US 20250265867A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2025/0265867 A1**

Silva et al. (43) **Pub. Date: Aug. 21, 2025**

(54) **FACIAL MONITORING DATA ANONYMIZATION**

(71) Applicant: **International Business Machines Corporation**, Armonk, NY (US)

(72) Inventors: **Ashley Kristin Silva**, Durham, NC (US); **Frank Isaacs**, Wake Forest, NC (US); **Randy A. Rendahl**, Raleigh, NC (US)

(73) Assignee: **International Business Machines Corporation**, Armonk, NY (US)

(21) Appl. No.: **18/581,902**

(22) Filed: **Feb. 20, 2024**

Publication Classification

(51) **Int. Cl.**

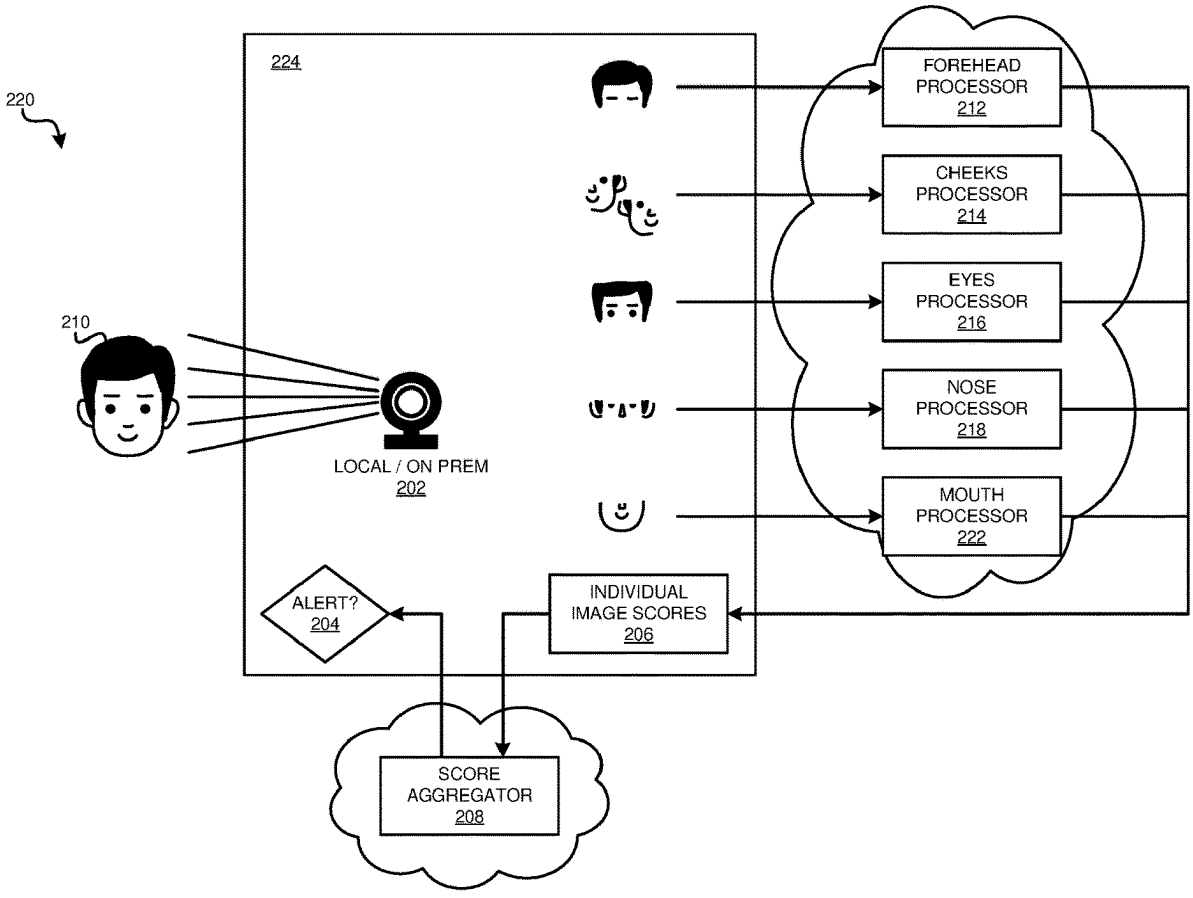
G06V 40/16	(2022.01)
G06F 21/62	(2013.01)
G06V 10/82	(2022.01)

(52) **U.S. Cl.**

CPC ***G06V 40/171*** (2022.01); ***G06F 21/6254*** (2013.01); ***G06V 10/82*** (2022.01); ***G06V 40/161*** (2022.01); ***G06V 40/172*** (2022.01)

(57) **ABSTRACT**

An embodiment includes detecting by a Detection Component of an Image Monitoring System an image of a subject. The embodiment includes responsive to detecting the image, sharding by a Sharding Component of the Image Monitoring System the image into an image shard based on a key point. The embodiment includes training by a Processor Component of the Image Monitoring System a machine learning model to generate an image score of the image shard based on a parameter and the image shard where the subject is anonymous to the Processor Component. The embodiment also includes determining by a Score Aggregator Component of the Image Monitoring System a monitoring action of the subject based on the image score.



