

Image Recognition as a Method for Opt-in and Applications for Mobile Marketing

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Abstract

We discuss image recognition as an opt-in method and as an enabler of applications for mobile marketing. Image recognition is an opt-in method available to consumers with camera phones. In this model, a consumer opts into a mobile promotion by taking a picture of an advertisement or object using their camera phone and sending it to a specified address. The receiving system automatically recognizes the image; once the image is recognized, the system enters the consumer into the promotion or contest and/or sends the consumer customized interactive content. The content may include a mobile web site, or a ring tone, a wall paper or a video download. We compare image recognition opt-in to other opt-in methods available to mobile marketers. Several vertical applications powered by image recognition are described. We present an overview of the technology used to enable the image recognition opt-in.

Keywords

Mobile marketing, camera phone, image matching, image recognition, opt-in marketing, content downloads.

1 Introduction

Mobile marketing campaigns frequently include opt-ins that provide consumers a way to express interest in a product or promotion. Opt-ins are implemented in a variety of ways, including SMS, IVR, and mobile web (Becker, 2006; Becker, 2007; Braiterman, et al, 2007; MMA Education Series, 2007). In this article, we discuss the image recognition opt-in method, a special opt-in method implemented using recognition of camera phone images.

In the image recognition opt-in method, a consumer expresses interest in a campaign by taking a picture of a specified object and sending it to a specified address. Depending on the specific campaign, the consumer may take a picture of a print advertisement, a banner, a poster, an outdoor billboard, or an in-store promotion, etc. The system that receives the image recognizes it and sends the consumer a response relevant to the query image.

We discuss many promising campaigns and applications that are possible using image recognition. These involve variations of the theme, where the target object in the picture varies by the application, and content, mobile website, or information is customized by the application.

A wide variety of campaigns can be designed using image recognition as an opt-in. Examples of these include the following (and others presented later in the article):

- A movie poster announcing a new movie release includes a call to action to send a picture of the poster to a specified address to receive ring tones, wall papers, trailers, show times, and reviews.
- A sports team banner announces an opt-in that allows consumer to receive sports scores, schedules, alerts, and information.
- A publication that uses a coordinated call to action that applies to all pages and advertisements included in it; the consumer can opt-in by taking a picture of any page in the publication and receive an offer customized by the advertiser.

A rich set of vertical applications can be designed using image recognition. Examples of these include the following (and others presented later in the article):

- A DVD info application that recognizes a picture of a DVD and presents consumers reviews, add-to-queue feature.
- A wine review application that recognizes a wine label sent by a consumer and responds with reviews and information on the wine.
- A book info application that recognizes a book cover and offers reviews, prices, and other information on the book.

We compare image recognition opt-ins to other common forms of opt-ins, discussing the trade offs and relative merits of each approach. Other form of opt-ins include SMS, IVR, Bluetooth, QR Codes, the # method, the ** method, mobile web, and posting the phone# into a website. The main advantages of image recognition as an opt-in are simplicity, versatility and the absence of codes.

We present an overview of the technology used to power image recognition opt-ins. Latest technology developments allow for support of large image databases in the backend and make new and exciting applications possible. It is now possible to enroll a large number of images in their original unaltered form into a database for recognition purposes. Image recognition opt-ins can be designed to take advantage of this. For example, a single call to action can apply to a large number of images such as all the pages in a given publication, or an entire series of publications, or a large set of products. The consumer may send a picture that matches any image in the database and receive information relevant to that specific image.

Recent market trends indicate a strong worldwide up-tick in penetration and usage of camera phones. Market data from 2006Q4 (Telephia, 2007) indicates that in the U.S. 50.67% of mobile phones users have cameras on them; the adoption rate is 66.75% among recent buyers. Among camera phone owners in the U.S., 51% have taken pictures using their mobile phones; 55% among recent buyers. Adoption of camera phones is higher than that of mobile web. It ranks third only to voice and SMS penetration.

Image recognition as an opt-in method is relatively new and this topic has not been discussed in prior academic literature (Barnes, S.J. et al, 2004; Guther, S. et al, 2003). Software vendors in the industry offer innovative end to end solutions in this space; among those are SnapTell and Microsoft Research (SnapTell, 2007; Microsoft Research, 2007).

