Introduction of the GAZIRU Image Recognition Service

FUKUZAWA Shigekazu, AMANO Shinichi, YASUKAWA Takuji

Abstract

Based on research results of NEC, we are now providing the GAZIRU service. This is an image recognition service that operates on smartphones and comprehensively recognizes objects including three-dimensional objects that have conventionally been regarded as being difficult.

By using GAZIRU, companies will now be able to easily take advantage of image recognition technologies; thereby enabling their businesses to take advantage of the new services using image recognition. An overview of GAZIRU and examples of its service applications are described in this paper.

Keywords

image recognition, smartphone, cloud

1. Introduction

Having been proven in various competitions to represent a world beating technology, the image recognition technology of NEC has been applied practically for use in fingerprint identification and face recognition systems, including NeoFace, which is now widely marketed world wide. The GAZIRU service that is now offered does not use an image recognition technology that targets specific objects such as fingerprints and faces; rather, it uses an image recognition technology based on the results of NEC research that can recognize a comprehensive range of objects. The term "GAZIRU" is coined from a combination of two Japanese words - " *gazo* " meaning "image" and " *shiru* " signifying "recognize."

Although recognition using characters and barcodes are widely used nowadays, the quality of the design is compromised when barcodes and other coding marks are placed on target objects, especially those such as magazines and posters. The image recognition technology of GAZIRU features a compact image processing system that can operate even on smartphones as well as a high-speed computing algorithm performance. It provides various innovative services such as recognition services that do not require barcodes and it is used as a high-function smartphone application.

GAZIRU provides a platform from which to expand new businesses using image recognition technology via smartphones, and we are convinced that it can contribute to the creation of new markets. While introducing practical usage examples where the GAZIRU image recognition service creates new added value to existing businesses, the features of the image recognition engine are also described. To conclude the anticipated future progress of GAZIRU is also discussed.

2. Overview and Practical Usage Examples of GAZIRU

2.1 Overview of GAZIRU

GAZIRU offers image recognition that can identify images acquired by snapping a recognition target with a smartphone. A database called a "dictionary" is created in advance from suitable images of objects to be recognized, and the target object is then identified using this dictionary.

NEC has begun to offer this service as a platform for new businesses that utilize smartphones. This enables many companies to easily use image recognition so that they can expect that their businesses will be expanded by creating new services and providing added value to existing services. Some actual examples that are in use are discussed below.

2.2 Practical Usage Examples of GAZIRU

The examples of services that can be achieved by companies through the recognition of snapped objects by using GAZIRU are listed in the following.

(1) Service linked with print collaterals and other advertising media

After making advertising materials such as print collateral and TV spots of the products as recognition targets,

companies can distribute content linked to such materials and also provide consumers with advertising linkage applications that lead to web pages for purchasing the products. Advertising linkage services can then be accomplished without applying additional gimmicks for the existing media. Moreover, provision of a flexible service is possible when only general information is placed on print collateral, and the parts susceptible to changes are distributed online (**Fig. 1**).

(2) Usage for campaigns and events

When posters exhibited at particular places such as inside stores and movie theaters are snapped with a smartphone, premium content can be distributed using GAZIRU.

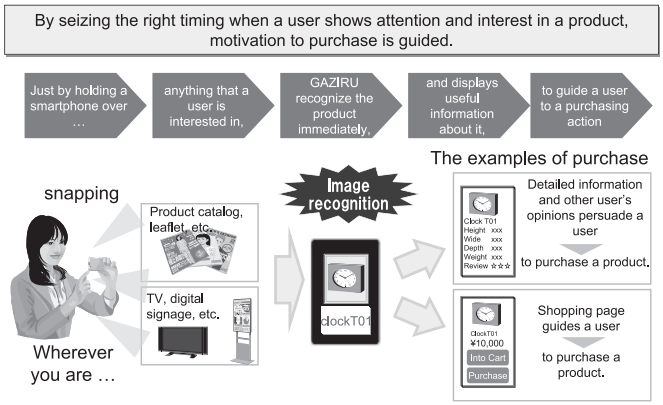

Fig. 1 Advertisement linkage service.