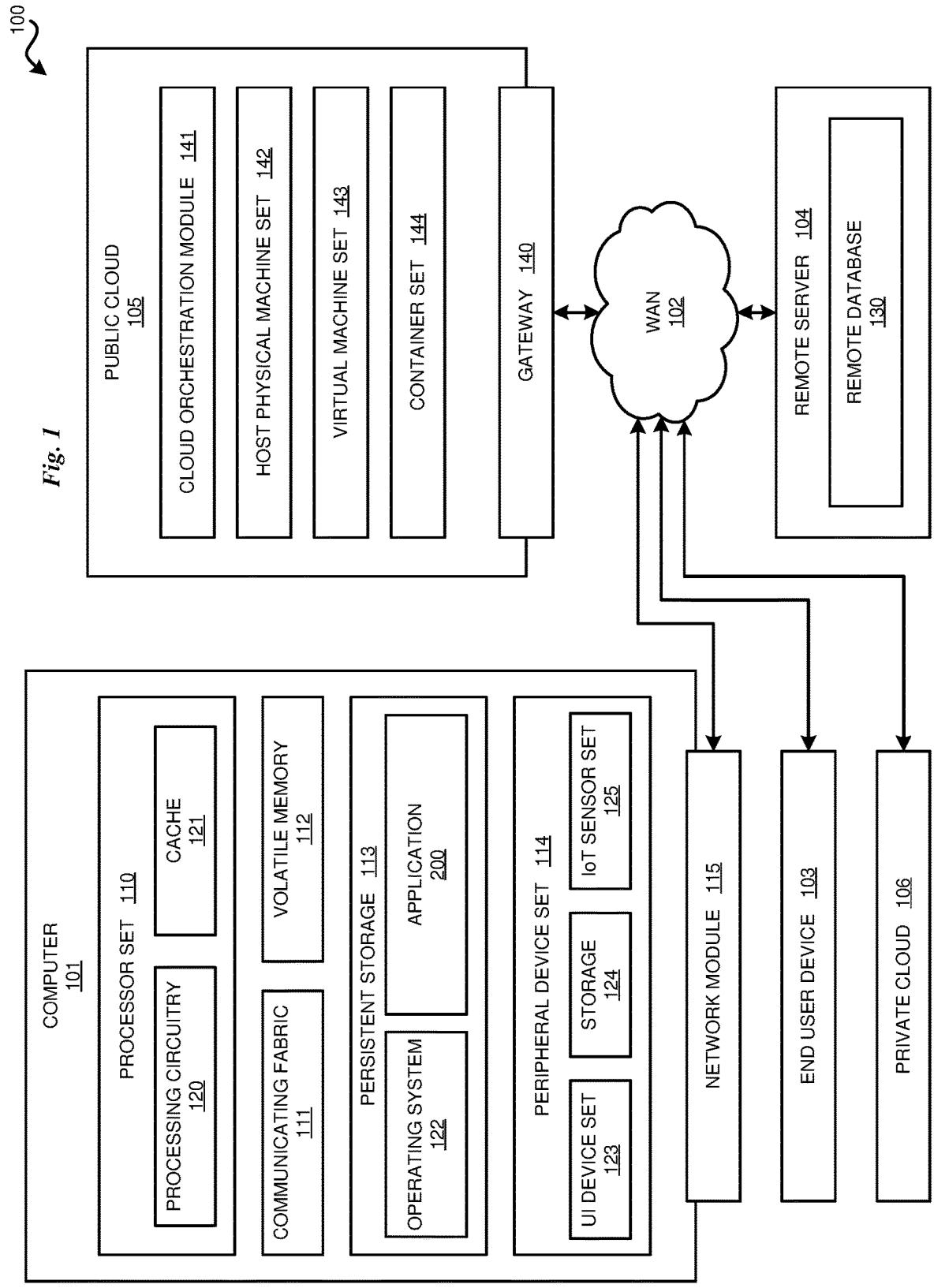

100
PUBLIC CLOUD 105
CLOUD ORCHESTRATION MODULE 141
HOST PHYSICAL MACHINE SET 142
VIRTUAL MACHINE SET 143
CONTAINER SET 144
GATEWAY 140
WAN 102
REMOTE SERVER 104
REMOTE DATABASE 130
COMPUTER 101
PROCESSOR SET 110
PROCESSING CIRCUITRY 120
CACHE 121
COMMUNICATING FABRIC 111
VOLATILE MEMORY 112
PERSISTENT STORAGE 113
OPERATING SYSTEM 122
APPLICATION 200
PERIPHERAL DEVICE SET 114
UI DEVICE SET 123
STORAGE 124
IoT SENSOR SET 125
NETWORK MODULE 115
END USER DEVICE 103
PRIVATE CLOUD 106