2 Image recognition as an opt-in method

In this section, we discuss a variety of use cases for image recognition as an opt-in method in campaigns or in media. Some of these types of campaigns have been deployed in the past, and some are new possibilities. Figure 1 presents a pictorial overview of the usage flow involved in an image-recognition opt-in.



Figure 1. Usage flow in image recognition opt-ins and applications

2.1 Interactive advertisements in magazines or publications

Image recognition opt-in can be used in an advertisement or a set of advertisements in a magazine or a publication to turn the advertisement(s) into an interactive mobile experience. A call to action in the advertisement informs the consumer that they can take a picture of the advertisement and send it to an MMS short code or an email address. The consumer then receives a reward that may include mobile content such as a ring tone, a video, or a wall paper, a mobile web site, or a promotion or a coupon. The call to action may be placed in a specific advertisement.

The call to action is the communication to the consumer that informs them that they can take a picture and send it to a specified destination to receive content. A key advantage of image recognition opt-in is that the call to action can be placed in a common area so that it applies to a set of content instead of a single advertisement. In the case of a magazine, all the pages in the magazine can be photo-enabled. In fact, the call to action may apply to a whole series of publications. The consumer may take a picture of any page in the publication or set of publications and send it to the address specified by the call to action and receive content customized to the specific page.

2.2 Media launches and promotions

When a new movie, DVD or music CD is launched, a media company can use image recognition to make the print material associated with the campaign interactive. A call to action on a poster can inform the consumer that they can take a picture of the poster and send it to a specified destination and receive a free ring tone, or a wall paper, or an interactive mobile web site with reviews, and content on the media. Optionally, the campaign can provide consumers the ability to buy premium music, ring tones, etc. by clicking on a buy link in the mobile web site.

2.3 Brand promotions

A major brand (for example, Coca Cola or Nike) may use image recognition opt-in in their campaign print material, or physical goods (a bottle or shoe packaging). A consumer takes a picture of an advertisement, a bottle, or product packaging and is offered a coupon, a mobile consumable such as a ring tone, an entry into a contest, or rich content on the brand and product.

2.4 Outdoor signs and billboards

In a similar way, an outdoor billboard can be enabled with image recognition opt-in. A consumer may take a picture of a billboard (for example, advertising an automobile) to receive promotional ring tones or wall papers (and the location of dealers in the region).

A call to action may apply across a whole set of billboards identified by a logo. The consumer is informed that any billboard that has the logo has been photo enabled. They can take a picture of a billboard or sign that includes the logo and receive customized promotional material specific to that billboard.

2.5 Scavenger hunts

Image recognition opt-in permits innovative and fun automated scavenger hunt contests where a consumer sends a series of pictures of specified items or places in order to participate in the contest. As the consumer sends each picture they may receive clues for the next picture. The call to action for the scavenger hunt specifies the first picture, or the series of pictures the consumer must send to be entered into the contest to receive a prize. The image recognition system automatically verifies a picture sent by the consumer against the database of images registered for the scavenger hunt.

2.6 Voting by picture

A campaign may use this innovative scheme to allow consumers to communicate their preference. They take a picture of their favorite flavor, style, or candidate by taking a picture of the object of their preference and sending it to the specified destination. A prominent example of voting by mobile phone is in the popular TV show “American Idol”, where a consumer sends in their rating of contestants using their phone.

2.7 Event promotions

An event at a venue or night club may use image recognition opt-in for fun interaction with the attendees. Attendees at the event may be asked to take a picture of signs posted at the stadium to be entered in a contest to receive prizes. The call to action at the event may apply to a specific poster, or to all the posters or signs at the event.

2.8 Interactive advertisements at a stadium or event

In this use case, all advertisements at a stadium or event are enrolled into the image recognition opt-in. A call to action at the event (for example, the program for the event) informs consumers that they can take a picture of any advertisement at the event and receive promotional material, prizes, or consumables on the mobile phone.

As in the magazine use case, a key advantage of the image recognition opt-in is that the call to action can be localized to one place rather than be required on all the photo-enabled printed content. This requires no changes on the part of the event coordinator or the magazine publisher to the photo-enabled printed content.

2.9 CPG promotions

In the consumer packaged goods industry, vendors can enable image recognition on their product packaging. A consumer may take a picture of the package, send it to a specified destination and receive a coupon, or rich content specific to the product, brand, and entry into a contest or promotion.

The call to action with CPG promotions may apply to a specific product, or a set of products.

