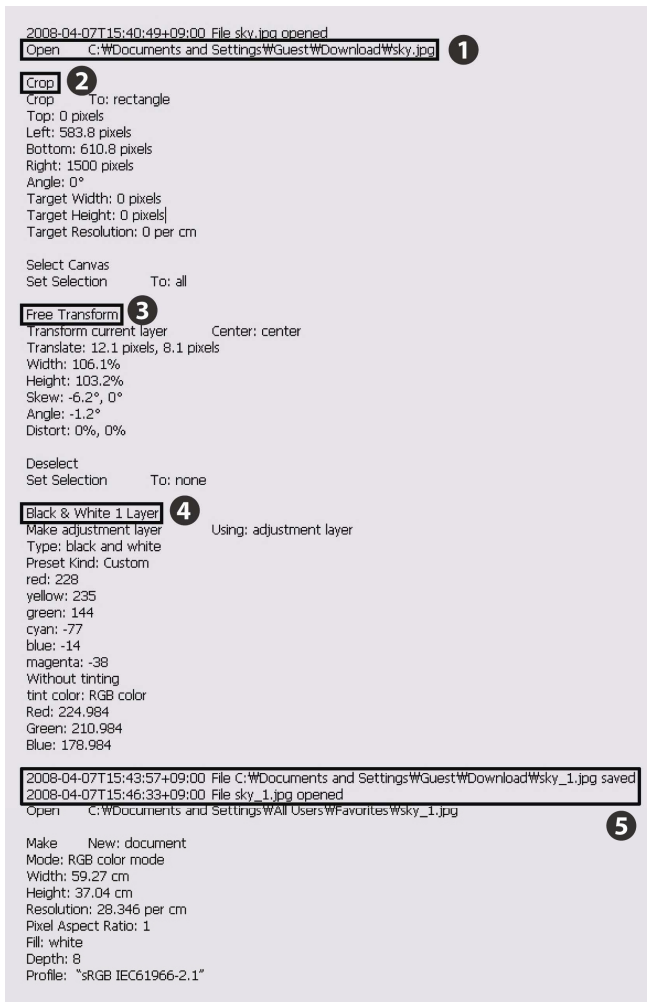


Figure 1. Sky_1.jpg history contents in Photoshop File Info

resemble an infrared photograph, before being saved with a different name, 'sky_1.jpg,' by another party. Moreover, through the history, we can clearly see the times when the image has been opened, saved routes and places, and other modifications in detail.

Conclusion

This research is based on the practical application of metadata for digital images without needing knowledge of any special systems or skills. Metadata in digital images enables the management and location of files and the maintenance of owned copyright. With this in mind, this study suggests an application of XMP through the web. Once an original image is uploaded to the web, it can easily be subject to illegal use or infringement of copyright. To prevent this abuse, we provide a framework, using XMP option (Photoshop CS2 version or above) via the setting: edit > preferences > general > history log > both > detailed. If the image containing its metadata is then transmitted on the web we can easily recognize its contact information, links, license usages, copyright notifications, modifications, image histories and EXIFs. We experiment with that one image by setting the XMP options in Photoshop and then moving it to several computers across the web,

and accessed by different users. The results prove effective in that the whole modified history and original ownership remains viewable. Based on W3C standards, the Adobe eXtensible Metadata Platform supports easy accessibility to image contents with readable text fields. As previously mentioned, many web images and contents are misused so that there are multiple violations of owners' rights and infringements of copyrights. Therefore, Adobe's XMP, which provides original copyright and image information like EXIF data, is a suitable web-based scheme to guarantee sharing of electronic information and protecting of copyright simultaneously.

Reviewing the Approach

Unlike some previous studies, this research does not deal with difficult programs, schemas and metadata structures, but rather presents an easy, accessible framework to support Digital Rights Management (DRM) and Digital Asset Management (DAM) for image users. Unique image identification can be assigned and recognized by metadata wherever the image goes. To establish better authenticity and transparency of web culture, image users should be more proactive with regard to metadata information. At this stage of development, Adobe's XMP will be an important alternative in the practical applications of metadata to digital imaging.

Reference

- [1] Brody, R. Information Ethics. IEEE Technology and Society Magazine.22, 34-39. (2003).
- [2] Catarc, I. The Life Cycle of Multimedia Metadata. (University of Rome. 2005).
- [3] Corcoran, P.M. Internet Connectivity solutions for digital photography. IEEE transactions on Consumers Electronics. 46.494-499. (2000)
- [4] Eismann, K., Real World Digital Photography. (Pearson Education, 2004)pg.58
- [5] Evening, Martin. Adobe Photoshop CS3 for Photographers. (Focal Press, 2007)pg.413
- [6] Fraser, Bruce, Camera Raw with Adobe Photoshop CS2. (Adobe Press, 2005)pg.68
- [7] Jacobson, E. R., Ray, F. S., Attridge, G. G., and Axford, R. N., The Manual of Photography 9th edition, (Focal Press, 2000)pg.214.
- [8] Liu, P. Metadata Standards for Web-Based Resources. Siemens Corporate Research.2.397-400. (2001).
- [9] R. Smith, J. Metadata Standards Roundup. IBM.13.84-88. (2006).
- [10] S. Lazinger, S. Digital Preservation and Metadata: History, Theory, Practice. Libraries Unlimited. (2001)

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Hyung Ju Park has been working as a chief researcher in the Digital Scientific Imaging Lab at Chung-Ang Univ. in South Korea since August, 2006, after finishing her master study at Brooks Institute of Photography (Santa Barbara, Ca, US). Her major areas include photography, digital imaging, image quality evaluation and analysis, standardization, and academic/ industrial cooperation with major companies.