Fig. 1

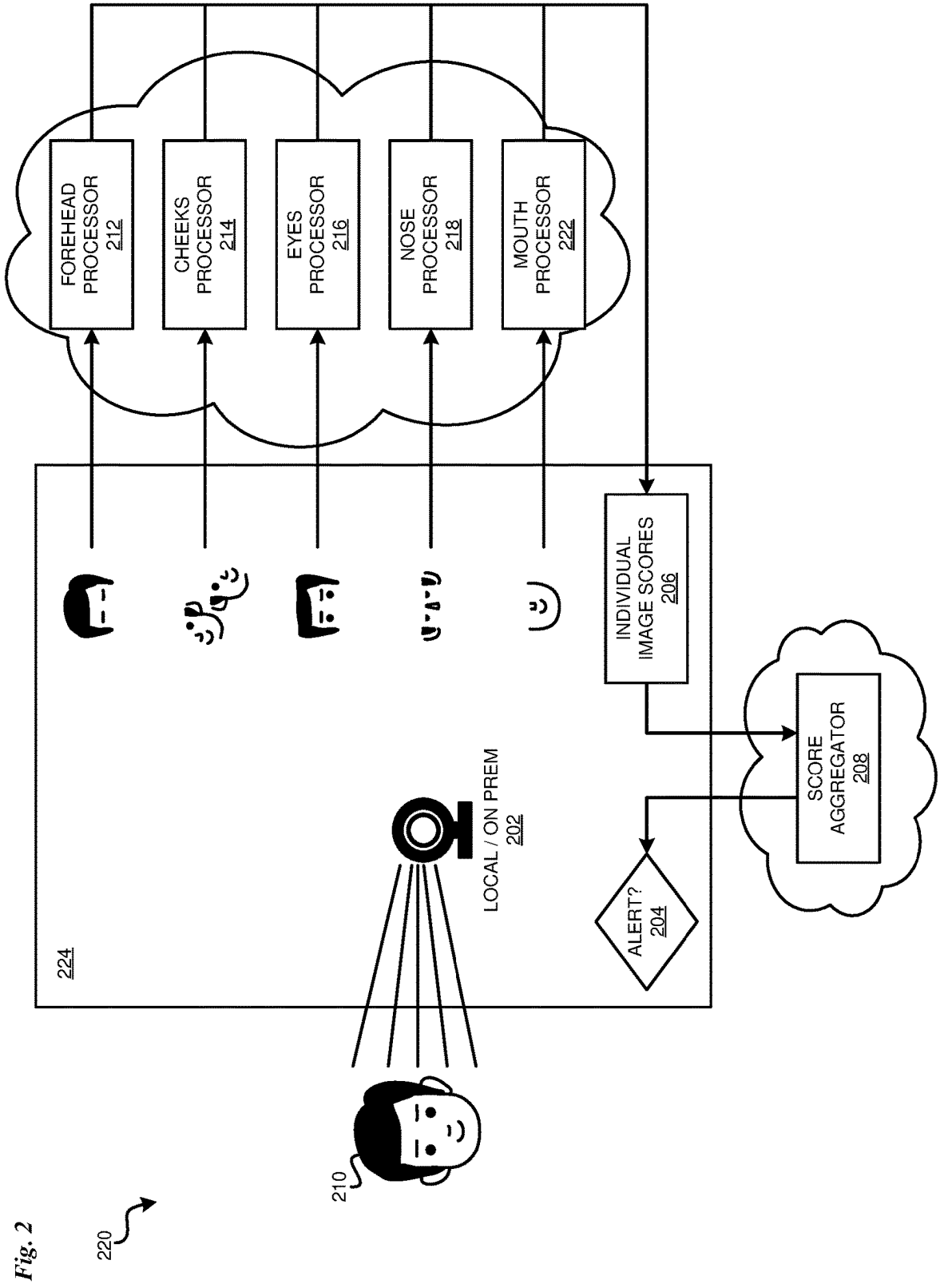

FOREHEAD PROCESSOR 212
CHEEKS PROCESSOR 214
EYES PROCESSOR 216
NOSE PROCESSOR 218
MOUTH PROCESSOR 222
INDIVIDUAL IMAGE SCORES 206
SCORE AGGREGATOR 208
ALERT? 204
LOCAL / ON PREM 202
224
210
220

Fig. 2

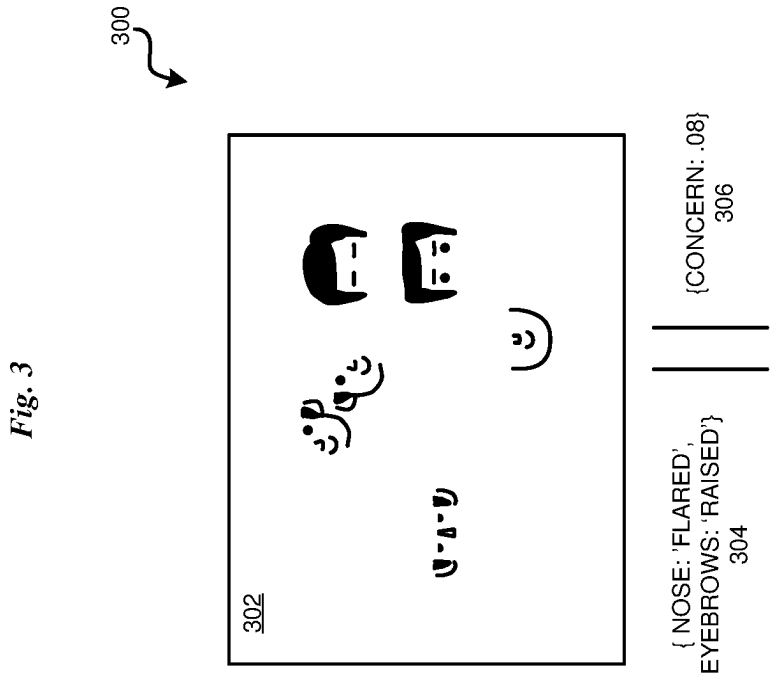


Fig. 3

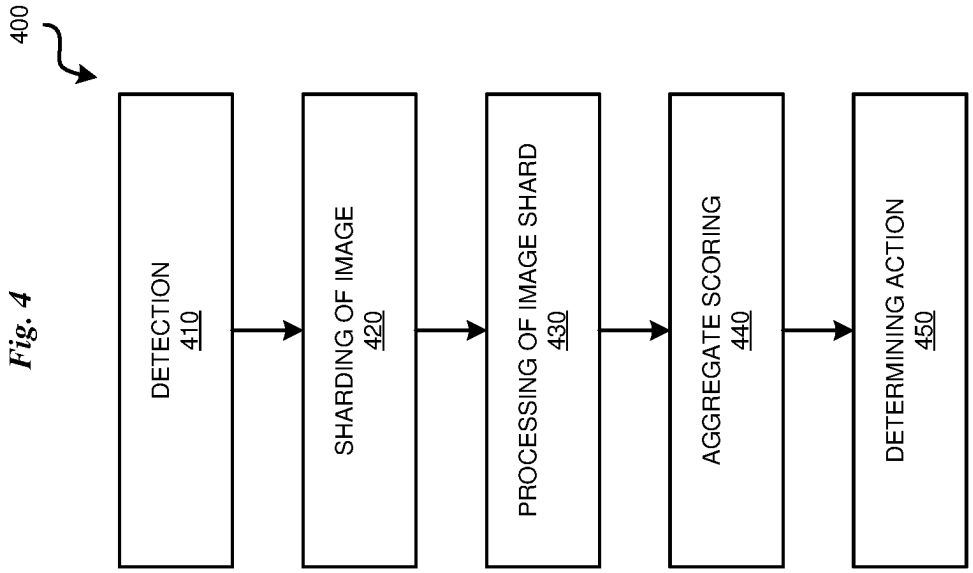

400
DETECTION
410
SHARDING OF IMAGE
420
PROCESSING OF IMAGE SHARD
430
AGGREGATE SCORING
440
DETERMINING ACTION
450

Fig. 4

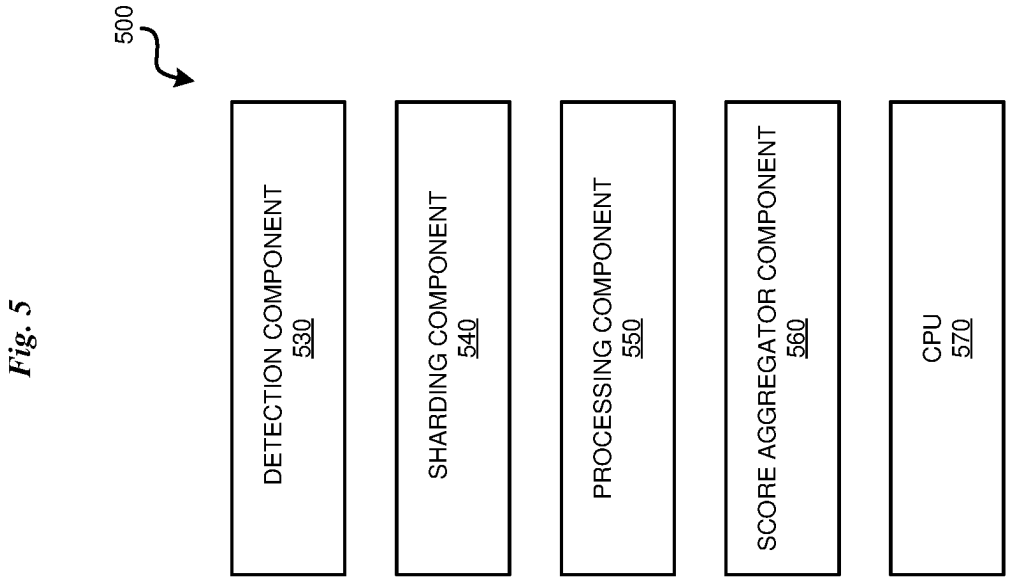

500
DETECTION COMPONENT
530
SHARDING COMPONENT
540
PROCESSING COMPONENT
550
SCORE AGGREGATOR COMPONENT
560
CPU
570

Fig. 5

FACIAL MONITORING DATA ANONYMIZATION

BACKGROUND

[0001] The present invention relates generally to artificial intelligence. More particularly, the present invention relates to a method, system, and computer program for Facial Monitoring Data Anonymization.

