

Towards a Safe, Secure Society

The development of information technology has had a hugely beneficial impact on our lives. However, at the same time, problems and crimes which were heretofore unimaginable are now on the rise. We talked to NII researchers working on countermeasures employing a variety of approaches.

NII Interview

Preventing Surreptitious Filming in the Divide Between Digital and Physical

Digital Information Becomes Unprotected and Subject to Surreptitious Filming the Moment It Becomes Analog

Motomura Advances in information technology have given us instant access to all types of information. On the other hand, they have also resulted in a host of information security problems, such as the leakage of personal information and surreptitious filming. One approach to improving this situation has been the technology used in preventing surreptitious filming in cinemas, the product of your research. This was discussed in one of our articles, and I read it with great interest. The unfamiliar term “analog hole” came up many times. Could you explain exactly what that is?

Echizen That term was originally used in research regarding how to prevent the unauthorized copying of DVDs using DVD players. The video data on commercial DVDs is encrypted, and can only be played back using a DVD player with decryption functionality, but when that video is then sent out via a DVD player’s analog outputs, the protection offered by that encryption is eliminated, and copying is possible. This is a security flaw -- in other words, a hole -- and hence the term “analog hole”. In recent years, the resolution of mass market video cameras and camera phones has risen, so we are faced with a growing problem of unauthorized copying performed by surreptitiously filming the video shown on screens at cinemas. This is the new analog hole that I have focused on. According to the Japan and International Motion picture Copyright Association (JIMCA), the amount lost due to surreptitious filming in cinemas totals approximately 18 billion yen per year in Japan alone.

Motomura In other words, the nature of the analog hole has changed.

Echizen Exactly. Until now, mass market video camera and camera phone video quality was not so high, so people didn’t envision their use in this type of unauthorized copying.

Motomura The issue isn’t only movies, either. On video sharing sites, you can do searches on musicians’ names, and find concert footage that clearly wasn’t authorized. Once something gets onto the Internet, there is the risk that it will be spread uncontrollably. This is an example of the very modern issue of copyright infringement.

Echizen Not only that, but there are also personal information leakage cases like the recent one, in which a staff member at a medical institution used a digital camera to take a photo of a computer which was showing patients’ medical histories, and used the image

in a presentation outside the institution. Regardless of how strictly digital security management is implemented, once that digital information has been converted into visible, analogue form, surreptitious filming and photography are possible.

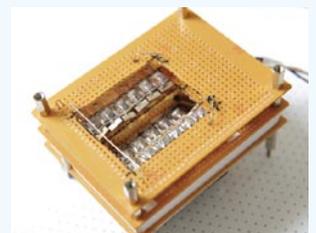
Motomura Are there any other researchers, besides yourself, working to resolve the problem of surreptitious filming?

Echizen There are people researching digital stage security measures, such as unauthorized copying prevention technologies for protecting digital content, focusing on “encryption technologies”, and technologies for the prevention of unauthorized information transmission. Hollywood is also using “digital watermarking technologies”, which embeds cinema ID information in digital content, which is difficult to see with the naked eye, but which can be used to determine, from surreptitiously filmed material, when the filming was done, and at which cinema. However, while digital watermarking technology has a psychological damping effect on surreptitious filming, it does not directly prevent surreptitious filming by recording devices. It also appears that creators, who also feel a strong attachment to their works, would rather avoid processing content itself.

Introducing Noise into Video Recorded by Digital Cameras Using Light Which Is Not Visible to the Naked Eye

Motomura You came up with the idea of using special devices using LEDs to interfere with surreptitious filming without actually modifying the digital content. Can you briefly explain the device?

Echizen Movie screens contain countless 1mm diameter holes to allow sound to pass through them. This device is installed behind the movie screen, and radiates near-infrared light with wavelengths near 870 nanometers, invisible to the human eye, through these holes. However, in order to maintain sensitivity, mass produced cameras are designed to be sensitive to the near-infrared spectrum as well, recording near-infrared light as color information such as red or green. When this video is played back, the near-infrared light



The surreptitious video filming prevention device developed by Associate Professor Echizen



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emitted by the LEDs appears as unpleasant flickering noise. Of course, there are no physical effects due to this light.