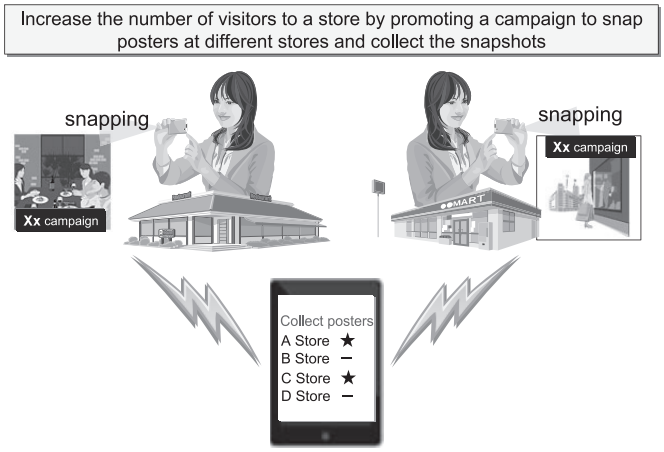

Fig. 2 Campaign example in which posters at different stores are snapped and collected.

When linked with a location information system such as a GPS, content that differs from location to location even with the same poster can also be distributed. This also enables assembling crowds of visitors in particular locations (**Fig. 2**).

Usage is also possible for entertainment events in which posters are snapped - events similar to the "stamp rally" that are popular activities in Japan can be advertised for different venues.

(3) Usage for electronic manuals

The use of GAZIRU also enables a company to provide an electronic manual application whose recognition targets are various parts of the company's product line. For example, when the user holds a smartphone over a product component that he or she doesn't know how to use, the relevant page and instruction movie can be displayed. This will make it unnecessary to look for the instructions of the part in question in the TOC (table of contents) or index of the manual, thereby contributing to an increase in user satisfaction and a decrease in otherwise unnecessary inquiries to the support staff (**Fig. 3**).

(4) Food assessment

In healthcare service where daily health management is essential for users, they sometimes have to register photos of food they have eaten as records of their meals. When these photos are used for the image recognition, the users can register the details of their meals without entering the names of the food, manage the calories as the information related to the food, and even receive suggestions for recommended recipes and groceries - all done simply by snapping the food (**Fig. 4**).

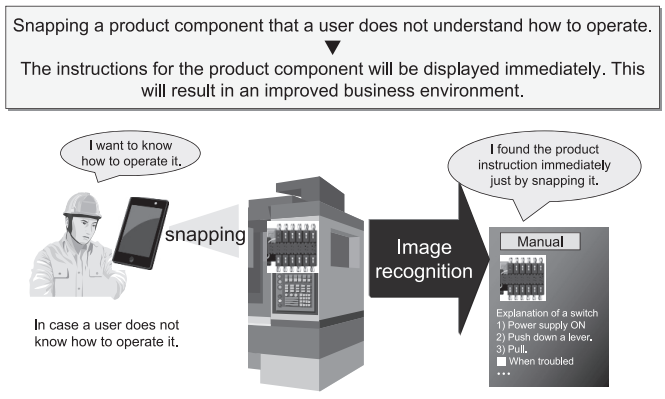

Fig. 3 Practical usage example of an electronic manual.

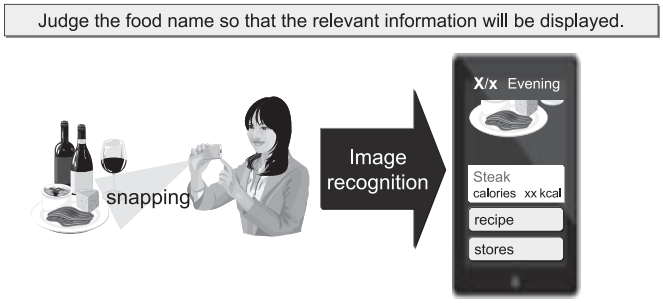

Fig. 4 Example when used in food assessment.