2.10 Best practices for image recognition opt-ins

The call to action is a critical component of a successful campaign. The call to action should be as simple as possible, ideally requiring just two steps from the consumer - that of taking the picture and sending it to the specified destination. If the call to action includes any extra required steps such as pre-registration, interaction on a web site, etc. the rate of consumer participation may drop off significantly. An easily identified logo can be placed on the advertisement, poster or magazine page to indicate that image recognition opt-in is enabled.

3 Image recognition in vertical applications

Image recognition can be used to power a range of innovative applications. These applications allow the consumer to take a picture of one among a whole category of things and receive content customized to the item they took a picture of.

The applications fall in several categories. Content discovery applications allow the consumer to find rich content pertaining to an item (for example, physical media such as a DVD) by taking a

picture of the item. Retail assisted shopping applications allow a consumer to find rich content on a product including reviews, prices, etc. by taking a picture of the product label or packaging.

3.1 Content discovery for movies

A consumer takes a picture of a movie poster on a billboard, a bus, or a theatre and sends it to receive content specific to the movie, including a mobile web site with reviews, ring tones, video clips, downloads, etc. All movies ever released (or a subset thereof) may be photo-enabled by this application.

3.2 Shop for DVDs

A consumer takes a picture of a DVD cover in a retail store (or elsewhere) and receives rich content on the DVD, including a mobile web site with reviews, ring tones, and video clips. As an example, a consumer at a Blockbuster store may use this application to point their camera at any DVD cover, send it and receive reviews and content on the DVD. They may add the DVD to their rent queue on Netflix or Blockbuster online by simply clicking on a link on the mobile web site.

3.3 Shop for music and ring tones from CDs

A consumer takes a picture of a CD cover at any place like a music store, a concert or a library, sends it to receive a mobile web site containing a review, information on the artist, a sample ring tone, and an optional music download or buy option.

3.4 Shop for books

In this application, a consumer takes a picture of any book cover in a book store or a library and receives content on the book. The content may include a mobile web site with reviews, information on the authors, and the price of the book at an online vendor like Amazon.

3.5 Shop for wine

In this application, a consumer takes a picture of a wine label at a store or winery and receives information and reviews on the wine. The content may include a mobile web site with the history of the wine, information on where it is sold, and prices at a few stores.

3.6 Street sign recognizer

A consumer takes a picture of a street sign of a store or a business with their camera phone and sends it to a destination. The system recognizes the street sign among all business or entities at that location and responds with reviews and information on the business.

For this application to work, the system requires partial information on the location of the business - for example, the phone number area code, a cell tower location, or coarse-granularity GPS information from the carrier. The system uses the partial location information as a constraint to limit the number of businesses the query image is compared to.

3.7 Museum assistant

A consumer walking through a museum takes a picture of an art display and receives an interactive description of the art. The description may include history, a review, and links to related art. The

consumer can add the piece to a wish list for subsequent review. The call to action for this application may be included with the museum information brochure, or posted in a location in the museum. The artwork may remain unchanged.

4 Comparison of opt-in mechanisms

Marketers can use of a variety of mechanisms to provide consumers the ability to opt-into or out of a promotion. Table A lists a number of opt-in mechanisms available in the market today. Typically, the marketer includes a call to action to the consumer specifying how to participate in the opt-in. Carrier requirements typically require that an opt-out mechanism must be supported. We compare available opt-in mechanisms and trade offs associated with them as well as associated market adoption trends.

The most common opt-in mechanisms in use today are SMS text messaging and entering a web form. Other opt-in mechanisms are gaining adoption. Image recognition as an opt-in mechanism is being used in novel campaigns in Asia, Europe, and more recently in North America. 2-D codes such as QR-codes or data matrix codes provide an opt-in mechanism that is similar to image recognition in that it uses the camera on the mobile phone. However, there is a significant difference: 2-D code recognition is performed by client software resident on the mobile phone; the consumer does not send the image to a destination server as in the image recognition opt-in. The code is recognized on the mobile phone and the consumer is directed to information pointed to by the 2-D code.

