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Shuster

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(54) **METHOD AND APPARATUS FOR
PHOTOGRAPH FINDING**

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continuation of application No. 15/481,595, filed on
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continuation of application No. 14/518,655, filed on
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(56)

References Cited

U.S. PATENT DOCUMENTS

5,280,530 A 1/1994 Trew et al.
5,748,904 A 5/1998 Huang et al.
(Continued)

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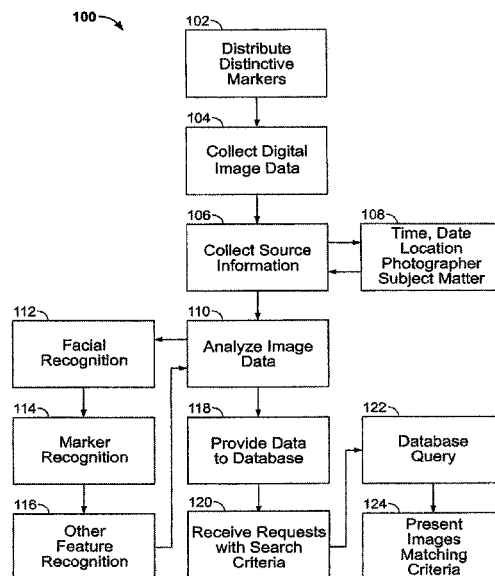
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(57)

ABSTRACT

Digital image data including discrete photographic images
of a variety of different subjects, times, and so forth, are
collected and analyzed to identify specific features in the
photographs. In an embodiment of the invention, distinctive
markers are distributed to aid in the identification of par-
ticular subject matter. Facial recognition may also be
employed. The digital image data is maintained in a database
and queried in response to search requests. The search
requests include criteria specifying any feature category or
other identifying information, such as date, time, and loca-
tion that each photograph was taken, associated with each
photograph. Candidate images are provided for review by
requesters, who may select desired images for purchase or
downloading.

20 Claims, 2 Drawing Sheets



Related U.S. Application Data

Oct. 20, 2014, now Pat. No. 9,619,486, which is a continuation of application No. 13/776,463, filed on Feb. 25, 2013, now Pat. No. 8,867,798, which is a continuation of application No. 13/090,026, filed on Apr. 19, 2011, now Pat. No. 8,385,691, which is a continuation of application No. 12/874,929, filed on Sep. 2, 2010, now Pat. No. 7,929,810, which is a continuation of application No. 12/325,589, filed on Dec. 1, 2008, now Pat. No. 7,844,141, which is a continuation of application No. 11/056,699, filed on Feb. 10, 2005, now Pat. No. 7,460,737.

- (60) Provisional application No. 60/544,570, filed on Feb. 12, 2004.

References Cited**U.S. PATENT DOCUMENTS**

5,793,371 A 8/1998 Deering
 5,835,244 A 11/1998 Bestmann
 5,848,410 A 12/1998 Walls et al.
 5,912,980 A 6/1999 Hunke
 5,926,647 A 7/1999 Adams et al.
 5,926,812 A 7/1999 Hilsenrath et al.
 6,094,649 A 7/2000 Bowen et al.
 6,353,840 B2 3/2002 Saito et al.
 6,397,213 B1 5/2002 Cullen et al.
 6,421,675 B1 7/2002 Ryan et al.
 6,424,587 B1 7/2002 Hosoda
 6,530,944 B2 3/2003 West et al.
 6,564,214 B1 5/2003 Bhide
 6,608,923 B1 8/2003 Zhang et al.
 6,654,758 B1 11/2003 Teague
 6,658,408 B2 12/2003 Yano et al.
 6,690,828 B2 2/2004 Meyers
 6,738,653 B1 5/2004 Sfez et al.
 6,772,150 B1 8/2004 Whitman et al.
 6,778,697 B1 8/2004 Shin et al.
 6,792,434 B2 9/2004 Moghaddam et al.
 6,873,806 B2 3/2005 Kobayashi et al.
 6,894,494 B2 5/2005 Stergiopoulos et al.
 6,898,582 B2 5/2005 Lange
 6,919,892 B1 7/2005 Cheiky
 6,963,663 B1 11/2005 Yoshida
 6,975,418 B1 12/2005 Ohta et al.
 6,982,811 B2 1/2006 Sato
 7,006,881 B1 2/2006 Hoffberg
 7,027,054 B1 4/2006 Cheiky et al.
 7,110,996 B2 9/2006 Kawamura
 7,112,806 B2 9/2006 Lussier
 7,140,535 B2 11/2006 Sussman
 7,171,058 B2 1/2007 Luo
 7,174,332 B2 2/2007 Baxter et al.
 7,181,480 B1 2/2007 Nikiel et al.
 7,184,814 B2 2/2007 Lang et al.
 7,209,653 B2 4/2007 Umeda
 7,231,243 B2 6/2007 Tearney et al.