Motomura So this method of preventing surreptitious filming uses the high sensitivity of cameras against them. Was there a lot of trial and error involved?

Echizen We went through around 100 failures. We had also researched whether there were any audio noise sources we could use which people could not hear, but which would be picked up by camera microphones. As a result of trying a range of different approaches, we hit on the 870 nanometer near-infrared spectrum.

Motomura Looking at the actual device, it looks simple and analogue, something that one could easily make with parts found in Akihabara.

Echizen That's right. In fact, we did buy these parts in Akihabara (laughs). Before working at NII, I worked in a regular company for around 10 years, involved in research and development targeted at the user level. Because of this background, I believe that it is important, when developing new devices, to keep them simple, low cost, and easy to use.

Motomura The structure of the device is simple, but the idea of looking at analog holes that other researchers had overlooked, while appearing simple in retrospect, was actually a revolutionary idea. When will the device start seeing actual use in cinemas?

Echizen We're receiving offers from around the world. There are licensing issues to be handled, but I think we're very close to the actual field application stage.

Motomura But as soon as surreptitious filming prevention technologies such as this are developed, new technologies are created to circumvent them, starting a vicious circle.

Echizen Emitting infrared light from behind a screen to prevent surreptitious filming is fine, but what happens when someone develops a filter to block that light, right? Thinking about that led me to consider the fact that infrared light filters reflect that infrared light, and I developed a technology using an infrared camera installed on the screen side to detect, in real-time, the use of infrared blocking filters by people filming screens surreptitiously.

Motomura So when you see suspicious reflections from the audience, you would catch the person doing the filming?

Echizen Exactly. We've already created a prototype, winning the Best Demonstration Award at the 2010 IPSJ Computer Security Symposium, which is one of the famous national symposiums on information security.

Motomura That will be very exciting, having the technology you developed used in theaters around the world. Do you see any other applications for it?

Echizen Yes, displays. As with the case of the medical institution I mentioned before, in the future the protection of not only entertainment but also personal information

and confidential information stored on computers will also be critical. I would like to develop technology which would render photographs of display contents illegible by introducing noise.

Arriving at an Age Where We Rethink the "Hide Everything or Show Everything" Approach to Information Security

Motomura Listening to you, the topic of "WikiLeaks(*)", which has the world abuzz, came to mind. Even when confidential information is being strictly managed by organizations, people with access to that information are contacting the WikiLeaks people and providing them with information in the name of "righteousness". That must include interaction in the physical world of communication between people.

Echizen This kind of contact, including the buying of secrets, will never disappear.

Motomura It also shows the limitless amounts of "confidential information" in this world. Isn't there a need to determine whether all of this information really needs to be protected?

Echizen Yes. Until now, information security has focused on the information being handled, and decided whether either that information had to be steadfastly protected, or left unprotected. A binary decision. The stance was that if even part of the information contained elements that needed to be kept confidential, all of the information would be restricted from viewing.

Motomura When thinking about information security, some people take the position of just hiding everything, right?

Echizen But that also results in less communication, which might result in a less interesting world. Instead, I think there is a need for services which offer flexibility, revealing some information on a case-by-case and person-by-person basis.

Motomura Last, a basic question: in the end, what is "human friendly information security"? What types of initiatives should be taken?

Echizen There is, of course, a need for researchers to develop new technologies, but there is also a need for awareness raising and education that "surreptitious filming is a crime". In 2007, a law was passed regarding filming in cinemas, and I've heard reports that this has resulted in a decrease in surreptitious filming. I believe that it is important to thoroughly review the three pillars that support the creation of an information society in which we can live comfortably: "technology", "morals", and "systems".

*WikiLeaks: Global whistleblower site that publishes confidential information from governments, companies, and research organizations.



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Comment from the Interviewer

An accepted theory of failure theory is that "failures occur where technologies meet other technologies". The same goes for the analog hole. One can't help but laughing to think that there are "holes" in the digital society that people created, and it is people that are digging those holes, and filling those holes. Professor Echizen's "ultra-analog", homemade-looking surreptitious filming prevention device fills one of those holes. I felt his conviction as a researcher when he said that if we strengthen security too much, communication between people will vanish, resulting in a less interesting society.