

# Product Line-up for Face Recognition Solutions and its Social Applications

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## Abstract

Face recognition is one of biometric authentication technologies that can capture probe images without being noticed by targeted persons. As a result, it is expected to have a wider range of applications than other authentication technologies. This paper introduces NEC's product line-up, featuring its high-performance face recognition technology together with its social applications. Also discussed are revisiting KIOSK systems in the Tachibana-dai Hospital, the criminal identification system of the Chicago Police Department and the Save the Memory Project, one of projects for supporting recoveries from the 2011 Great East Japan Earthquake, conducted by Ricoh Company, Ltd.

## Keywords



biometric authentication, face recognition, face identification, entry/exit system, 2011 Great East Japan Earthquake, criminal investigation, surveillance system.

## 1. Introduction

In present societies, the authentication technologies of personal identities are indispensable, which are used in the various scenarios of our everyday lives. Their importance has significantly increased since the 9/11 attacks occurred in the United States. However, proof of personal identities obtained by presenting I.D. cards or by inputting IDs and/or passwords cannot solve the fundamental issues of preventing leaks, falsifications or impersonations. Such issues have focused market attention on authentication technologies based on individual biometric information and their applications have been penetrating the domain of ePassports and immigration controls at an accelerated rate.

Biometric authentication technologies are based on various personal characteristics such as fingerprints, irises, veins and faces. Among these, recognition based on the faces is the most similar means to the one that human beings use to communicate with each other every day. The face recognition technology can therefore be applied for various purposes other than for security. It can use facial images obtained by using general-purpose cameras, which offers a great advantage compared to other biometric authentication technologies. The others

often require users to learn how to operate unfamiliar devices such as specialized fingerprint sensors, etc. Another advantage of face recognition technology is that users do not have to take any extra action for it.

NEC began research and development of the face recognition technology in 1989 and marketed the first face recognition system in 1999. Since then, NEC has extended it to a wide range of solutions. The recognition accuracy has been continually improved so that NEC face recognition technology has been ranked the first since 2010, in the Multiple Biometric Evaluation and the Face Recognition Vendor Test (FRVT) held by the U.S. National Institute of Standards and Technologies (NIST), benchmark tests in which several leading vendors all over the world also participated.

In this paper, the authors introduce NEC's face recognition product line-up as well as a couple of solutions that have been provided for customers and details of their achievements.

## 2. Face Recognition Product Lineup

NEC provides the face detection/matching software development kit, named NeoFace as the core product to support application development for face recognition products. This

paper explains three kinds of its product line-up. For other ones, please refer to the NEC face recognition webpage whose URL is shown at the end of this paper.

### 2.1 NeoFace – Face Recognition Software Development Kit

NeoFace is the software development kit for embedding NEC's originally researched high-accurate face detection/matching algorithms into various applications. The SDK provides the library required for development and the runtime library for execution of the applications. It supports PCs or servers running Windows or Linux as well as the mobile devices running Android or iOS.

NeoFace provides two basic kinds of processing functions: one is face detection that finds faces in images and the other is face matching that calculates how much the detected face resembles faces enrolled in advance. Various face recognition solutions can be implemented by employing them as appropriate respectively.

### 2.2 NeoFace Monitor – Authenticates a User's Face during Manipulation of the Terminal

When a user manipulates a terminal such as PC or tablet, the user naturally positions his or her face frontal onto the display, which means that the terminal installing a camera makes it possible to capture and match the user's face without being noticed by the user. This novel idea will provide new applications that cannot be implemented with either IC card or password systems, not even with any other biometric authentication technologies.

With NeoFace Monitor, the user logon can be done just after authentication simply by sitting in front of the terminal with the camera, and any other special operations are not required. NeoFace Monitor performs face recognition of the user continually through the user manipulates the terminal. Hence, it can ensure that the person manipulating the terminal is a genuine user and will lock the terminal automatically when the user leaves the keyboard (Fig. 1). If an unauthorized person is detected by NeoFace Monitor, the terminal can be locked in order to avoid the possible attacks that the displayed information might be viewed over the genuine user's shoulder.

NeoFace Monitor can be used in standalone mode as well as be linked with Active Directory in order to adopt an optimum configuration of the system (Fig. 2). Since most PCs and tablets already incorporate a camera, no additional expense is imposed nowadays.

### 2.3 KAOATO – Entry/Exit Management and Crime Prevention

KAOATO (face trait in Japanese) can link the face recognition technology with ID cards for the entry/exit gates and

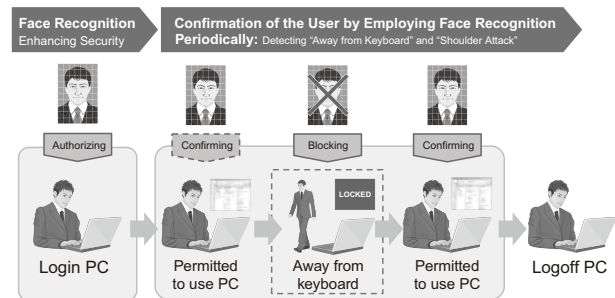


Fig. 1 Sample use scenario of NeoFace Monitor.