7,233,684 B2 6/2007 Fedorovskaya et al.
 7,236,264 B2 6/2007 Kanno
 7,259,785 B2 8/2007 Stavely et al.
 7,266,544 B1 9/2007 Dodge et al.
 7,286,723 B2 10/2007 Taugher et al.
 7,286,871 B2 10/2007 Cohen
 7,287,253 B2 10/2007 Yamamura et al.
 7,298,931 B2 11/2007 Kim et al.
 7,302,057 B2 11/2007 Rotholtz et al.
 7,308,550 B2 12/2007 Cornett
 7,319,780 B2 1/2008 Fedorovskaya et al.
 7,333,963 B2 2/2008 Widrow et al.
 7,346,631 B2 3/2008 Amirghodsi
 7,356,512 B2 4/2008 Okita et al.
 7,359,535 B2 4/2008 Salla et al.
 7,366,994 B2 4/2008 Loui
 7,379,627 B2 5/2008 Li et al.
 7,382,903 B2 6/2008 Ray
 7,388,693 B2 6/2008 Ahmed et al.
 7,418,116 B2 8/2008 Fedorovskaya et al.
 7,428,744 B1 9/2008 Ritter
 7,440,594 B2 10/2008 Takenaka
 7,474,808 B2 1/2009 Ozaki et al.
 7,499,916 B2 3/2009 Liu et al.
 7,555,148 B1 6/2009 Steinberg et al.
 7,562,299 B2 7/2009 Millar et al.
 7,564,994 B1 7/2009 Steinberg et al.
 7,583,294 B2 9/2009 Ray et al.
 7,596,247 B2 9/2009 Ioffe
 7,609,864 B2 10/2009 Nagasaka et al.
 7,639,898 B1 12/2009 Chan
 7,660,445 B2 2/2010 Ray
 7,706,633 B2 4/2010 Chef d'hotel et al.
 7,711,145 B2 5/2010 Gallagher
 7,715,659 B2 5/2010 Zhao et al.
 7,813,822 B1 10/2010 Hoffberg
 7,843,495 B2 11/2010 Aas et al.
 7,860,320 B2 12/2010 Luo et al.
 7,881,506 B2 2/2011 Nagasaka et al.
 7,921,020 B2 4/2011 Kalies
 7,941,197 B2 5/2011 Jain et al.
 7,941,442 B2 5/2011 Li
 8,005,272 B2 8/2011 Grim, III et al.
 8,064,650 B2 11/2011 Webb
 8,065,611 B1 11/2011 Chan et al.
 8,150,584 B2 4/2012 Mackin et al.
 8,199,979 B2 6/2012 Steinberg et al.
 8,224,849 B2 7/2012 Li
 8,316,237 B1 11/2012 Felsher
 8,374,466 B2 2/2013 Webb
 8,460,103 B2 6/2013 Mattice et al.
 8,513,513 B2 * 8/2013 Komano G10H 1/24
 84/649
 8,531,474 B2 9/2013 Chang et al.
 8,543,573 B2 9/2013 MacPherson
 8,583,263 B2 11/2013 Hoffberg
 9,311,619 B2 * 4/2016 Mosley G06F 16/951
 9,547,883 B1 * 1/2017 Stepanenko H04N 5/23238
 9,560,415 B2 * 1/2017 Good H04N 21/47815