Index	Opt-In Mechanism	Description	Pros	Cons	Market adoption
1.	Image recognition	Consumer takes a picture with their camera phone and sends it via MMS to a destination specified in the call to action	<ul style="list-style-type: none"> • No key entry is required except typing the MMS destination • Call to action may apply to a whole collection of objects, such as all pages of a magazine, or a series of publications, or a set of posters or billboards • This method does not require the target image to be changed or defaced (no 2-D codes need to be added to the image) 	<ul style="list-style-type: none"> • Sending the camera phone picture to a destination is a required step • The target in the image must be previously enrolled for recognition 	Use of image recognition as an opt-in mechanism is a promising trend. It has been used on a small scale with movie launches and magazine promotions
2.	2-D codes	Consumer takes a picture of a 2-D code (such as a QR-code or a data matrix code) with a camera phone; software on the phone processes the code and presents the consumer with relevant content	<ul style="list-style-type: none"> • Does not require typing text or numbers; hence the opt-in requires minimal steps • Does not require sending the camera phone picture to a destination • In some markets such as Japan, consumers have come to recognize 2-D codes (QR-codes) as codes that can be processed using camera phones 	<ul style="list-style-type: none"> • Requires a code recognizer client to be installed on the mobile phone; consumers are very reluctant to install client software on mobile phones • In some markets, this capability requires industry-wide coordination between the operator and a handset maker • Lack of an industry-wide 2-D code standard in the U.S. and Europe inhibit progress 	2-D codes are popular in parts of East Asia, particularly Japan and South Korea. They have not gained adoption in the Europe or the U.S.
3.	SMS short code	Consumer sends a text message to a short code as specified in the call to action	<ul style="list-style-type: none"> • Text messaging is available on >90% of mobile phones; • More than 40% of consumers are familiar with text messaging 	<ul style="list-style-type: none"> • Requires consumer to type a short code, keyword and (sometimes) a keyword-suffix for every opt-in • Call to action for SMS opt-in needs to be highly specific, and individual to each short code, keyword 	SMS adoption is high throughout the world and usage in opt-ins is quite common

				and suffix	
4.	IVR	Consumer calls a phone number specified in the call to action	<ul style="list-style-type: none"> • Voice capability is universal • Adoption is universal. 	<ul style="list-style-type: none"> • Requires an IVR system or call center infrastructure • Caller needs to specify which opt-in they are enrolling in 	Voice capability on mobile phones is universal
5.	Web based	Consumer enters their phone number into a form on a website	<ul style="list-style-type: none"> • This opt-in method is very easy to use if the consumer is in front of a browser • Internet adoption is world wide; web based opt-in is inherently available to consumers worldwide 	<ul style="list-style-type: none"> • This is a fundamentally non-mobile opt-in mechanism as it is only available to consumers in front of a desktop or a laptop browser • Usually web opt-in requires consumers to specify the carrier in addition to the phone number because the carrier may be hard to determine from the phone number 	Web-based opt-in is available to any consumer with Internet access
6.	“#” method	Consumer calls a phone number with a “#” in front of it	<ul style="list-style-type: none"> • Easy to use • Voice capability on phones is universal 	<ul style="list-style-type: none"> • Requires deep integration into a carrier’s network infrastructure to facilitate the “#” method • Absence of industry standard means that this may work on some carriers and not on others 	Voice capability on mobile phones is universal
7.	“**” method	Consumer calls a phone number with a “**” in front of it	<ul style="list-style-type: none"> • Easy to use • Voice availability on phones is universal 	<ul style="list-style-type: none"> • Requires deep integration into a carrier’s network • Absence of industry standard means that this may not work on all carriers 	Voice capability on mobile phones is universal
8.	Bluetooth alert	Consumer sends a Bluetooth alert to a specified Bluetooth destination specified in the call to action	<ul style="list-style-type: none"> • Well suited for scenarios with geographical limits such as proximity marketing in malls or stadiums 	<ul style="list-style-type: none"> • Works only on mobile phones that have Bluetooth capability and have Bluetooth enabled • Requires Bluetooth devices to be installed 	Use of Bluetooth for opt-ins has been tried in some malls, but is a relatively new trend

				at the location where the service is being marketed	
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Table A. List of opt-in mechanisms available to marketers

5 Technology enabling image recognition

5.1 Overview

Figure 2 presents a high level block architecture of a system that implements image recognition opt-in.

