Query database with biometric (e.g. iris, face, fingerprint) or biographic information of person of interest

Does information match?

Output: "person unknown"

Output: biographical and complete biometric information about person including known associates
FIG. 1
User inputs identifying information about Subject 1

Biometric template(s) and/or biographical information is extracted from Subject 1’s identifying info

Biometric template(s) and/or biographical information is submitted to search engine(s)

Search results of Subject 1 and Subject 2 are compared

Are any common links found?

Return common links found between subjects

Return “No link found” message

FIG. 2
Key Store Search Operator Service User interface

Biometric Application Database Trust Store Biometric Template Matcher Biometric Template Extractor Network Proxy

Communications network

FIG. 3
Capture fingerprint with sensor connected to computing component

Based on identifiable input, determine the biometric modality as fingerprint
Segregate the data received from other data collected as fingerprint biometric data

Capture face with certified camera connected to computing component

Based on identifiable input, determine the biometric modality as face
Segregate the data received from other data collected as facial biometric data

Capture irises with certified external iris sensor connected to computing component

Based on identifiable input, determine the biometric modality as iris
Segregate the data received from other data collected as iris biometric data

Accept raw biometric fingerprint data

Accept raw biometric facial data

Accept raw biometric iris data

Send biometric information to template generation subroutine

FIG. 4
Biometric Feature Extraction from Raw Biometric Data

Identify which template generation algorithm to use based on segregation

Apply template algorithm to create a Biometric Template from Biometric Feature Data

FIG. 5
Build database from images

Crawl for images on web that contain faces

Extract faces from image

Use facial ID program to match faces to biometric records

Does face match a record in database?

Create new database entry

Mark all person in photograph as associates of each other

FIG. 6
Query database with biometric (e.g. iris, face, fingerprint) or biographic information of person of interest

Does information match?

Output: "person unknown"

Output: biographical and complete biometric information about person including known associates

FIG. 7
BIOMETRIC SOCIAL NETWORK

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of U.S. provisional patent application No. 61800374.

BACKGROUND

[0002] The subject matter of this specification relates to the field of organizing and linking biometric and biographical information about individuals.

[0003] Information has become one of the most abundant and important resources in modern society. Both private companies and government entities spend billions of dollars gathering and processing this data. However, often the different sets of information remain in separate databases. For example, social networking sites often have information relating to who people know, where they travel, what activities they enjoy, etc. Government databases have biographical (address, birth date, etc.) and biometric (fingerprints, etc.). There is no common linkage between these sites, even if a user has access to these sites.

[0004] In addition, access to this information often requires specific text searches. Even many search engines that return non-text data such as images and photographs function by searching text-based meta-tags which are manually entered. There are instances when instead of text, other data such as images are more convenient for queries. For example, you may see someone at a business conference. It would be advantageous to know information about them based strictly on their image, particularly any common links you may have to that person.

SUMMARY

[0005] The Biometric Social Network solves this problem by providing a system that is able to cross-search between social networking site, public documents on the web, as well as any other database containing biographical or biometric information about individuals.

[0006] The Biometric Social Network is a system that identifies and connects information available on the internet to real-world personal interaction. In practice, it will provide a means for people to be identified and associated with other people, places, or common touchstones through a continually-updated corpus of information extracted from the internet that contains social, contextual, professional, historic, and other types of information. The system is also able to cross-search for multiple individuals and identify any links between them.

DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0007] FIG. 1 is a system diagram depicting the core physical machine functionality and operating system functionality of a computer.

[0008] FIG. 2 is a flow chart depicting the subroutines in one embodiment of the Biometric Social Network “program code/system”.

[0009] FIG. 3 is a system diagram depicting functional components of the biometric search application.

[0010] FIG. 4 is a flow diagram of the biometric segregation subroutine.

[0011] FIG. 5 is a flow diagram of the template generation subroutine.

[0012] FIG. 6 is a flow diagram of the build database subroutine.

[0013] FIG. 7 is a flow diagram of the identification routine.

DETAILED DESCRIPTION

[0014] Webcrawlers or other information-gatherers comb through the internet (body of available public and non-public information containing imagery, and other information); these webcrawlers or other information gatherers create a database of identifying imagery and associated information including available metadata. For face information, this may be a database of facial templates extracted from images containing images of people, as well as a record or other facial images that appear in common pictures, metadata such as where or when the image was taken, what site it appeared on, or in the case of applications such as Facebook or LinkedIn, could extract a list of the persons friends or associates.

[0015] The information can be accessed multiple ways, including the manual upload of a photograph through a server or other portal, or through the use of a camera phone or other portable device.

