

A Proposal about the Method of Image Obfuscation in the Sensitive Area through the Reflection of the Elements of Artistic Sensibility in Smart Devices

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Abstract. Obfuscation techniques such as blurring, pixelization, and low-resolution are being widely used for protection of images in the sensitive area that requires privacy protection. Most of these techniques focus on non-identifiability of the sensitive area. However, user sensibility, play and immersion act as important factors according to the features of the smart device. The phenomenon of image deformation, which suddenly occurs, can cause irritation to smart device users and exclude users from the related device. In this context, this study presented obfuscation for privacy protection, the reflection of artistic sensibility and formative beauty through an analysis on the expression methods of artworks.

Keywords: smart device, privacy protection, artistic sensibility and convergence

1 Introduction

According to the development of digital devices and the release of many different smart phones and wearable devices including smart glass, the issue of protecting personal information has emerged as a much more important topic. Many studies and social interests have been concentrated on the protection of the images, such as facial images, where privacy protection is required. However, changes in the life environment caused by the rapid development of digital media techniques and communication media have changed users emotional and sensual feelings. As a result, the study on human senses and sensibility has been carried out in earnest to satisfy user needs through the convergence of many different fields.

In this context, if the image currently playing on the screen is suddenly mosaicked or blurred at any moment for privacy protection, users can be irritated and have doubts about the use of the devices themselves. Accordingly, it is required to develop image obfuscation techniques which can minimize the infringement of user sensibility and simultaneously protect private life. For this, this study presents a visualization plan based on artistic sensibility. This is importantly connected to the immersion of smart device users where it is considered important to be emotional and sensual.

Moreover, it is expected that this study will be an important study in minimizing user stress and relieving user fatigue.

2 Image Obfuscation Techniques for Privacy Protection

The protection methods frequently used for privacy protection are as follows: first, the method of extracting the sensitive area within the image to 'blank' it out completely; second, the 'obfuscation technique' by applying many different algorithms which sense people's behaviors, but keep the detailed information within a sensitive area from being identified such as 'mosaicking', 'high compression', 'pixelization', 'blurring' and 'lossy compression'; third, the 'scrambling' technique, a method which completely removes even the image occasionally identified with the obfuscation technique; fourth, the method of abstraction; fifth, the 'encryption method' which keeps people who do not have a proper decryption key from seeing the encrypted interest area; and lastly, the 'multiple privacy level' which enables the control of many different privacy levels in relation to sensitive information within a single image stream through the provision of multiple privacy levels[1]. The existing compression techniques such as M-JPEG, M-JPEG 2000, MPEG-4 or AVC/H.264 are mainly used as these privacy protection techniques.

This study is limited to the visualization method of 'obfuscation techniques', the second method.

As explained previously, the emphasis is generally placed on the purposes such as livelihood security in the techniques set up to prevent privacy infringement. Accordingly, it should be considered that user sensibility is viewed as the most important area in the context of the entertainment industry along with the fact that smart devices perform specific purposes and functions. For this, the method through the convergence with artistic sensibility will be presented in Chapter 3.

3. Suggestion of the Visualization Plan through a Convergence of Artistic Sensibility

3.1 Reflection of artistic sensibility through an analysis on the expression methods of artworks

As user sensibility and immersion become important, the study on human sensibility and the five senses has actively been conducted in the technology area .

[Fig 1] shows Alvaro Cassinelli's Khronos Projector in the University of Tokyo, Japan. It is a research result about not only the technique introduced in Emerging Technology' of Siggraph in 2005 but also about media artwork [2].

The method of sensibility expression used in the work of Francis Bacon [Fig 2], a modernist artist, was analyzed and used as a concept of technology to develop emotional skills.

An isolated person's inward mentality and facial image, a symbol of self-reflection, are divided into several pieces. The expressions distorted to be presented, namely the methods of sensibility expression in the artwork which have already got public sympathy, were analyzed to be applied to technique development (development of flexible screens [2]).