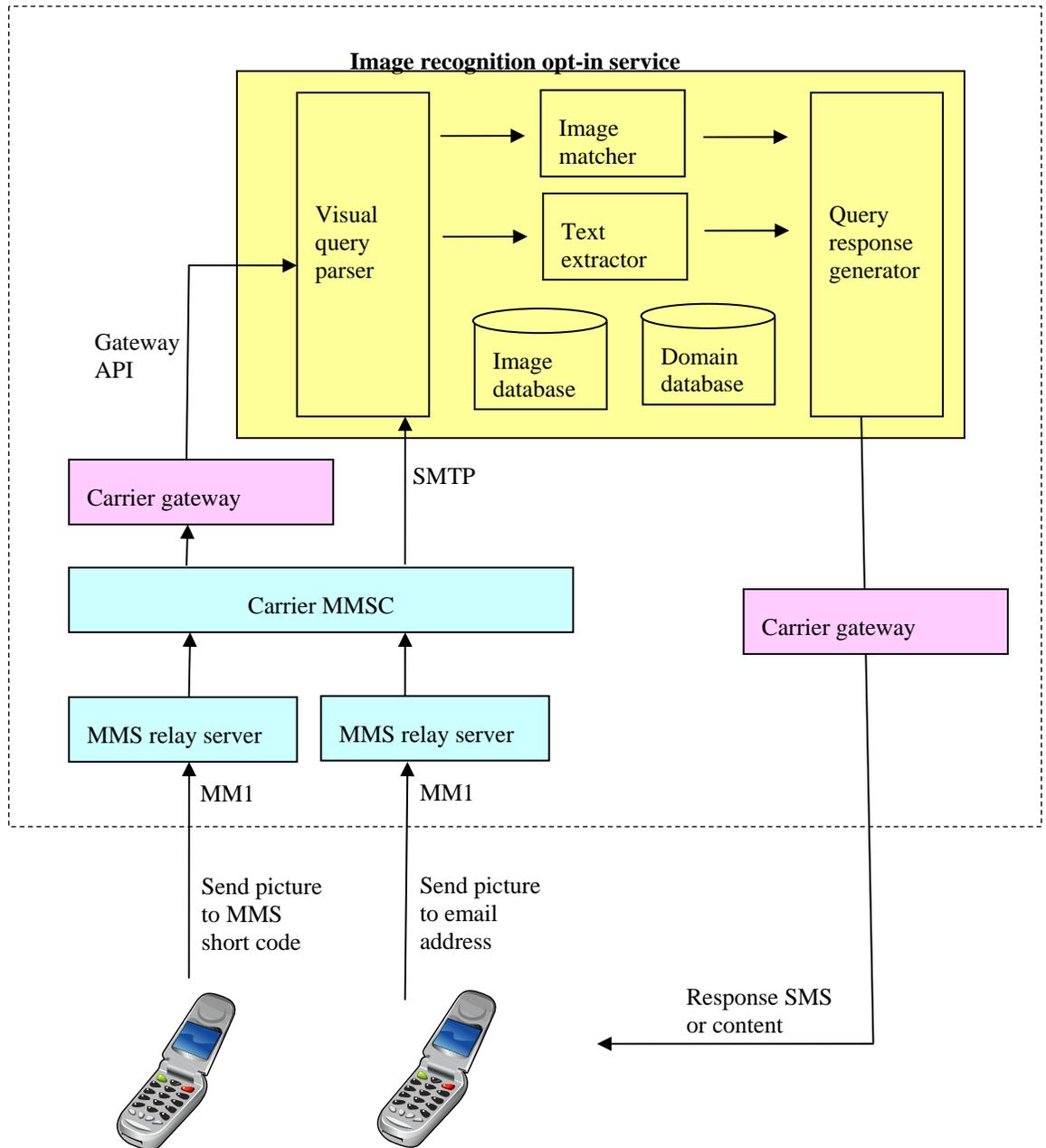


Figure 2. Overview of technical architecture enabling image recognition

MMS messaging allows consumers to send binary content including pictures to other phones or short codes (Wap Forum, 2001; Harmer, 2003; Guthery, 2003). Image recognition opt-in service processes MMS messages sent as queries from a camera phone addressed to a short code or to an email address. A consumer may send an MMS message from a camera phone addressed to an MMS short code or an email address. If it is sent via an MMS short code it is directed to the MMSC resident at the carrier. From the MMSC, it is then directed to the service hosting the short code, namely the image recognition service. If the query is sent via an email address it is directed by the SMTP gateway on the carrier to the SMTP server on the image recognition service.

The image query extractor component in the image recognition service retrieves the image from the message and sends it to the image matcher, and optionally to the text extractor component. The image matcher finds the matching image (or the absence thereof) in the database.