[0016] In a simple sub-example, the system can answer the question “who is this person in front of me” by taking a picture, querying the corpus of internet-derived information, and identifying the individual. To go a step further, in this social example, the system can also answer the question, “are the two individuals in front of me acquainted?” by identifying both and a linkage or lack-thereof between the two. This linkage may be a published image showing both, or extracted and implied from associated data such as both individuals having attended common events as determined by archived information, having other individuals that connect them, or being able to determine that they have previously been in the proximity of one another by residence, or other.

[0017] Biographic information are historical facts about a person’s life such as her name, age, weight, occupation, social security or telephone number, date of birth, marital status, etc. Biometric information are biometric indicators of that person, such as fingerprints, dna, hand gestures, facial images, gait, iris, etc. Biometric information is linked to biographic information if it references the same person, such as when a facial image appears on an id card with the person’s home address, or when a video of a person walking is referenced by an article stating their name and describing their occupation.

[0018] The system is intended to operate on information in multiple forms; to illustrate by way of an example, we will use facial imagery as a specific type of available information. In this example, the integrated system may operate as follows.

[0019] In one embodiment of the invention, a user can capture a photograph of an individual at a party and submit it as a query into the system as shown in FIG. 7. (alternatively the user could enter certain biographical information and run the search off that information). The system will then return all information on the internet linking the image taken to other biometric or biographic information. Optionally, this information can be automatically summarized or returned first to a subsystem, which performs further manipulations before returning results to the user such as matching the return to existing databases of know individuals.
In one embodiment, the system comprises a computing component selected from the group consisting of a virtual machine and a computer (a physical machine). Each computer has at least one processor and at least one storage device.

A processor operable by the computing component executes a first program code stored in a storage device accessible by the computing component for: collecting from the user a first search query which contains identifying information about a first subject; collecting from the user a second search query which contains identifying information about a second subject; extracting a first set of biographic or biometric information from the first search query; extracting a second set of biographic or biometric information from the second search query; searching the body of information using the first set of biographic or biometric information to produce a first set of search results; searching the body of information using the second set of biographic or biometric information to produce a second set of search results; comparing the first set of search results with the second set of search results to produce a set of common search results; and displaying the set of common search results to the user.

Said search query identifying information may be from the group consisting of a digital images, digital video, digital audio, text, biometric information, or a plurality thereof.

Said biometric information may be from the group consisting of fingerprints, dna, hand gestures, facial images, handwriting, gait, iris, voice, or a plurality thereof. Other biometrics are well known to a person of ordinary skill in the art.

Said biographic information are historical facts about a person's life. A non-exclusive list of these facts are a person's name, alias, age, weight, occupation, social security number, identification number, telephone number, date of birth, marital status, or a plurality of. Other biographical information types are well known to a person of ordinary skill in the art.

All or a part of the methods described herein may be implemented as a computer program product that is a non-transitory computer-readable storage medium encoded with computer code that is executable by a processor.

The details of one or more embodiments of the subject matter of this specification are set forth in the drawings and descriptions contained herein. Other features, aspects, and advantages of the subject matter will become apparent from the description, drawings, and claims.

The subject matter of this specification functions in a variety of component combinations and contemplates all those types of components a person of ordinary skill in the art would find suitable for functions performed. The figures describe specific components in specific embodiments. However the range of types of components mentioned in the description of the figures may be applied to other embodiments as well.

The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting. As used herein, the singular forms “a,” “an,” and “the” are intended to include the plural forms as well, unless the context clearly indicates otherwise. The terms “comprises” and/or “comprising.” when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

The subject matter of this specification is described below with reference to system diagrams, flow diagrams, and screen mockups of systems, methods, and computer program products. Except where used in the claims, the term “system” refers broadly to the subject matter of this specification, including embodiments that are, systems, methods, or computer program products. Each block or combinations of blocks in the diagrams can be implemented by computer program code and may represent a module, segment, or portion of code. Program code may be written in any combination of one or more programming languages, including object oriented programming languages such as the JAVA®, SMALLTALK®, C++, C#, OBJECTIVE-C® programming languages and conventional procedural programming languages, such as the “C” programming language.

It should be noted that, in some alternative implementations, the functions noted in the blocks may occur out of the order noted in the figures. For example, two blocks shown in succession may, in fact, be executed substantially concurrently, or the blocks may sometimes be executed in the reverse order, depending upon the functionality involved. It will also be noted that each block or combination of blocks in the diagrams can be implemented by special purpose hardware-based systems that perform the specified functions or acts.

