

Image Recognition and Facial Authentication Solutions as Measures for COVID-19



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1. Introduction

Since the expansion of the COVID-19 pandemic, there are fewer opportunities for human contact, and we have needed to adapt to new types of lifestyle. In many fields, this is resulting in accelerating use of machines to automate work that was formerly done by people.

The camera modules found in smartphones and other devices have become both generic and inexpensive, and performance has leapt forward in recent years. With a single smartphone, the camera and communication modules can be used easily, together with image recognition technologies on the cloud. As such, image recognition technology has reached a stage where it can be used practically as a technical element in replacing human work with machinery.

In March, 2020, NTT DOCOMO also began provision of our 5th generation mobile communications system (5G), which features high speed and capacity, low delay, and massive connectivity. 5G will enable video transmission with higher capacity than ever before, so solutions combining 5G communication and image recognition technology are expected to appear.

This article introduces NTT DOCOMO’s image recognition platform, the “EasyPass powered by SAFR” face-recognition solution and the “AI Temperature Measurement Solution,” as a potentially effective measures against infectious disease.

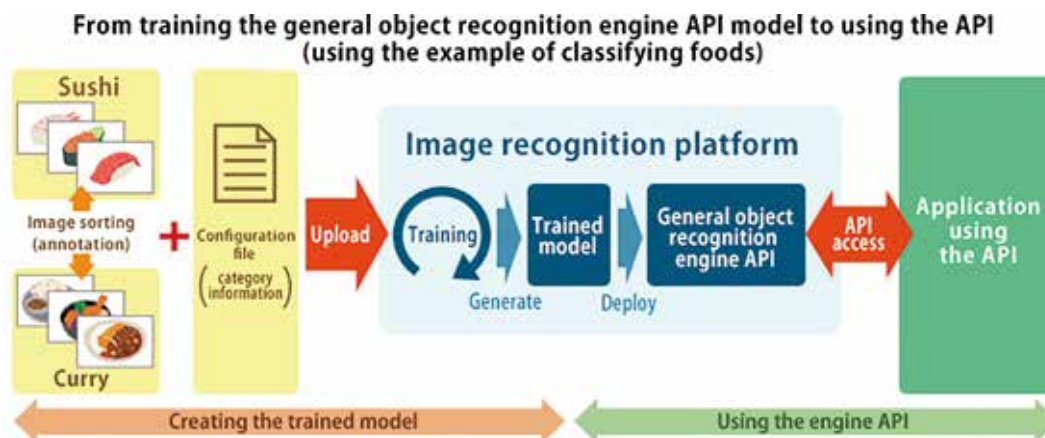
2. NTT DOCOMO Image Recognition Platform

In May, 2020, NTT DOCOMO began providing our “NTT DOCOMO Image Recognition Platform”^[1]. This platform is a cloud service that makes it easy to use our image recognition AI.

Previously, application of image recognition AI solutions required much work and specialized technology, including annotation work creating the data used to train the image recognition AI, generating the trained model, and building the image recognition engine. The NTT DOCOMO Image Recognition Platform automates these processes, from creating the training model to building the image recognition engine, so lead time for introducing solutions can be reduced significantly. Developers can focus their efforts on developing the application or system that will use the image recognition AI, rather than on the image recognition AI component (Figure 1).

One example using the NTT DOCOMO image recognition technology was to automate inspection of mobile phone base stations for rust using aerial images taken by drones. NTT DOCOMO has mobile base stations in approximately 50,000 locations and the work of inspecting them is time consuming and dangerous. Automation of inspection work contributes to improved work environments and reduced costs. An example of using the image recognition engine to detect rust areas is shown in Figure 2. The state of rusted areas can be checked from base-station images taken by the drones. As a result of this automation,

■ Figure 1: NTT DOCOMO image recognition platform overview



■ **Figure 2: Detection of rust**



the time required to inspect each base station can be reduced by approximately 100 minutes. The technology is to be used for inspecting base stations at approximately 1,500 locations, which should eliminate more than 2,000 hours of work^[2].

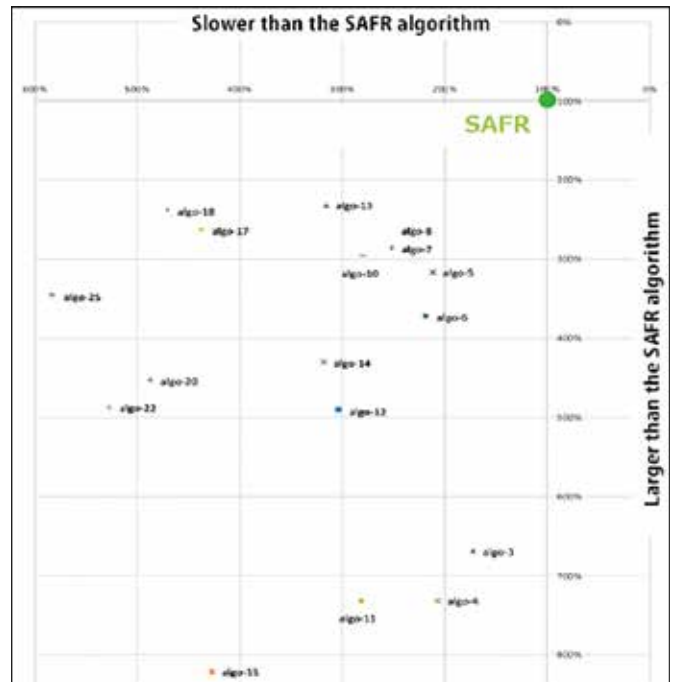
3. COVID-19 Solution using Face Authentication