[0002] As technology has evolved to ever more capability in smaller and cheaper packages, it has brought about a revolution in monitoring such as baby monitoring, monitoring in hospitals, nursing homes, and airports. Cameras, processing power have been brought together by a variety of vendors to provide enhanced monitoring above the traditional audio/video monitoring that has long been the primary monitoring technology. The approaches vary and may include additional artifacts such as smart clothes or smart blankets.

SUMMARY

[0003] The illustrative embodiments provide for Facial Monitoring Data Anonymization. An embodiment includes detecting by a Detection Component of an Image Monitoring System an image of a subject. The embodiment includes responsive to detecting the image, sharding by a Sharding Component of the Image Monitoring System the image into an image shard based on a key point. The embodiment includes training by a Processor Component of the Image Monitoring System a machine learning model to generate an image score of the image shard based on a parameter and the image shard wherein the subject is anonymous to the Processor Component. The embodiment also includes determining by a Score Aggregator Component of the Image Monitoring System a monitoring action of the subject based on the image score.

[0004] An embodiment includes a computer usable program product. The computer usable program product includes a computer-readable storage medium, and program instructions stored on the storage medium.

[0005] An embodiment includes a computer system. The computer system includes a processor, a computer-readable memory, and a computer-readable storage medium, and program instructions stored on the storage medium for execution by the processor via the memory.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, however, as well as a preferred mode of use, further objectives, and advantages thereof, will best be understood by reference to the following detailed description of the illustrative embodiments when read in conjunction with the accompanying drawings, wherein:

[0007] FIG. **1** depicts a block diagram of a computing environment in accordance with an illustrative embodiment;

[0008] FIG. **2** depicts a diagram of a monitoring system in an environment in accordance with an illustrative embodiment;

[0009] FIG. **3** depicts a diagram in accordance with an illustrative embodiment;

[0010] FIG. **4** depicts a flowchart diagram in accordance with an illustrative embodiment; and

[0011] FIG. **5** depicts a system diagram in accordance with an illustrative embodiment.

DETAILED DESCRIPTION

[0012] As technology has evolved to ever more capability in smaller and cheaper packages, it has brought about a revolution in monitoring such as baby monitoring, monitoring in hospitals, nursing homes, and airports. Cameras, processing power have been brought together by a variety of vendors to provide enhanced monitoring above the traditional audio/video monitoring that has long been the primary monitoring technology. The approaches vary and may include additional artifacts such as smart clothes or smart blankets.

[0013] The present disclosure addresses the deficiencies described above by providing a method, a machine-readable medium, and a system for Facial Monitoring Data Anonymization. An embodiment includes detecting by a Detection Component of an Image Monitoring System an image of a subject. The embodiment includes responsive to detecting the image, sharding by a Sharding Component of the Image Monitoring System the image into an image shard based on a key point. The embodiment includes training by a Processor Component of the Image Monitoring System a machine learning model to generate an image score of the image shard based on a parameter and the image shard wherein the subject is anonymous to the Processor Component. The embodiment also includes determining by a Score Aggregator Component of the Image Monitoring System a monitoring action of the subject based on the image score.

[0014] Illustrative embodiments include wherein the image score is in part based on a characteristic of an adjacent image shard.

[0015] Illustrative embodiments include wherein the Processor Component is selected based on a confidence score.

[0016] Illustrative embodiments include wherein the key point comprises a feature of the subject.

[0017] Illustrative embodiments include wherein the parameter comprises a requested image score.

[0018] Illustrative embodiments include wherein the Processor Component is deployed in a cloud.

[0019] Illustrative embodiments also include wherein the machine learning model implements a convolutional neural network algorithm.

[0020] For the sake of clarity of the description, and without implying any limitation thereto, the illustrative embodiments are described using some example configurations. From this disclosure, those of ordinary skill in the art will be able to conceive many alterations, adaptations, and modifications of a described configuration for achieving a described purpose, and the same are contemplated within the scope of the illustrative embodiments.

[0021] Furthermore, simplified diagrams of the data processing environments are used in the figures and the illustrative embodiments. In an actual computing environment, additional structures or components that are not shown or described herein, or structures or components different from those shown but for a similar function as described herein may be present without departing the scope of the illustrative embodiments.

[0022] Furthermore, the illustrative embodiments are described with respect to specific actual or hypothetical components only as examples. Any specific manifestations of these and other similar artifacts are not intended to be

limiting to the invention. Any suitable manifestation of these and other similar artifacts can be selected within the scope of the illustrative embodiments.

[0023] The examples in this disclosure are used only for the clarity of the description and are not limiting to the illustrative embodiments. Any advantages listed herein are only examples and are not intended to be limiting to the illustrative embodiments. Additional or different advantages may be realized by specific illustrative embodiments. Furthermore, a particular illustrative embodiment may have some, all, or none of the advantages listed above.

[0024] Furthermore, the illustrative embodiments may be implemented with respect to any type of data, data source, or access to a data source over a data network. Any type of data storage device may provide the data to an embodiment of the invention, either locally at a data processing system or over a data network, within the scope of the invention. Where an embodiment is described using a mobile device, any type of data storage device suitable for use with the mobile device may provide the data to such embodiment, either locally at the mobile device or over a data network, within the scope of the illustrative embodiments.

[0025] The illustrative embodiments are described using specific code, computer readable storage media, high-level features, designs, architectures, protocols, layouts, schematics, and tools only as examples and are not limiting to the illustrative embodiments. Furthermore, the illustrative embodiments are described in some instances using particular software, tools, and data processing environments only as an example for the clarity of the description. The illustrative embodiments may be used in conjunction with other comparable or similarly purposed structures, systems, applications, or architectures. For example, other comparable mobile devices, structures, systems, applications, or architectures therefor, may be used in conjunction with such embodiment of the invention within the scope of the invention. An illustrative embodiment may be implemented in hardware, software, or a combination thereof.