Computer program code may be provided to a processor or multiple processors of a computer to produce a particular machine, such that the program code, which executes via the processor, creates means for implementing the functions specified in the system diagrams, flow diagrams, and screen mockups.

The subject matter of this specification is implemented on one or more physical machines. Each physical machine is a computer comprising one or more processors and one or more storage devices; however a single processor and a single storage device are sufficient. A person of ordinary skill in the art will recognize the variety of types of computers suitable for the functions described, including desktops, laptops, handsets, smartphones, tablets, servers, or accessories incorporating computers such as watches, glasses, or wearable computerized shoes or textiles. A non-exhaustive list of specific examples of computers includes the following: Dell ALIENWARE™ desktops, Lenovo THINKPAD® laptops, SAMSUNG™ handsets, Google ANDROID™ smartphones, Apple IPAD® tablets, IBM BLADECENTER® blade servers, PEBBLE™ wearable computer watches, Google GLASS™ wearable computer glasses, or any other device having one or more processors and one or more storage devices, and capable of functioning as described in this specification.

A processor may be any device that accepts data as input, processes it according to instructions stored in a storage component, and provides results as output. A person of ordinary skill in the art will recognized the variety of types of processors suitable for the functions disclosed, including general purpose processing units and special purpose processing units. A non-exhaustive list of specific examples of processors includes the following: Qualcomm SNAPDRAGON™ processors; Nvidia TEGRA® 4 processors; Intel CORE™ i3, i5, and i7 processors; TEXAS INSTRUMENTS™ OMAP4430; ARM® Cortex-M3; and AMD OPTERON™ 6300, 4300, and 3300 Series processors. Each
computer may have a single processor or multiple processors operatively connected together (e.g. in the “cloud”).

A device is any type of non-transitory computer readable storage medium. A person of ordinary skill in the art will recognize the variety of types of storage devices suitable for the functions disclosed, including any electronic, magnetic, optical, electromagnetic, infrared, or semiconductor system or device, so long as it does not reduce to a transitory or propagating signal. A non-exhaustive list of specific examples of storage devices includes the following: portable computer diskettes, hard disks, random access memory, read-only memory, erasable programmable read-only memory, flash memory, optical fibers, portable compact disc read-only memory, optical storage devices, and magnetic storage devices. Each computer may have a single storage device or multiple storage devices operatively connected together (e.g. in the “cloud”).

This system may be implemented on one or more computers running one or more instances of a virtual machine. A virtual machine is a software implementation of a computer that executes programs like a physical machine. Thus a single physical machine may function conventionally as a physical computer, while also implementing a virtual machine that can perform the same processes as the physical computer. Multiple instances of a virtual machine may run on one computer or across multiple computers. A person of ordinary skill in the art will recognize the variety of types of virtual machines suitable for the functions disclosed, including system level virtual machines, process level virtual machines, fivective computers, and distributed computers. A non-exhaustive list of specific examples of virtual machines includes the following: VMWARE® virtual machines and Oracle VM VIRTUAL BOX™ virtual machines.

For the purposes of this specification, the term “computing component” means a computer, a virtual machine, or multiple computers or virtual machines functioning as a single component. The term “computer” is limited to physical machines. Generally a computer functions as a computing component by implementing an operating system through which program code, which implements the methods of this system, is executed. Generally, when a virtual machine functions as a computing component, a computer implements a hypervisor which implements a separate operating system, through which the program code is executed.

As referenced above, a single computer may implement multiple computing components, wherein the computer itself functions as a computing component and concurrently implements one or more instances of a virtual machine. Each virtual machine functions as a separate computing component. Similarly, a plurality of computing components may be made up of separate computers, none of which implement a virtual machine, or a plurality of computing components may be implemented on a single computer wherein only the virtual machines function as computing components. Additional combinations are contemplated as well, such as where a computing component is implemented across multiple computers. For example, a hypervisor of a virtual machine may manage the processors and storage devices of three computers to implement a virtual machine that functions as a single computing component. A person of ordinary skill in the art will recognize the range of combinations of computers and virtual machines that are suitable for the functions disclosed.

Each of the plurality of computing components, whether implemented as separate computers or on a single computer, are operatively connected to one another, such as by a communications network. One skilled in the art will recognize the appropriate media over which multiple computing components may be operatively connected to each other in a manner suitable for the functions disclosed, including as a communications network that allows the computing components to exchange data such that a process in one computing component is able to exchange information with a process in another computing component. The communications network may also be a virtual communications network managed by a hypervisor. A non-exhaustive list of specific examples of transmission media includes: serial or parallel bus systems, wireless, wireline, twisted pair, coaxial cable, optical fiber cable, radio frequency, microwave transmission, or any other electromagnetic transmission media. In addition computing components can be operatively connected using secure socket layer or HTTPS communications networks employing PKI techniques as described below.