* cited by examiner

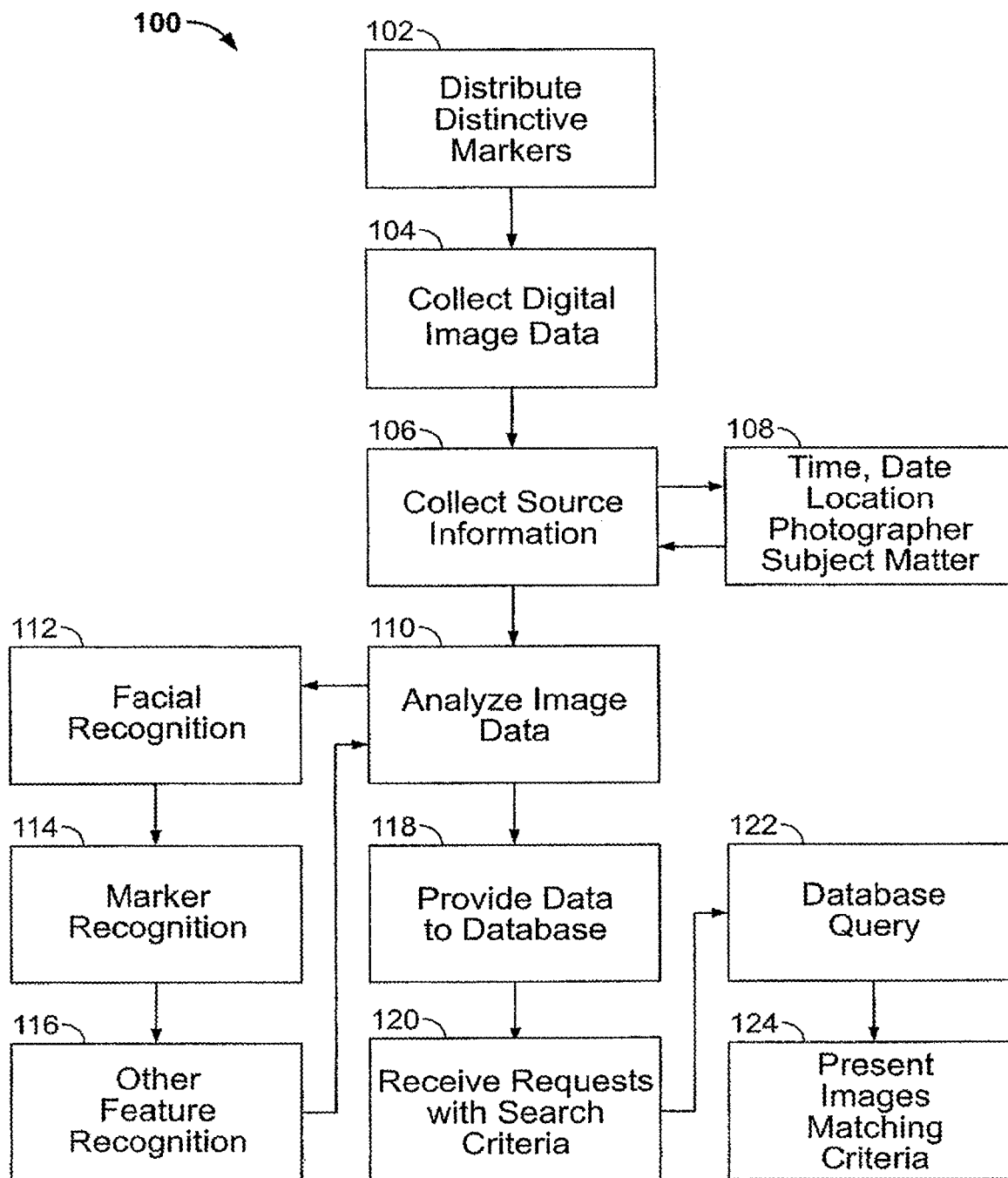


FIG. 1

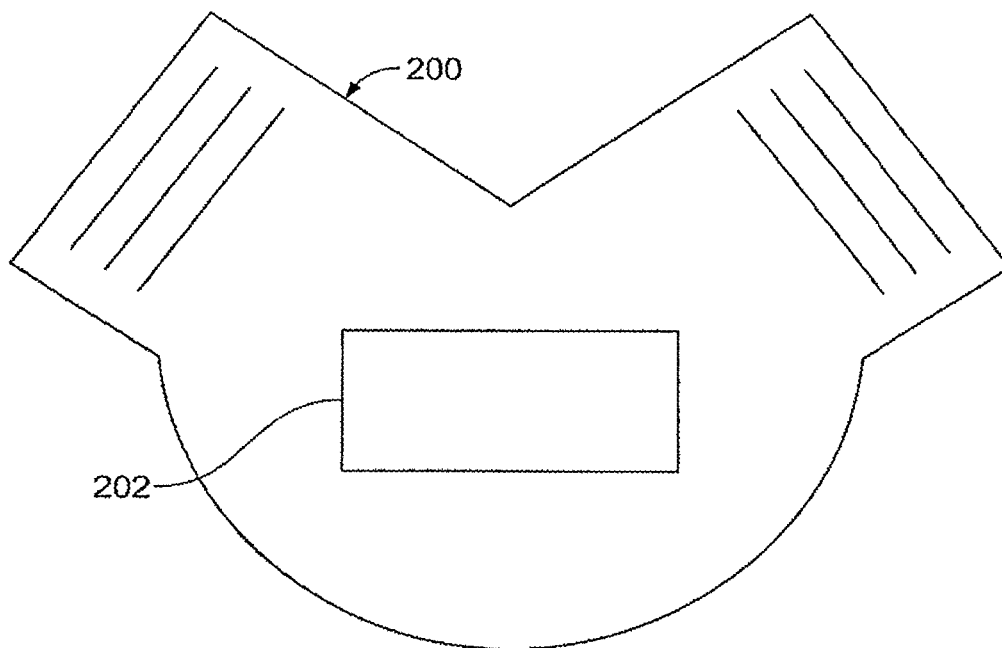


FIG. 2

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METHOD AND APPARATUS FOR PHOTOGRAPH FINDING

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application is a continuation of U.S. application Ser. No. 17/020,671, filed Sep. 14, 2020 (now U.S. Pat. No. 11,061,971), which is a continuation of U.S. application Ser. No. 16/105,876, filed Aug. 20, 2018 (now U.S. Pat. No. 10,776,430), which is a continuation of U.S. application Ser. No. 15/481,595, filed Apr. 7, 2017 (now U.S. Pat. No. 10,055,497), which is a continuation of U.S. application Ser. No. 14/518,655, filed Oct. 20, 2014 (now U.S. Pat. No. 9,619,486), which is a continuation of application Ser. No. 13/776,463, filed Feb. 25, 2013 (now U.S. Pat. No. 8,867,798), which is a continuation of U.S. application Ser. No. 13/090,026, filed Apr. 19, 2011 (now U.S. Pat. No. 8,385,691), which is a continuation of U.S. application Ser. No. 12/874,929, filed Sep. 2, 2010 (now U.S. Pat. No. 7,929,810), which is a continuation of U.S. application Ser. No. 12/325,589 filed Dec. 1, 2008 (now U.S. Pat. No. 7,844,141), which is a continuation of U.S. application Ser. No. 11/056,699, filed Feb. 10, 2005 (now Pat. No. 7,460,737) which claims priority to U.S. Provisional Appl. No. 60/544,570, filed Feb. 12, 2004 the disclosures of each of the above-referenced applications are incorporated by reference herein in their entireties.

BACKGROUND OF THE INVENTION

Field of the Invention

Photography has transformed how people conceive of the world. Photographs allow people to see all sorts of things that are actually many miles away and/or years preceding. Photography lets people capture moments in time and preserve them for years to come.

Often people at a public place notice that a stranger has taken a photograph of which they would love to have a copy. Alternatively, after going somewhere, a person may bemoan the fact that he did not have a photograph of the event (in the present context, photograph also includes video, audio, or other representation).

A need exists, therefore, to provide a method and apparatus for identifying and connecting people with photographs they want. In addition, there is a need to provide a method and apparatus for characterizing errant photographs stored on computer databases that makes use of a variety of attributes to reliably characterize photographs in such a way as to reduce the amount of manual review necessary to identify and connect people with the photographs they want.

SUMMARY OF THE INVENTION

The present invention provides a method and apparatus that matches people with photographs in which they accidentally (or purposely) appear or with photographs of events they have attended.