[0026] The examples in this disclosure are used only for the clarity of the description and are not limiting to the illustrative embodiments. Additional data, operations, actions, tasks, activities, and manipulations will be conceivable from this disclosure and the same are contemplated within the scope of the illustrative embodiments.

[0027] Various aspects of the present disclosure are described by narrative text, flowcharts, block diagrams of computer systems and/or block diagrams of the machine logic included in computer program product (CPP) embodiments. With respect to any flowcharts, depending upon the technology involved, the operations can be performed in a different order than what is shown in a given flowchart. For example, again depending upon the technology involved, two operations shown in successive flowchart blocks may be performed in reverse order, as a single integrated step, concurrently, or in a manner at least partially overlapping in time.

[0028] A computer program product embodiment ("CPP embodiment" or "CPP") is a term used in the present disclosure to describe any set of one, or more, storage media (also called "mediums") collectively included in a set of one, or more, storage devices that collectively include machine readable code corresponding to instructions and/or data for performing computer operations specified in a given CPP claim. A "storage device" is any tangible device that can retain and store instructions for use by a computer processor. Without limitation, the computer readable storage medium may be an electronic storage medium, a magnetic storage medium, an optical storage medium, an electromagnetic storage medium, a semiconductor storage medium, a mechanical storage medium, or any suitable combination of the foregoing. Some known types of storage devices that include these mediums include: diskette, hard disk, random access memory (RAM), read-only memory (ROM), erasable programmable read-only memory (EPROM or Flash memory), static random-access memory (SRAM), compact disc read-only memory (CD-ROM), digital versatile disk (DVD), memory stick, floppy disk, mechanically encoded device (such as punch cards or pits/lands formed in a major surface of a disc) or any suitable combination of the foregoing. A computer readable storage medium, as that term is used in the present disclosure, is not to be construed as storage in the form of transitory signals per se, such as radio waves or other freely propagating electromagnetic waves, electromagnetic waves propagating through a waveguide, light pulses passing through a fiber optic cable, electrical signals communicated through a wire, and/or other transmission media. As will be understood by those of skill in the art, data is typically moved at some occasional points in time during normal operations of a storage device, such as during access, de-fragmentation or garbage collection, but this does not render the storage device as transitory because the data is not transitory while it is stored.

[0029] With reference to FIG. **1**, this figure depicts a block diagram of a computing environment **100**. Data center environment **100** contains an example of an environment for the execution of at least some of the computer code involved in performing the inventive methods, such as an Application module **200** that provides Facial Monitoring Data Anonymization. In addition to block **200**, computing environment **100** includes, for example, computer **101**, wide area network (WAN) **102**, end user device (EUD) **103**, remote server **104**, public cloud **105**, and private cloud **106**. In this embodiment, computer **101** includes processor set **110** (including processing circuitry **120** and cache **121**), communication fabric **111**, volatile memory **112**, persistent storage **113** (including operating system **122** and block **200**, as identified above), peripheral device set **114** (including user interface (UI) device set **123**, storage **124**, and Internet of Things (IoT) sensor set **125**), and network module **115**. Remote server **104** includes remote database **130**. Public cloud **105** includes gateway **140**, cloud orchestration module **141**, host physical machine set **142**, virtual machine set **143**, and container set **144**.

[0030] COMPUTER **101** may take the form of a desktop computer, laptop computer, tablet computer, smart phone, smart watch or other wearable computer, mainframe computer, quantum computer or any other form of computer or mobile device now known or to be developed in the future that is capable of running a program, accessing a network or querying a database, such as remote database **130**. As is well understood in the art of computer technology, and depending upon the technology, performance of a computer-implemented method may be distributed among multiple computers and/or between multiple locations. On the other hand, in this presentation of computing environment **100**, detailed discussion is focused on a single computer, specifically computer **101**, to keep the presentation as simple as possible. Computer **101** may be located in a cloud, even though it is

not shown in a cloud in FIG. **1**. On the other hand, computer **101** is not required to be in a cloud except to any extent as may be affirmatively indicated.

[0031] PROCESSOR SET **110** includes one, or more, computer processors of any type now known or to be developed in the future. Processing circuitry **120** may be distributed over multiple packages, for example, multiple, coordinated integrated circuit chips. Processing circuitry **120** may implement multiple processor threads and/or multiple processor cores. Cache **121** is memory that is located in the processor chip package(s) and is typically used for data or code that should be available for rapid access by the threads or cores running on processor set **110**. Cache memories are typically organized into multiple levels depending upon relative proximity to the processing circuitry. Alternatively, some, or all, of the cache for the processor set may be located "off chip." In some computing environments, processor set **110** may be designed for working with qubits and performing quantum computing.

[0032] Computer readable program instructions are typically loaded onto computer **101** to cause a series of operational steps to be performed by processor set **110** of computer **101** and thereby effect a computer-implemented method, such that the instructions thus executed will instantiate the methods specified in flowcharts and/or narrative descriptions of computer-implemented methods included in this document (collectively referred to as "the inventive methods"). These computer readable program instructions are stored in various types of computer readable storage media, such as cache **121** and the other storage media discussed below. The program instructions, and associated data, are accessed by processor set **110** to control and direct performance of the inventive methods. In computing environment **100**, at least some of the instructions for performing the inventive methods may be stored in block **200** in persistent storage **113**.

[0033] COMMUNICATION FABRIC **111** is the signal conduction path that allows the various components of computer **101** to communicate with each other. Typically, this fabric is made of switches and electrically conductive paths, such as the switches and electrically conductive paths that make up buses, bridges, physical input/output ports and the like. Other types of signal communication paths may be used, such as fiber optic communication paths and/or wireless communication paths.

[0034] VOLATILE MEMORY **112** is any type of volatile memory now known or to be developed in the future. Examples include dynamic type random access memory (RAM) or static type RAM. Typically, volatile memory **112** is characterized by random access, but this is not required unless affirmatively indicated. In computer **101**, the volatile memory **112** is located in a single package and is internal to computer **101**, but, alternatively or additionally, the volatile memory may be distributed over multiple packages and/or located externally with respect to computer **101**.