The example in [Fig 2] shows the applicability to the method for image obfuscation to protect smart device-based privacy in the context that sensibility and techniques are converged to induce user satisfaction.

Figure 3 shows the example that 'blurring' explained in chapter 2 is applied among obfuscation techniques which focus on the non-identifiability of a sensitive area within the image.

The image contents in Figure 3 and Figure 4 are not identified and protected. The induction of the user's eyes, the harmony of colors and others are considered to be expressed through the screen density, gradient effects, emphasis and omission on the screen and others in Figure 4 in contrast with simple and boring expression in Figure 3.



Fig. 1. Alvaro Cassinelli's Khronos Projector, Siggraph Emerging Technology, 2005 [2]



Fig 2. Francis Bacon's Art Painting used as the Technical Concept of Sensibility Expression [2]



Fig. 3. Privacy Protection Technique using a Obfuscation Technique (Blurring),
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Fig. 4. An example of the Artwork which can be directed with Blurring Techniques, Paul Hellard's artwork, Siggraph 2011, © the Association for Computing Machinery, Inc. [5]

3.2 Image obfuscation through the reflection of the formative beauty on the screen

Figure 5 displays an example which the image in a sensitive area is kept from being identified through the 'pixelization' method to protect privacy. In comparison, Figure 6 shows the direction similar to pixelization in artwork. The formative beauty can be identified in Figure 6 as compared with the sensitive area which just focuses on the non-identifiability of the image in Figure 5. Also visual balance, the arrangement and the darkness of colors, the control of strength and others are considered to be directed on the full screen in Figure 6. Even though the contents of detailed images are not distinguished in both Figure 5 and Figure 6, the formative principles where people can have emotional satisfaction, seeing the artwork, are used to present beauty to viewers in contrast with Figure 5.



Fig. 5. Privacy Protection Technique using a obfuscation Technique (Pixelization) [2], © EMITALL Surveillance SA

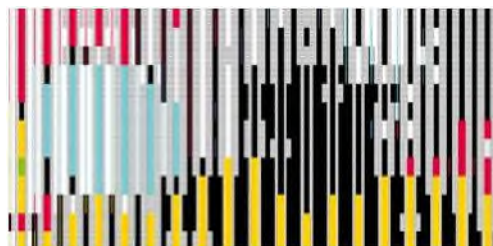


Fig. 6. An example of the Artwork which can be directed with Pixelization, © Rainer Kohlberger [6]

4 Conclusion

In many cases of the security area such as CCTV, the method which distorts images is largely used through obfuscation techniques such as mosaic, blurring, pixelization, low-resolution to protect individual privacy. However, in most of these techniques, the emphasis is placed on preventing people from identifying the sensitive area related to privacy. Therefore, user sensibility is not considered in the smart device where many factors such as the abundance of individual life, entertainment and user immersion are considered important. The blanking and the distortion phenomena phenomenon which suddenly appear can be problems. They can cause irritation to users and exclude them from the related device.

However, smart devices have rapidly increased day by day and various wearable smart devices including smart glass have currently been released one after another. Accordingly, the complementary problem of smart devices becomes an important issue.

Accordingly, this study was presented to resolve the sensitive area related to privacy through the convergence of artistic sensibility based on the user friendly sensibility features of the smart device as follows: analyze the expression methods used in the artworks which have already got public sympathy before and apply them to the 'obfuscation' technique; reflect the principles of directing the formative beauty on the screen to deform the image; and deform the image based on cognitive and visual-perceptual principles. In addition, this study examined the cases related to the development of screen techniques (artworks) which led to users' successful immersion through the convergence of artistic sensibility and investigated the reasonable possibility of the above proposal.

It is planned to intensify every element presented in this study and actually test them on smart devices in the future. It is considered that this study can contribute to not only the study on the methods of protecting privacy based on user-friendly features of smart devices but also the creation of other users' sensibility satisfaction with smart devices.

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