Specifically, in one embodiment, a web site is created with a database backend. The database is seeded with information provided by (1) the photographer; (2) recovering metadata from the photograph; (3) reading devices such as a Global Positioning System (GPS) device; (4) referencing the account data of the photographer (i.e., account number, photographer's zip code or area code, etc.); (5) analyzing the photograph (i.e., computer recognizes eye color, optical

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character recognizes any text found in the photograph, recognizes the number of persons, the gender of persons, the hair color, the time of day by optical character recognizing any clocks in the photograph or analyzing the lighting conditions, the weather, etc.); (6) photograph quality information; and/or (7) any other information.

A user looking for a photograph would visit the web site and search for certain criteria. The user is then provided with a gallery of thumbnails that match the criteria. When the user identifies a photograph he wants to own, he can then download the full quality version, or order print(s). In a preferred implementation, the user is charged some amount of money that is split between the site owner and the photographer. Alternatively, the user may be charged in some other way, such as by viewing advertisements or by exchanging credits for downloads or by some other payment or a combination thereof.

A more complete understanding of the present invention will be afforded to those skilled in the art, as well as a realization of additional advantages and objects thereof, by a consideration of the following detailed description of the preferred embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a flow diagram showing exemplary steps of a method according to the invention.

FIG. 2 is a diagram showing an exemplary distinctive marker for photographic data.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention provides a method and apparatus that matches people with photographs in which they accidentally (or purposely) appear or with photographs of events they have attended.

FIG. 1 illustrates exemplary steps of a method according to the invention. At optional step 102, distinctive markers may be distributed to persons desiring to contribute photographic images to a database. The markers may comprise, for example, distinctive bins, badges, or stickers for placing on objects to be photographed. The markers should be designed so as to be easily recognized using automatic recognition algorithms, but should not be too conspicuous.

At step 104, image data is collected from a variety of sources. It may be desirable to accept material from as many sources as possible, to increase the number of images available for browsing. Optionally, images may be accepted from qualified sources only.

At step 104, source information regarding each photograph is collected. For example, at step 108, the image provider may be asked for information, such as the time and date of the photograph, the subject matter, location, photographer, etc. Image metadata may also be read to obtain such information. Other ways of associating images to identifying information may include, for example, reading devices such as a Global Positioning System (GPS) device attached to a camera or other image capture device, or by referencing account data of the image contributor (e.g., account number, photographer's zip code or area code, etc.).

At step 110, image data is analyzed to identify any characteristics that may be of interest to users. Such characteristics may include, for example, eye color, words and sentences, a number or gender of persons, the hair color, time of day, lighting conditions, and so forth. For further example, at step 112, a facial recognition program as known

in the art may be used to analyze any faces appearing in the photos at a sufficiently high resolution. At step 114, the images may be analyzed for the presence of any known markers. And at step 116, other features and qualities of the image may be classified, for example, whether it is taken indoors or outdoors, whether it contains people, dogs, cats, or other animals, whether it contains automobiles, airplanes, or other objects, and so forth. At step 118, selected feature information and other source information is associated with each image and provided to any suitable relational database.

At step 120, requests specifying search criteria for photographic images are received. For example, a user looking for a photograph may visit a web site hosted by the system and fill out a search form specifying search criteria of interest. The criteria may include specific subject matter, times, dates, and locations. For example, "Disneyland AND Matterhorn AND blue eye AND child AND Jan. 1, 2004 AND morning" would search for a photograph or photographs taken at Disneyland's Matterhorn with a child who has blue eyes on the morning of Jan. 1, 2004.

At step 122, the image database is queried as known in the art, to identify images that at least partially match the search criteria. Such images may be presented, at step 124, to the user. For example, the user may be provided with a gallery of "thumbnail" (reduced-size) images generated from images that match the criteria. When the user identifies a photograph he wants to own, he can then download the full quality version, or order print(s). In a preferred implementation, the user is charged some amount of money that is split between the site owner and the photographer. Alternatively, the user may be charged in some other ways such as by viewing advertisements or by exchanging credits for downloads or by some other payment or a combination thereof. The price can be on a sliding scale depending on the quality of the photograph that the user downloads or the size or quality of the print. For example, a photograph may cost \$1.00 for 1024x768 resolution or \$2.00 for 1600x1200 resolution. Similarly, a print may cost \$1.00 for 3x5 or \$5 for 8x10. For downloads, an "upgrade" may be possible by charging the difference between the resolutions. An automated process may be used to reduce the number of pixels for purposes of having a lower quality version to sell.