[0035] PERSISTENT STORAGE **113** is any form of non-volatile storage for computers that is now known or to be developed in the future. The non-volatility of this storage means that the stored data is maintained regardless of whether power is being supplied to computer **101** and/or directly to persistent storage **113**. Persistent storage **113** may be a read only memory (ROM), but typically at least a portion of the persistent storage allows writing of data, deletion of data and re-writing of data. Some familiar forms of persistent storage include magnetic disks and solid state storage devices. Operating system **122** may take several forms, such as various known proprietary operating systems or open source Portable Operating System Interface-type operating systems that employ a kernel. The code included in block **200** typically includes at least some of the computer code involved in performing the inventive methods.

[0036] PERIPHERAL DEVICE SET **114** includes the set of peripheral devices of computer **101**. Data communication connections between the peripheral devices and the other components of computer **101** may be implemented in various ways, such as Bluetooth connections, Near-Field Communication (NFC) connections, connections made by cables (such as universal serial bus (USB) type cables), insertion-type connections (for example, secure digital (SD) card), connections made through local area communication networks and even connections made through wide area networks such as the internet. In various embodiments, UI device set **123** may include components such as a display screen, speaker, microphone, wearable devices (such as goggles and smart watches), keyboard, mouse, printer, touchpad, game controllers, and haptic devices. Storage **124** is external storage, such as an external hard drive, or insertable storage, such as an SD card. Storage **124** may be persistent and/or volatile. In some embodiments, storage **124** may take the form of a quantum computing storage device for storing data in the form of qubits. In embodiments where computer **101** is required to have a large amount of storage (for example, where computer **101** locally stores and manages a large database) then this storage may be provided by peripheral storage devices designed for storing very large amounts of data, such as a storage area network (SAN) that is shared by multiple, geographically distributed computers. IoT sensor set **125** is made up of sensors that can be used in Internet of Things applications. For example, one sensor may be a thermometer and another sensor may be a motion detector.

[0037] NETWORK MODULE **115** is the collection of computer software, hardware, and firmware that allows computer **101** to communicate with other computers through WAN **102**. Network module **115** may include hardware, such as modems or Wi-Fi signal transceivers, software for packetizing and/or de-packetizing data for communication network transmission, and/or web browser software for communicating data over the internet. In some embodiments, network control functions and network forwarding functions of network module **115** are performed on the same physical hardware device. In other embodiments (for example, embodiments that utilize software-defined networking (SDN)), the control functions and the forwarding functions of network module **115** are performed on physically separate devices, such that the control functions manage several different network hardware devices. Computer readable program instructions for performing the inventive methods can typically be downloaded to computer **101** from an external computer or external storage device through a network adapter card or network interface included in network module **115**.

[0038] WAN **102** is any wide area network (for example, the internet) capable of communicating computer data over non-local distances by any technology for communicating computer data, now known or to be developed in the future. In some embodiments, the WAN **012** may be replaced and/or supplemented by local area networks (LANs) designed to

communicate data between devices located in a local area, such as a Wi-Fi network. The WAN and/or LANs typically include computer hardware such as copper transmission cables, optical transmission fibers, wireless transmission, routers, firewalls, switches, gateway computers and edge servers.

[0039] END USER DEVICE (EUD) **103** is any computer system that is used and controlled by an end user (for example, a customer of an enterprise that operates computer **101**), and may take any of the forms discussed above in connection with computer **101**. EUD **103** typically receives helpful and useful data from the operations of computer **101**. For example, in a hypothetical case where computer **101** is designed to provide a recommendation to an end user, this recommendation would typically be communicated from network module **115** of computer **101** through WAN **102** to EUD **103**. In this way, EUD **103** can display, or otherwise present, the recommendation to an end user. In some embodiments, EUD **103** may be a client device, such as thin client, heavy client, mainframe computer, desktop computer and so on.

[0040] REMOTE SERVER **104** is any computer system that serves at least some data and/or functionality to computer **101**. Remote server **104** may be controlled and used by the same entity that operates computer **101**. Remote server **104** represents the machine(s) that collect and store helpful and useful data for use by other computers, such as computer **101**. For example, in a hypothetical case where computer **101** is designed and programmed to provide a recommendation based on historical data, then this historical data may be provided to computer **101** from remote database **130** of remote server **104**.

[0041] PUBLIC CLOUD **105** is any computer system available for use by multiple entities that provides on-demand availability of computer system resources and/or other computer capabilities, especially data storage (cloud storage) and computing power, without direct active management by the user. Cloud computing typically leverages sharing of resources to achieve coherence and economies of scale. The direct and active management of the computing resources of public cloud **105** is performed by the computer hardware and/or software of cloud orchestration module **141**. The computing resources provided by public cloud **105** are typically implemented by virtual computing environments that run on various computers making up the computers of host physical machine set **142**, which is the universe of physical computers in and/or available to public cloud **105**. The virtual computing environments (VCEs) typically take the form of virtual machines from virtual machine set **143** and/or containers from container set **144**. It is understood that these VCEs may be stored as images and may be transferred among and between the various physical machine hosts, either as images or after instantiation of the VCE. Cloud orchestration module **141** manages the transfer and storage of images, deploys new instantiations of VCEs and manages active instantiations of VCE deployments. Gateway **140** is the collection of computer software, hardware, and firmware that allows public cloud **105** to communicate through WAN **102**.

[0042] Some further explanation of virtualized computing environments (VCEs) will now be provided. VCEs can be stored as "images." A new active instance of the VCE can be instantiated from the image. Two familiar types of VCEs are virtual machines and containers. A container is a VCE that uses operating-system-level virtualization. This refers to an operating system feature in which the kernel allows the existence of multiple isolated user-space instances, called containers. These isolated user-space instances typically behave as real computers from the point of view of programs running in them. A computer program running on an ordinary operating system can utilize all resources of that computer, such as connected devices, files and folders, network shares, CPU power, and quantifiable hardware capabilities. However, programs running inside a container can only use the contents of the container and devices assigned to the container, a feature which is known as containerization.

[0043] PRIVATE CLOUD **106** is similar to public cloud **105**, except that the computing resources are only available for use by a single enterprise. While private cloud **106** is depicted as being in communication with WAN **102**, in other embodiments a private cloud may be disconnected from the internet entirely and only accessible through a local/private network. A hybrid cloud is a composition of multiple clouds of different types (for example, private, community or public cloud types), often respectively implemented by different vendors. Each of the multiple clouds remains a separate and discrete entity, but the larger hybrid cloud architecture is bound together by standardized or proprietary technology that enables orchestration, management, and/or data/application portability between the multiple constituent clouds. In this embodiment, public cloud **105** and private cloud **106** are both part of a larger hybrid cloud.