The system allows for the collection of a set of biometric information from a subject. Biometric information is a distinctive, measurable, physiological and behavioral characteristic of an individual. A person of ordinary skill in the art will recognize the range of biometric information that can be collected and included in a set of biometric information suitable for the functions disclosed. A non-exhaustive list of specific examples of biometric information includes: iris, fingerprint, firnernal, hand, knuckle, palm, vascular, face, retina, deoxyribonucleic acid, odor, earlobe, sweat pore, lips, signature, keystroke, voice, eye vein, hand writing, and gait. A set of biometric information may consist entirely of one biometric type or modality, or multiple types or modalities.

The system collects the set of biometric information through one or more biometric collectors operatively connected to one or more of the plurality of computers. A person of ordinary skill in the art will recognize the range of biometric collection devices that are suitable to collect biometric information, including fingerprint readers, iris scanners, facial recognition imagers, and DNA samplers. A non-exhaustive list of specific examples of biometric collectors include the Fujitsu’s PS88 USB 2.0 fingerprint scanner, FBI FIPS 201 compliant fingerprint scanners, AOPTIX STRATUSTM iris scanners, FBI FIPS compliant iris scanners, the B12 MORISSTM facial recognition device, the Bode Technology BUCCAL DNA COLLECTORSTM, I-1 Identity Solution’s HIIDESTM device, Secure Planet’s BRAVSTM system, SRI International’s IRIS ON THE MOVE® systems, and Bayometric Inc.’s voice authentication system.

Records of biometric information associated individual are stored as biometric application databases in one or more storage devices. Databases are organized collections of data and include software applications that allow for the definition, creation, querying, update, and administration of the organized collections of data. A person of ordinary skill in the art will recognize the range of types of databases suitable for functions disclosed, including active databases, cloud databases, distributed databases, federated database systems, and unstructured database systems. A non-exhaustive list of specific examples of databases includes: MySQL, PostgreSQL, SQLite, MICROSOFT® SQL Server, Microsoft Access, Oracle, SAP, and IBM DB2.

The above components are described in greater detail below with reference to the figures. The descriptions
below set forth the various processes, relationships, and physical components of various embodiments of the subject matter of this specification.

[0043] FIG. 1 is a system diagram depicting core physical functionality and operating system functionality of a computer. Computer hardware 103 consists of a processor(s) 105, display device(s) 107, input device(s) 109, network device(s) 111, and storage device(s) 113. The operating system software 115 manages computer hardware resources and dictates the execution of all other software programs and processes. The operating system additionally controls the user interface 117, file system and memory management 119, access control 121, user applications 123, and network interface 125 of a functioning computer. The operating system can be multi-user, multiprocessor, multitasking, multithreading, real-time, and the like. The operating system performs basic tasks, including but not limited to: recognizing input from input device(s); sending output to display device(s); and keeping track of files and directories on storage device(s). The operating system includes various components for establishing and maintaining network connections (e.g., software for implementing communication protocols, such as TCP/IP, HTTP, Ethernet, USB, FireWire® protocols, etc.).

[0044] FIG. 2 is a flowchart depicting the subroutines in one embodiment of the Biometric Social Network “program code/system,” wherein linkages between persons are detected. A processor 105 operable by the computing component 101 executes a first program code stored in a storage device 113 accessible by the computing component. A graphical user interface is shown on the display 107. With the input device 109, the user inputs known data 1705 about the first subject. With the input device 109, the user then inputs known data 1707 about the second subject. In one embodiment, the data on both subjects may be entered concurrently. Said data may be biographical text information, digital media, biometric information, or biometric template information. Said data may also contain information about a person or persons other than subject 1, for example, a photograph containing subject 1 and one of subject 1’s known associates.

[0045] A first set of biographical search terms and biometric templates metadata 1710 are extracted from the first subject’s associated data 1705. The first set of metadata 1710 is submitted 1715 to a first search engine which searches a first database. In one embodiment, a search engine searches a plurality of databases. In an alternate embodiment, the metadata 1710 may be submitted to a plurality of search engines. In a parallel set of processes, a second set of biometric and biographical metadata will be extracted 1712 and submitted 1717 to the first search engine. In one embodiment, processes 1707, 1712, and 1717 may be executed after processes 1705, 1710, and 1715.