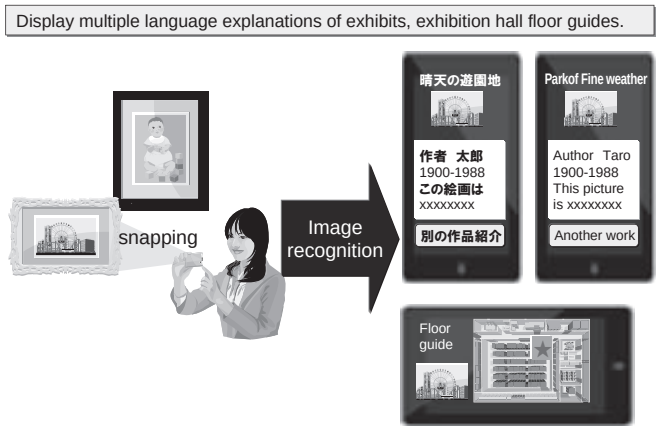

Fig. 5 Practical usage example in a museum.

(5) Use in museums

Curators of museums and exhibition demonstrators can use GAZIRU to provide visitors with applications explaining exhibited objects whose recognition targets are paintings, photographs and other artworks. When the visitor holds a smartphone over the exhibited object, he or she can confirm its detailed description. It is possible to provide various users with friendlier services by making the description available in multiple languages or providing audio guidance, for example. It can also be used to let users know where they are in the exhibit hall with floor maps, using the exhibited object in front of them as a reference point (**Fig. 5**).

3. Features of the Image Recognition Engines

GAZIRU offers multiple image recognition engines according to the targets to be recognized and the provided forms of the image recognition function. The engines are roughly divided into two types, depending on whether the target object is two or three-dimensional (**Table**).

Table Types of applicable image recognition engines.

Main recognition object	Two-dimensional objects Print media (newspapers, magazines, signboards) Two-dimensional objects (CDs, food packages) Screens (TV, digital signage)		Three-dimensional objects (automobiles, food, animals/plants)	
Recognition type	Comparison		Classification	
Recognition number (reference)	100 types	10,000 types*	100 types	1,000 types
Number of collected images	1 frame/type		Approx.100 frames/type	
System configuration	Device-oriented	Server-oriented	Device-oriented	Server-oriented
Applicable engine	GAZIRU-R		GAZIRU-X	GAZIRU-W
Intended smartphone	Android 2.3 or later/iOS4.3.3 or later			–

* Planned to be increased.

3.1 Recognition of Two-dimensional Objects (GAZIRU-R)

This image recognition type is mainly aimed at printed matter. Designed for two-dimensional objects having features (shapes and patterns), it can also recognize images displayed on TV screens in addition to printed matter. Even when the recognition target is snapped in a slanted (or rotated) condition or from some distance, the target can be reliably recognized. This image recognition verifies the snapshot image of the recognition target to find out whether or not there is a part that corresponds to the image registered in the dictionary in advance.

A key technical point of the image recognition is that it operates smoothly. The amount of data and computing is reduced from that of a conventional system thanks to the proprietary technology to achieve compactness of information on the characteristics obtained from the images of the recognition target so that less degradation of the recognition accuracy is acquired. This enables the user to perform real-time recognition of the targeted object simply by holding a smartphone over it.

The numbers of types of objects that can be recognized with the current practical level of smartphone operation are about 100 with the device-oriented type which installs the dictionary in the device and about 10,000 with the server-oriented type which installs the dictionary in the server. The number of recognitions of the server-oriented type is planned soon to be increased further.

This image recognition creates a dictionary using one image for one type of a recognition object. In order to allow client

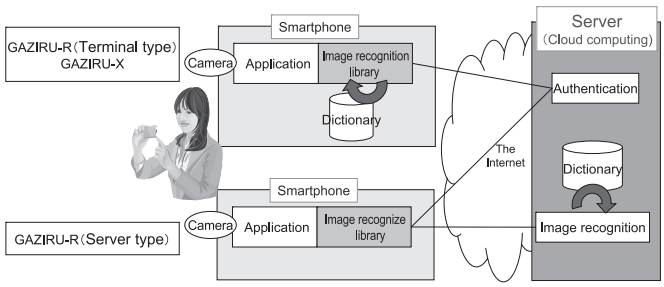

Fig. 6 Configuration of GAZIRU-R and GAZIRU-X.

companies to create their own dictionaries by themselves, a dictionary creation tool is also offered.