[0044] Measured service: cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts). Resource usage can be monitored, controlled, reported, and invoiced, providing transparency for both the provider and consumer of the utilized service.

[0045] The process software Facial Monitoring Data Anonymization is shared, simultaneously serving multiple customers in a flexible, automated fashion. It is standardized, requiring little customization, and it is scalable, providing capacity on demand in a pay-as-you-go model.

[0046] The process software can be stored on a shared file system accessible from one or more servers. The process software is executed via transactions that contain data and server processing requests that use CPU units on the accessed server. CPU units are units of time, such as minutes, seconds, and hours, on the central processor of the server. Additionally, the accessed server may make requests of other servers that require CPU units. CPU units are an example that represents but one measurement of use. Other measurements of use include, but are not limited to, network bandwidth, memory usage, storage usage, packet transfers, complete transactions, etc.

[0047] When multiple customers use the same process software application, their transactions are differentiated by the parameters included in the transactions that identify the unique customer and the type of service for that customer. All of the CPU units and other measurements of use that are used for the services for each customer are recorded. When the number of transactions to any one server reaches a number that begins to affect the performance of that server, other servers are accessed to increase the capacity and to share the workload. Likewise, when other measurements of use, such as network bandwidth, memory usage, storage

usage, etc., approach a capacity so as to affect performance, additional network bandwidth, memory usage, storage, etc. are added to share the workload.

[0048] The measurements of use employed for each service and customer are sent to a collecting server that sums the measurements of use for each customer for each service that was processed anywhere in the network of servers that provide the shared execution of the process software. The summed measurements of use units are periodically multiplied by unit costs, and the resulting total process software application service costs are alternatively sent to the customer and/or indicated on a web site accessed by the customer, who may then remit payment to the service provider.

[0049] In another embodiment, the service provider requests payment directly from a customer account at a banking or financial institution.

[0050] In another embodiment, if the service provider is also a customer of the customer that uses the process software application, the payment owed to the service provider is reconciled to the payment owed by the service provider to minimize the transfer of payments.

[0051] FIG. **2** depicts a diagram of a monitoring system in an environment **224** in accordance with an illustrative embodiment. In a particular embodiment, the diagram shows aspects of the application **200** of FIG. **1**.

[0052] In the illustrated embodiment, the local on premises sensor **202** detects the monitored subject **210**. The detected image is sharded into image shards of the forehead, cheeks, eyes, nose, and mouth. The image shards are processed by the Forehead Processor **212**, Cheeks Processor **214**, Eyes Processor **216**, Nose Processor **218**, and Mouth Processor **222**, respectively, and individual image scores **206** generated. The score aggregator **208** aggregates the scores and a decision is made whether to take action for example by sending alerts **204**.

[0053] FIG. **3** depicts a diagram **300** in accordance with an illustrative embodiment. In a particular embodiment, the diagram shows aspects of the application **200** of FIG. **1**.

[0054] In the illustrated embodiment, the image shards **302** with observed conditions **304** are processed and a score generated for each image shard. In an embodiment, the scores are aggregated and a determination made whether to take action **306**.

[0055] FIG. **4** depicts a flowchart diagram in accordance with an illustrative embodiment. In a particular embodiment, the components **400** are representative of aspects of the application **200** of FIG. **1**.

[0056] In the illustrated embodiment, the Detection Component of the Image Monitoring System detects the subject's image **410**. In embodiments, the detection is performed through the use of sensors and cameras. Responsive to detection of the image, the sharding of the image is performed by the Sharding Component **420**. In embodiments, the sharding is performed based on key points, such as features of the subject including eyes, nose, mouth, and cheeks such that the image shards are anonymous and independent of each other. In some embodiments, the Sharding Component may remove any personally identifiable information from the image shard. The image shard is processed by the Processor Component **430** of the Image Monitoring System. In embodiments, the Processor Component is selected based on a confidence score. Due to the individual images being anonymous, the Image Monitoring System may be a series of API calls to multiple processor components. In this way, a confidence score may be developed by the Image Monitoring System, for example, processor A is preferred for eye images, and processor B is preferred for mouth images. The Image Monitoring System may also intentionally only provide a small percentage of images to any individual processor.

[0057] In embodiments, the Processor Component comprises a machine learning model trained to generate an image score of the monitored image based on a parameter such as Type of subject, for example: infant, toddler, child, adult, ICU patient; Requested score(s): is the subject crying, breathing, fever, position, bruising, etc.; Score type: internal, or one or more "adjacency" scores; Environment: describing the conditions under which the image shard were taken, for example low light, sleeping, awake, outdoor, hospital, playground, classroom, rain, dry, or temperature; Personal adjustment factors: skin tone in standardized light, hair color, weight, distinguishing features such as scars or scabs. In embodiments, the machine learning model may implement algorithms including k-nearest neighbors (KNN), clustering or Convolutional Neural Network (CNN) to generate the image score. The generated score for example may comprise a self-contained score: an evaluation of the likelihood of desired conditions being present in the full image based solely on an image shard; adjacency score: the score based on the characteristics of another image if it is adjacent to the image shard. For example, when evaluating eyes, open vs. closed may have a different value if the characteristic of the adjacent to a nose shard is a runny nose vs. a clear, dry nose. Or when the environment indicator shows that the expected condition is "sleeping", the response would be negative if eyes are indicated sufficiently open to suggest being awake; or a condition score; and additional score that does not depend on position of this image, but rather provides additional info if other conditions are present. For example, if the skin appears wet and there is an indicator of outdoor weather being rainy, no additional score is provided, but if conditions are either indoor or otherwise dry (sunny day), wet skin might indicate sweat or tears are present, and provide a higher score. The generated score is aggregated in the aggregate scores step **440** and the monitoring action determined **450** such as whether to raise alert about the monitored subject.

[0058] FIG. **5** depicts a system diagram **500** in accordance with an illustrative embodiment. In a particular embodiment, the system components **500** are representative of aspects of the application **200** of FIG. **1**.

[0059] In the illustrated embodiment, the Detection Component **530** of an Image Monitoring System detects an image of a subject. Responsive to detecting the image, sharding by the Sharding Component **540** the image into an image shard based on a key point. A machine learning model is trained by the Processor Component **550** based on a parameter and the image shard to generate an image score. In some embodiments, training the machine learning model further comprises training based on a corpus of historical image shards and parameters. The Score Aggregator Component **560** aggregates the image scores and the monitoring decision is made. A central processing unit (CPU) **570** performs operations on the various components.