3.1 The SAFR® Face Authentication Engine

The SAFR face authentication engine provided by Real Networks Inc. is image recognition software that authenticates users quickly and accurately using a face image. NTT DOCOMO has recognized the technical superiority of SAFR and its applicability in mobile solutions, and has used it as the facial recognition engine in various face authentication solutions. It has also obtained good results for recognition accuracy and speed in the Face Recognition Vendor Tests (FRVT) organized by the USA National Institute of Standards and Technology (NIST)^[3]. According to SAFR developer, Real Networks Inc., it was the fastest and most light-weight among algorithms achieving recognition accuracy of 96% or greater in FRVT 1:1 recognition tests conducted in FY2019^[4]. Compared with other highly accurate algorithms, SAFR was twice as fast as the average and 35% smaller than the next-smallest algorithm (Figure 3). Thus, SAFR achieves a good balance in the tradeoff between recognition accuracy and computational cost, and does not require expensive computation devices, so it is very practical. In the FRVT Wild category, which focuses on recognition of subjects that are unaware of the camera including profile images, SAFR was shown to be extremely fast and accurate as an algorithm for recognizing images in live video. In addition to being highly evaluated in the FRVT Wild category, SAFR also has development environments for smartphones, including iOS and Android SDKs, so it is very attractive for NTT DOCOMO's solutions business and we are introducing it into various solutions.

With the spread of the COVID-19 pandemic, SAFR also

■ **Figure 3: Comparison of recognition speed and algorithm size**



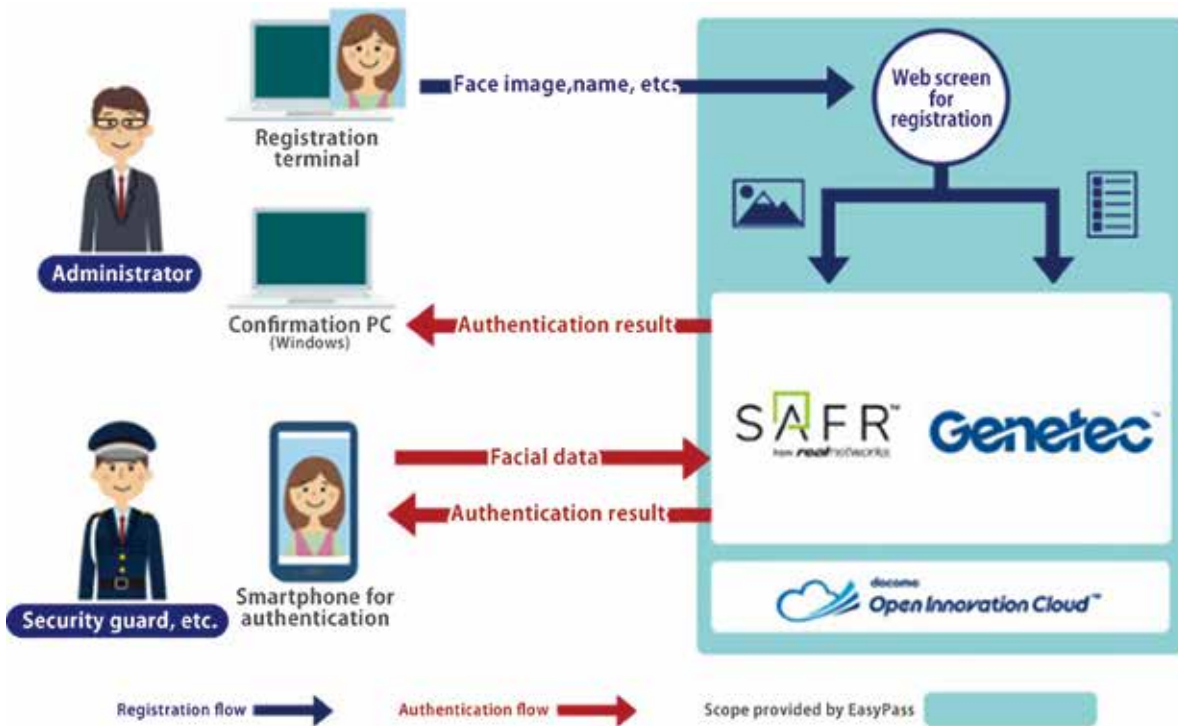
added support for recognition of users while wearing masks in April 2020^[5]. To recognize faces obscured by masks or other objects, the AI recognizes the parts of the face that are not obscured. The ability to perform authentication without requiring masks to be removed is extremely useful under conditions of the COVID-19 pandemic. According to Real Networks internal testing, SAFR achieved 98.85% accuracy recognizing subjects wearing masks in the Wild category.