In addition, a surcharge may be applied (even if no surcharge is required) for various enhancements to the photograph, such as "upconverting" to a higher resolution, eliminating red-eye, enhancing shadow, color, or brightness, etc.

Moreover, when a photographer takes photographs, he can be provided with printed cards bearing a Uniform Resource Locator (URL) and a unique code in order that the user would be able to enter into the web site to find the photograph or the series of photographs then being taken. The photographer can also distribute cards (the printed cards bearing the URL and the unique code or any other cards known to those skilled in the art) to people whom he photographs, whether intentionally or inadvertently. The photographer can further advertise the same (e.g., the URL and the unique code) via a mark on his camera, a T-shirt, or other means.

Fixed-place cameras can also serve this function (e.g., the of photographer). For example, a camera set up at an intersection in Hollywood might take and upload one photograph every 10 seconds.

Photographers can also be given accounts and be allowed to upload photographs to the site. The database is populated during this process, although additional database information can be added later by web site users. In addition, the

number of times the photograph has been purchased and/or viewed can be a part of the database.

In one embodiment, the method and apparatus of the present invention should be capable of face recognition. It should assign values to various factors (i.e., ratio of distance between pupils to distance to tip of nose, etc.). It would add this information to the database for uploaded photographs. A user can then upload a photograph of the target person and the system would then generate the same data from that photograph and use it to limit the possible search targets.

A provider of the present method and apparatus or a photographer can also hand out pins, clothing, or other materials that are marked in a way that allows a computer to later recognize them in a photograph. FIG. 2 shows an exemplary distinctive marker 200 having an optical code 202, such as a bar code. The marker may have a color combination, distinctive shape, lettering, bar code, or other optical pattern, or some combination of the foregoing, that is unique to the marker. The marker may be computer generated, for example, and produced using an end-user's laser or ink-jet printer. The marker may be associated with specific information, for example, a particular user account, photographer, subject matter type, person, event, or location. Users can later search for photographs containing an image of the marker.

Numerous distribution mechanisms exist whereby photographs may be distributed from a source over a wide area network, such as the Internet. In some cases, the photographs are distributed using a centralized server system (such as Napster 2.0, eBay, or from a web site). In other cases, the photographs are distributed using a decentralized system (such as Gnutella). In a preferred implementation, the photographs are distributed to a person using the centralized server system or using a central hub.

Embodiments of the present invention operate in accordance with at least one web-hosting mechanism and a plurality of user mechanisms communicating over a wide area network, such as the Internet. Specifically, a web-hosting mechanism includes a database, an interface application and a server, wherein the server is adapted to communicate with a plurality of user mechanisms over a wide area network. It should be appreciated that the mechanisms described can include, but are not limited to, personal computers, mainframe computers, personal digital assistants, wireless communication devices and all other physical and wireless connected network devices generally known to those skilled in the art. It should further be understood that the database depicted can include, but is not limited, to RAM, cache memory, flash memory, magnetic disks, optical disks, removable disks, SCSI disks, IDE hard drives, tape drives, and all other types of data storage devices (and combinations thereof, such as RAID devices) generally known to those skilled in the art. In addition, the mechanisms described above are for purposes of example only and the invention is not limited thereby.

Having thus described several embodiments for photograph finding, it should be apparent to those skilled in the art that certain advantages of the system have been achieved. It should also be appreciated that various modifications, adaptations, and alternative embodiments thereof may be made within the scope and spirit of the present invention. For example, in the context of the present invention a photograph can include video, audio, and/or other representation of how people conceive of the world. The invention is defined by the following claims.