[0046] The first set of search results pertaining to the first set of metadata and the second set of search results pertaining to the second set of metadata are compared 1725 based on methods known to those of ordinary skill in the arts. In one embodiment, the intersection set of the first set of results and of the second set of results is calculated. A decision 1730 is made depending on the comparison. If any similarities are found 1735 (the intersection set is not empty), the intersection set is displayed on the users display device 107 and stored on the user’s storage device 113. If no similarities are found 1740 (the intersection set is empty), a message indicating that no links was found is displayed on the users display device 107.

[0047] It is understood by those of ordinary skill in the arts that portions of the processes may be run on a second or plurality of computers.

[0048] FIG. 3 is a system diagram depicting an embodiment showing functional components of the biometric search application 201. When embodiments of the invention run searches of biometric information, the subroutine depicted in FIG. 3 is one example of a component that executes the search. In this embodiment the biometric search application executes over a plurality of computing components. The biometric search application contains an operator user interface 211 that provides an interface for collecting biometric data, performing biometric searches, validating and managing PKI certificates, and configuring local and remote biometric application databases. The operator user interface also manages biometric template extraction using the biometric template extractor 217 and provides an interface to all supported biometric collectors 221.

[0049] FIG. 4 depicts the subroutine that is executed when multiple modalities of biometric information is collected. A simple collection would consist of collecting only one biometric modality from a subject. A segregated collection would consist of collecting a plurality of biometric modalities. FIG. 4 demonstrates a plurality of biometric modalities being collected by an accompanying biometric collector. The appropriate biometric collector must be operatively connected to a computing component and interface with the biometric search application. All data collected by the biometric collector is accepted as raw biometric data. The data received by a biometric collector may be associated with a particular data field, which will generally correspond to a specific biometric modality or a specific physical parameter of the biometric data collected (“type”). Data fields may be configured as needed by the nature of the biometric information required to be searched against. For example a biometric collector may collect a full set of ten-prints and have separate data fields for each finger collected as well as the set as a whole, or an imaging device may collect facial and iris information in a single collection but associate iris data as one data field and the facial data as a second data field. Based on these data fields, the type and modality of the biometric collected is determined.

[0050] After the data is collected, it is then segregated into subsets of biometric information associated with each biometric application database of the system. For example, there may be three entities controlling biometric application databases in the system. The first entity may have records associated with fingerprint biometrics, the second with facial biometrics, and the third with iris. In another example, all three participating organizations may control biometric application databases associated with fingerprint biometrics; however the first may only contain thumbprint data, while the other two contain full ten-print sets. In either example the original set of biometric information would be segregated into subsets consistent with the type and modality of biometric information associated with the biometric application databases of each participating organization. After segregation, the biometric information is sent to be generated into a biometric template using the appropriate template generation algorithm for that particular biometric type or modality.

[0051] FIG. 5 is a flow diagram depicting a template creation subroutine executed by biometric template extractor.
Raw biometric data such as a ten digit set of fingerprints is collected using a biometric collector. The minutiae that enable fingerprint identification are then extracted from the raw biometric data. The template creation algorithm associated with the modality to be searched against is selected and applied to the extracted features to generate the applicable searchable template for the type or modality. Software implementing biometric template generation algorithms are well known in the art, including the CROSS MATCH® fingerprint template generator and Neurotechnology MEGAMATCHER™ fingerprint template generator.

FIG. 6 depicts a flow diagram for the creation of a database of known individuals for reference purposes. The process collects a set of images, extracts identifiable biometric features from those images, identifies the personnel based on pre-existing biometric records of personnel, such as driver’s licenses or social media profiles, and compares newly collected images to find identifying biometrics and continue to build and update the database.

FIG. 7 depicts the basic subroutine for determining identifying information for a given individual whose biometric information is collected with an embodiment of the invention.

The description of the subject matter of this specification has been presented for purposes of illustration and description, and is not intended to be exhaustive or limited to the form disclosed. Many modifications and variations will be apparent to those of ordinary skill in the art. The embodiments were chosen and described in order to best explain the principles of the system, practical applications, and to enable others of ordinary skill in the art to understand various embodiments with various modifications as are suited to the particular use contemplated.

1. A system for providing social networking between users subscribing to said system from communication devices, said system comprising:
   a first program component having a access to a body of information comprising biographic a biometric information about people and operatively connected to a biometric collector for capturing additional biometric information;
   a second program component adaptable to search the body of information for information linking biometric and biographic information; and
   a third program component adaptable to identify other people by returning linked information in response to a query of biographic or biometric information entered by a user.

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