Figure 4 shows a case of face authentication while wearing a mask.

■ **Figure 4: Facial authentication while wearing a mask**



■ Figure 5: EasyPass overview



3.2 EasyPass powered by SAFR

In May, 2020, NTT DOCOMO began providing the “EasyPass powered by SAFR” service (“EasyPass”)^[6]. An overview of EasyPass is shown in Figure 5.

The EasyPass solution achieves access control with simple, fast and highly accurate face recognition by simply installing the EasyPass application on a smartphone. It is expected to be used by providing security personnel with a smartphone, which will be used to check those entering and leaving a facility by simply having them face the smartphone camera.

EasyPass is both convenient and extensible through integration of SAFR face authentication with Genetec® Security Center Synergis™, which is a Video Management System (VMS). It can be implemented with smartphones and mobile networks, so it requires no installation of cameras or communication lines or other construction, minimizing preparation time required to introduce the system. It also has various operational benefits from using smartphone devices, such as the ease of replacing any faulty devices.

In one company that has introduced EasyPass, security staff at entrances previously checked photo IDs of those entering and leaving, which resulted in line-ups and congestion at the beginning and end of the workday. These conditions also created security risks such as potential for impersonation or error by security staff. After EasyPass was introduced, security personnel only had to visually check the authentication result on the

application, reducing the time required to less than one second (Figure 6).

EasyPass is extremely useful as a way to deal with COVID-19, for enterprises enforcing this sort of access control. Since EasyPass does not require removal of masks for authentication, it can reduce the risk for security personnel, of infection from those entering and leaving. According to analysis of COVID-19^[7], doubling

■ Figure 6: Authenticating a driver using EasyPass



■ Figure 7: Temperature measurement using Seek Thermal



the distance between people halves the risk of infection. With the earlier operating model, visual checks required distances of approximately 1 m, while this solution allows distances of 2 m, so we can say the solution reduces risk by half.

3.3 AI Temperature Measurement Solution

In November, 2020, NTT DOCOMO began providing our AI Temperature Measurement Solution^[8]. By integrating the SAFR face authentication engine, a temperature measurement device from SeekThermal Inc., and communication tools such as Microsoft Teams, it provides a solution that includes non-contact staff authentication and temperature measurements together with reporting and management. Although remote work is becoming widely established, it is still difficult to completely eliminate the need to visit company offices. Many companies are requiring temperature measurements of those visiting their offices, which is burdensome for both those coming to work and for administration.

For commercial facilities with many visitors, one COVID-19 counter measure is to screen visitors by taking their temperature when they enter. According to a September 2020 report from the USA Centers for Disease Control and Prevention, trial calculations indicate that approximately 40% of patients are asymptomatic, so taking temperatures when people arrive is not a perfect measure, but from a psychological perspective for those visiting a commercial facility, it does raise awareness that the facility is screening for people with a fever. This type of solution that takes consumer psychology into consideration is also necessary for enterprises as they continue economic activity in our new way of life.

Note that the temperature measuring device used for this solution is the Seek Scan from Seek Thermal Inc. It is used together with a black-body standard to calibrate the thermo-sensor, giving it excellent characteristics able to take temperatures with only 0.3 degrees of measurement error. A SeekScan screen is shown in Figure 7. The red square appearing in the thermal image on the right is the black-body standard, showing how the standard temperature is constantly being measured.

4. Conclusion

Technology has a large role in dealing with changes in our lifestyles due to the spread of the COVID-19 pandemic. Solutions using image recognition to check for the three C's (Closed spaces, Crowded places, and Close contact) or for masks can be expected to spread in the future. With demand to replace human work with machinery, image recognition AI is a technology element that is developing remarkably, replacing human eyes and brains, but a simple and user friendly framework is needed to apply these latest technology elements in solutions. NTT DOCOMO is providing frameworks on the cloud, such as the DOCOMO Image Recognition Platform and the SAFR face authentication engine, that enable these advanced processing technologies to be used easily from a smartphone or Web browser. We also have our 5G Open Partnership Program, which is a base for partner enterprises to collaborate with NTT DOCOMO, or with each other, to create valuable solutions. Combining these initiatives, NTT DOCOMO and these partner enterprises will create solutions for societal issues in the future.

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