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What is claimed is:

1. A method, comprising:
 - a computer system receiving a search request that includes a digital image;
 - the computer system determining a set of multiple characteristics of the digital image, including:
 - one or more objects appearing in the digital image;
 - one or more colors appearing in the digital image; and
 - lighting conditions appearing in the digital image;
 - the computer system comparing the set of multiple characteristics with corresponding characteristics for respective ones of a plurality of stored digital images; and
 - the computer system transmitting a response to the search request, wherein the response indicates one or more stored digital images that meet one or more matching criteria for the comparing.
2. The method of claim 1, wherein the set of multiple characteristics further includes one or more characteristics of the following characteristics:
 - faces recognized in the digital image;
 - time of day represented in the digital image;
 - a device used to capture the digital image; and
 - a geographic location at which the digital image was captured.
3. The method of claim 1, wherein the one or more objects include visual facial characteristics.
4. The method of claim 1, wherein the one or more objects include a known marker object.
5. The method of claim 1, wherein at least one of the multiple characteristics is determined based on image metadata and at least one of the multiple characteristics is determined based on analyzing image data of the digital image.
6. The method of claim 1, wherein the search request is received via a wide area network, the digital image is uploaded via the wide area network, and the response is transmitted via the wide area network.
7. The method of claim 6, wherein the transmitting the response includes causing reduced-size versions, of the one or more stored digital images that meet one or more matching criteria, to be displayed via a web site.
8. The method of claim 1, further comprising:
 - the computer system receiving one or more search parameters based on user input;
 - wherein the comparing includes comparing characteristics for stored digital images with the received one or more search parameters.
9. A system, comprising:
 - one or more processors; and
 - one or more memories having program instructions stored thereon that are executable by the one or more processors to:
 - receive a search request that includes a digital image;
 - determine a set of multiple characteristics of the digital image, including:
 - one or more objects appearing in the digital image;
 - one or more colors appearing in the digital image; and
 - lighting conditions appearing in the digital image;
 - compare the set of multiple characteristics with corresponding characteristics for respective ones of a plurality of stored digital images; and
 - transmit a response to the search request, wherein the response indicates one or more stored digital images that meet one or more matching criteria for the comparison.

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10. The system of claim 9, wherein the set of multiple characteristics further includes the following characteristics: faces recognized in the digital image; and time of day represented in the digital image.

11. The system of claim 10, wherein the set of multiple characteristics further includes the following characteristics: a device used to capture the digital image; and a geographic location at which the digital image was captured.

12. The system of claim 9, wherein at least one of the multiple characteristics is determined based on image metadata and at least one of the multiple characteristics is determined based on an analysis of pixel data of the digital image.

13. The system of claim 9, wherein the search request is received via a wide area network, the digital image is uploaded via the wide area network, and the response is transmitted via the wide area network.

14. A non-transitory computer-readable medium having instructions stored thereon that are executable by a computing device to perform operations comprising:

- receiving a search request that includes a digital image;
- determining a set of multiple characteristics of the digital image, including:

- one or more objects appearing in the digital image;
- one or more colors appearing in the digital image; and
- lighting conditions appearing in the digital image;

- comparing the set of multiple characteristics with corresponding characteristics for respective ones of a plurality of stored digital images; and

- transmitting a response to the search request, wherein the response indicates one or more stored digital images that meet one or more matching criteria for the comparing.

15. The non-transitory computer-readable medium of claim 14, wherein the set of multiple characteristics further includes one or more characteristics of the following characteristics:

- faces recognized in the digital image;
- time of day represented in the digital image;
- a device used to capture the digital image; and
- a geographic location at which the digital image was captured.

16. The non-transitory computer-readable medium of claim 14, wherein at least one of the multiple characteristics is determined based on image metadata and at least one of the multiple characteristics is determined based on analyzing image data of the digital image.

17. The non-transitory computer-readable medium of claim 14, wherein the search request is received via a wide area network, the digital image is uploaded via the wide area network, and the response is transmitted via the wide area network.

18. The non-transitory computer-readable medium of claim 14, wherein the transmitting the response includes causing reduced-size versions, of the one or more stored digital images that meet one or more matching criteria, to be displayed via a web site.

19. The non-transitory computer-readable medium of claim 14, wherein the operations further comprise:

- receiving one or more search parameters based on user input;

- wherein the comparing includes comparing characteristics for stored digital images with the received one or more search parameters.

20. The non-transitory computer-readable medium of claim 14, wherein the one or more objects include visual facial characteristics.

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