To use this service, the image recognition library for smartphones needs to be incorporated in the customer's application. Not only does it allow customers to develop a new service by using the image recognition function, but it also enables them to increase added value by using the image recognition for existing services and applications.

The confirmation of the contract condition for this library is executed at specified intervals. The library currently available is intended for Android and iOS (**Fig. 6**).

3.2 Recognition of Three-dimensional Objects (GAZIRU-X and GAZIRU-W)

With the current image recognition technology, image recognition of three-dimensional objects of a higher level of difficulty can be performed. There is some difference between GAZIRU-X, which performs recognition in real time on the device, and GAZIRU-W, which performs recognition on the server.

In the recognition of three-dimensional objects, classification is made by judging how much the characteristics of a recognition target resemble the type of each target defined in the dictionary. When a dictionary for three-dimensional objects is made, it is created from about 100 images per type. Client companies need to prepare suitable images, and NEC is then assigned to create the dictionary from those images.

(1) Device-oriented type (GAZIRU-X)

With the device-oriented type, identification of objects is mainly performed on those whose shapes do not vary much between individual examples, such as the names of cars and the components mounted on an apparatus. The volume of dictionaries and the size of logic used to judge the recognition objects are optimally minimized by the proprietary technology created to operate smoothly on the device. This allows the user to perform real-time recognition of the target objects while holding a smartphone over them. The number of types of recognizable objects with a smartphone may be up to about 100. The method of using this service is achieved by installing the library of image recognitions for smartphones in the customer's application. This library is designed to periodically confirm contract conditions. The currently available library is for Android and iOS.

(2) Server-oriented type (GAXIRU-W)

The server-oriented type can also be used for the recognition of objects whose appearances vary with individual objects, such as plants and food, in addition to those mentioned in item (1), and a large number of types of recognizable objects are available (1,000). The method for using this service is different from that of GAZIRU-R and GAZIRU-X; recognition results are obtained by transmitting image files to WEB-API on the internet.

4. Expected Future Progress of GAZIRU

In addition to the image recognition functionality for recognizing target objects that GAZIRU currently offers, NEC is planning to expand the available image recognition functions with a view to helping achieve new services that use images by taking advantage of other technological advances at our laboratories and by adopting the new technologies derived from ongoing and future programs. The feasible functions and examples of their expected effects are listed below.

- Search for similar products from numerous products by using the resemblance search function that searches for similar images
- Simultaneous recognition of multiple objects that is expected to reduce the number of management processes in operations where a large quantity of products are managed
- Usage for traceability management of shipped products as well as for identification of counterfeits by using the technology to identify minute and subtle differences

In addition to the expansion of the functions, we are planning to also make the image recognition service available for devices other than smartphones.

We intend also to contribute to the creation of high value additions to marketing and other "Big Data" businesses as well as to the creation of core competence by using image recogni-

tion to automatically add metadata to images and movies in a highly precise manner.

5. Conclusion

With the cooperation of our laboratories and affiliated companies, we have created a general-purpose image recognition service that has been conventionally regarded hitherto as being difficult to achieve. We have been able to do this by utilizing the world's highest performing image recognition technology.

By taking advantage of the GAZIRU image recognition service, users can quickly achieve their own new services at low cost. This enables acquisition of required information simply by snapping objects, the names of which are unknown.

At NEC, we are committed to continue our efforts to offer more products so that our image recognition technology may be utilized by more companies and services.

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*iOS is a trademark of Cisco Systems, Inc. in the U.S. and other countries and is used under license.

Reference

1) IMAI Y., et al., "NEC's Pursuit of Imaging and Recognition Technologies," NEC Technical Journal, Vol. 6, No. 3, 2011.9
http://www.nec.com/en/global/techrep/journal/g11/n03/pdf/110302.pdf

Authors' Profiles

FUKUZAWA Shigekazu
Manager
3rd Carrier Services Division
Carrier Services Operations Unit

AMANO Shinichi
Assistant Manager
3rd Carrier Services Division
Carrier Services Operations Unit

YASUKAWA Takuji
Project Manager
Ubiquitous Network Systems Division
NEC Soft, Ltd.

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