Once a matching image is found (or no matching image exists), then the response generator component is activated to produce a response corresponding to the matching image (or absence of a matching image). The response generator looks up a database of responses that may be a mobile web site or mobile consumable content like a ring tone, a music download, a video, or a wall paper. The response is then directed to the consumer's camera phone via the carrier's gateway. The end to end query-response time is usually anywhere between 10 to 45 seconds depending on the carrier network coverage and network latency. The processing time of the image recognition service is typically a small fraction of the latency, typically under a second.

5.2 Image matching

Image recognition as an opt-in method is enabled by recent technological innovations in the research area of Computer Vision, within the field of Computer Science. Algorithms have been developed to process images in a variety of ways suitable for recognizing the image. One of the ways is to reliably match a query image to a database of images. These are known as "image matching" algorithms (Brown, M. et al, 2005; Toshev, A. et al, 2007; Philbin, J. et al, 2007; Gionis, A., et al).

Image matching algorithms typically involve extracting features from the image that collectively comprise a set of numbers that form a "signature" of the image. The algorithms create a database of features across all images in the database and store them in a database.

When a query image comes in, an image matcher extracts features from the image and searches for them in the database of features created from the image database. The search results in a set of candidate image matches (or none, if no match exists). A series of strict tests are performed to verify that the candidate match is a correct match.

Entry level camera phones in the U.S. typically contain 640 x 480 or 0.3 mega pixel resolution cameras. These cameras frequently produce poor quality images with considerable blur (because they have limited or no control of depth of field), lighting artifacts, noise and variation in the images. A notable feature of image matching techniques is that they tend to work amazingly well despite these severe shortcomings in camera phone images.

Recent developments in image matching technology permits a high level of robustness and accuracy of matching query images to database images in non-ideal conditions involving poor camera phone optics. Specially developed image matching algorithms can report a correct match despite extraordinarily poor picture conditions, including the following scenarios:

- partial occlusion by a superimposed object,
- focus blur,
- motion blur,
- poor lighting, and
- poor coverage (the target is, say less than 25% of the camera phone photo)

Remarkably, pictures taken from computer screens often match successfully (even though this scenario is not relevant for any use case).

5.2.1 Scaling of Image Matching

Some very recent technology developments allow accurate matching of a query image against a large database of images. The image database can include millions of images. These techniques are relatively new and have been demonstrated by a few academic research teams and software vendors (SnapTell, 2007; Microsoft Research, 2007). The vendors have developed proprietary algorithms to achieve scaling. The algorithms make use of special data structures to store the large collection of features across all images in the images database. The data structures allow fast index lookup and traversal to find candidate matches across the large image database.

5.3 Text extraction

Another technique available to process camera phone images is to apply OCR (optical character recognition) techniques to extract text. Vendors have developed proprietary OCR implementations that improve upon commercial OCR on poor quality camera phone images. Unfortunately, despite all the current improvements text extraction does not produce high accuracy on images taken with entry level camera phones, namely those of resolution 640 x 480. The following scenarios severely affect the quality of text extraction: focus blur, motion blur, use of non-standard fonts, and text on a non-uniform background. Text extraction produces higher accuracy when images are at least of 2.0 mega pixel resolution and are taken with camera phones that have the auto-focus feature turned on.

5.4 2-D code recognition

In Asia, specifically Japan and South Korea, mobile phones are mostly shipped with QR-code readers pre-installed on the phone. Recognition of 2-D codes by camera phones follows a different user interaction model relative to image recognition opt-in. A 2-D code is decoded by client software installed on the phone (the picture of a 2-D code is never sent from the camera phone to a server).

The decoded information from a 2-D code typically contains a URL, a suggested action, or a link to a resource. The client may direct the consumer to the link decoded from the 2-D code, or perform a context specific function based on the decoded information.

The code reader client application provides an integrated user experience for the consumer as points the camera at the QR-code. The embedded code reader kicks in, recognizes the code, and directs the consumer to the destination or information pointed to by the code.

6 Summary

We discussed a special form of opt-in known as image recognition opt-in that can be used to power innovative mobile marketing campaigns and applications. We describe several use cases for this opt-in method and compare it to existing opt-in methods. We discuss a variety of applications that can be powered using image recognition. An overview of the technology used to power the image recognition opt-in is presented.

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