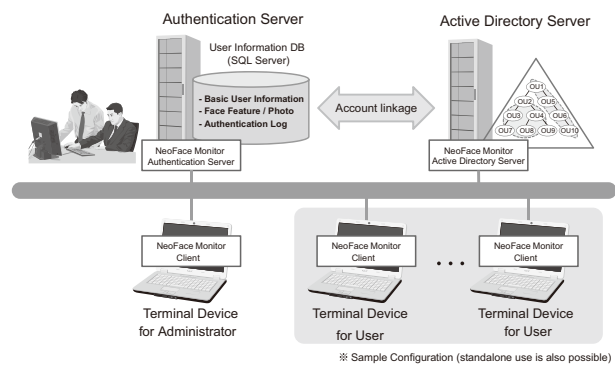


Fig. 2 System configuration example of NeoFace Monitor.

doors. Even if the improper use of a lost or stolen ID card is attempted, it can be prevented by face recognition just as merely passing in front of a camera, and system security can be improved without additional user's burden. KAOATO also records the face images onto its log file so that the system manager can check them easily by visual inspection. IC cards such as FeliCa can be employed by KAOATO. Moreover, color barcode technology, named chameleon code originally developed by a Japanese venture company, can also be used, which doesn't need a card reader and can share the camera to capture faces and color barcodes simultaneously.

KAOATO can also provide new types of services in areas where people go by, or at store fronts, e.g., by detecting registered persons passing in front of the cameras. If the faces of VIP customers are registered in advance, the store can notice them immediately when they come, and then offer special services customized for them. It is also possible to prevent potential threats by registering suspicious persons. KAOATO can send such information to the sales clerks and security staff soon and then they can choose their appropriate actions.

### 3. Case Studies of NeoFace Applications

#### 3.1 Revisiting KIOSK Systems in Tachibana-dai Hospital

The Tachibana-dai Hospital is an acute hospital located in Yokohama, Japan, that copes with emergencies. It offers 24-hour, 365-day medical emergency service, community-based nursing, specialized treatment with family hospitality. The hospital has recently noticed importance of outpatient care and patient services and they were categorized into topics requiring urgent resolution. As a result it acknowledged enhancement of the patient revisiting reception system.

With the previous revisiting KIOSK system, outpatients had to insert their patient registration cards into it. However, this kind of action was time- and labor-consuming to them and it often caused long waiting queues. In order to resolve this issue, the hospital adopted the face recognition technology. As the face recognition technology is user-friendly, so the hospital considered the patients can accept more readily than other methods including biometric recognition modalities such as fingerprints and veins. Finally, the hospital decided to introduce the revisiting KIOSK system developed by GoodFellows, Inc, incorporating NeoFace with high speed comparison and low error rate features (**Photo 1**). The system began to service since August 2013 and has been operating smoothly since then.

#### 3.2 The Criminal Identification System of the Chicago Police Department

The Chicago Police Department in U.S. has built a system for searching the face images among former criminal database, by employing NeoFace. This system is really large-scale and four million and fifty hundred thousand criminals are registered in it.

On 28th, January 2013, one of surveillance cameras of the Chicago Transit Authority captured a face image of a suspect who had robbed a cellphone with a gun and then ran off. The Chicago PD attempted to match this face image in their database, and the system output the person who was the actual



Photo 2 Registered face image of a burglar (left) and an image shot by a surveillance camera (right).

perpetrator at the top of the search results (**Photo 2**). Later, the suspect identified by NeoFace was arrested based on investigations that included confirmation by eyewitness and the collection of evidence and he was sentenced by the local court to a prison term in May 2014.

As shown above, NEC product, NeoFace is proving its high performance in searching from actual databases composed of millions of faces as well as in benchmark tests.

#### 3.3 "Save the Memory" Project

The Great East Japan Earthquake of 11th, March 2011 brought serious destruction to large area of Japan. Many people died, and other survived people lost their family members and friends as well as their possessions. In this situation, Ricoh Company, Ltd. started the "Save the Memory" project as one of its post-disaster reconstruction operations.

This project consists of activities such as collecting and cleansing the photos found in the quake- and tsunami-hit areas by local government staff and many volunteers and then delivering them to their original owners.

However, it is very time consuming to check visually every 400,000 photos that were collected from the debris of the quake-/tsunami-hit areas. In order to reduce such heavy burden, people's images are taken who visited project sites in order to look for photos that may record figures of their families and friends, and then NeoFace searches any photos including them in the 400,000 photo database. After employing Neoface, this project became to find targeted photos more effectively. Consequently, more visitors enabled to bring photos of their families, friends, etc. back home with recovered memories.



Photo 1 Outpatient revisiting system installed at the Tachibana-dai Hospital.

### 4. Conclusion

The NeoFace product lineup is designed, implemented and provided for users to make an effective use of NEC high per-

formance face recognition technology for a variety of innovative solutions in real scenes.

Through our world leading biometric technologies, such as NeoFace and its product lineup, NEC contributes, and will do to realize secure, safe and fair societies all over the world.

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The details about this paper can be seen at the following.

[Related URL:](#)

[http://www.nec.com/en/global/solutions/security/technologies/face\\_recognition.html](http://www.nec.com/en/global/solutions/security/technologies/face_recognition.html)

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**Vol.9 No.1**  
**January, 2015**

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