[0060] The following definitions and abbreviations are to be used for the interpretation of the claims and the specification. As used herein, the terms "comprises," "comprising,"

"includes," "including," "has," "having," "contains" or "containing," or any other variation thereof, are intended to cover a non-exclusive inclusion. For example, a composition, a mixture, process, method, article, or apparatus that comprises a list of elements is not necessarily limited to only those elements but can include other elements not expressly listed or inherent to such composition, mixture, process, method, article, or apparatus.

[0061] Additionally, the term "illustrative" is used herein to mean "serving as an example, instance or illustration." Any embodiment or design described herein as "illustrative" is not necessarily to be construed as preferred or advantageous over other embodiments or designs. The terms "at least one" and "one or more" are understood to include any integer number greater than or equal to one, i.e., one, two, three, four, etc. The terms "a plurality" are understood to include any integer number greater than or equal to two, i.e., two, three, four, five, etc. The term "connection" can include an indirect "connection" and a direct "connection."

[0062] References in the specification to "one embodiment," "an embodiment," "an example embodiment," etc., indicate that the embodiment described can include a particular feature, structure, or characteristic, but every embodiment may or may not include the particular feature, structure, or characteristic. Moreover, such phrases are not necessarily referring to the same embodiment. Further, when a particular feature, structure, or characteristic is described in connection with an embodiment, it is submitted that it is within the knowledge of one skilled in the art to affect such feature, structure, or characteristic in connection with other embodiments whether or not explicitly described.

[0063] The terms "about," "substantially," "approximately," and variations thereof, are intended to include the degree of error associated with measurement of the particular quantity based upon the equipment available at the time of filing the application. For example, "about" can include a range of +8% or 5%, or 2% of a given value.

[0064] The descriptions of the various embodiments of the present invention have been presented for purposes of illustration but are not intended to be exhaustive or limited to the embodiments disclosed. Many modifications and variations will be apparent to those of ordinary skill in the art without departing from the scope and spirit of the described embodiments. The terminology used herein was chosen to best explain the principles of the embodiments, the practical application or technical improvement over technologies found in the marketplace, or to enable others of ordinary skill in the art to understand the embodiments described herein.

[0065] The descriptions of the various embodiments of the present invention have been presented for purposes of illustration but are not intended to be exhaustive or limited to the embodiments disclosed. Many modifications and variations will be apparent to those of ordinary skill in the art without departing from the scope and spirit of the described embodiments. The terminology used herein was chosen to best explain the principles of the embodiments, the practical application or technical improvement over technologies found in the marketplace, or to enable others of ordinary skill in the art to understand the embodiments described herein.

[0066] Thus, a computer implemented method, system or apparatus, and computer program product are provided in the illustrative embodiments for managing participation in online communities and other related features, functions, or operations. Where an embodiment or a portion thereof is described with respect to a type of device, the computer implemented method, system or apparatus, the computer program product, or a portion thereof, are adapted or configured for use with a suitable and comparable manifestation of that type of device.

[0067] Where an embodiment is described as implemented in an application, the delivery of the application in a Software as a Service (SaaS) model is contemplated within the scope of the illustrative embodiments. In a SaaS model, the capability of the application implementing an embodiment is provided to a user by executing the application in a cloud infrastructure. The user can access the application using a variety of client devices through a thin client interface such as a web browser (e.g., web-based e-mail), or other light-weight client-applications. The user does not manage or control the underlying cloud infrastructure including the network, servers, operating systems, or the storage of the cloud infrastructure. In some cases, the user may not even manage or control the capabilities of the SaaS application. In some other cases, the SaaS implementation of the application may permit a possible exception of limited user-specific application configuration settings.

[0068] Embodiments of the present invention may also be delivered as part of a service engagement with a client corporation, nonprofit organization, government entity, internal organizational structure, or the like. Aspects of these embodiments may include configuring a computer system to perform, and deploying software, hardware, and web services that implement, some or all of the methods described herein. Aspects of these embodiments may also include analyzing the client's operations, creating recommendations responsive to the analysis, building systems that implement portions of the recommendations, integrating the systems into existing processes and infrastructure, metering use of the systems, allocating expenses to users of the systems, and billing for use of the systems. Although the above embodiments of present invention each have been described by stating their individual advantages, respectively, present invention is not limited to a particular combination thereof. To the contrary, such embodiments may also be combined in any way and number according to the intended deployment of present invention without losing their beneficial effects.

What is claimed is:

1. A computer-implemented method comprising:

detecting by a Detection Component of an Image Monitoring System an image of a subject;

responsive to detecting the image, sharding by a Sharding Component of the Image Monitoring System the image into an image shard based on a key point;

training by a Processor Component of the Image Monitoring System a machine learning model to generate an image score of the image shard based on a parameter and the image shard wherein the subject is anonymous to the Processor Component; and

determining by a Score Aggregator Component of the Image Monitoring System a monitoring action of the subject based on the image score.

2. The computer-implemented method of claim **1**, wherein the image score is in part based on a characteristic of an adjacent image shard.

3. The computer-implemented method of claim 1, wherein the Processor Component is selected based on a confidence score.

4. The computer-implemented method of claim 1, wherein the key point comprises a feature of the subject.

5. The computer-implemented method of claim 1, wherein the parameter comprises a requested image score.

6. The computer-implemented method of claim 1, wherein the Processor Component is deployed in a cloud.

7. The computer-implemented method of claim 1, wherein the machine learning model implements a convolutional neural network algorithm.

8. A computer program product comprising one or more computer readable storage media, and program instructions collectively stored on the one or more computer readable storage media, the program instructions executable by a processor to cause the processor to perform operations comprising:

detecting by a Detection Component of an Image Monitoring System an image of a subject;

responsive to detecting the image, sharding by a Sharding Component of the Image Monitoring System the image into an image shard based on a key point;

training by a Processor Component of the Image Monitoring System a machine learning model to generate an image score of the image shard based on a parameter and the image shard wherein the subject is anonymous to the Processor Component; and

determining by a Score Aggregator Component of the Image Monitoring System a monitoring action of the subject based on the image score.

9. The computer program product of claim 8, wherein the image score is in part based on a characteristic of an adjacent image shard.

10. The computer program product of claim 8, wherein the Processor Component is selected based on a confidence score.

11. The computer program product of claim 8, wherein the key point comprises a feature of the subject.

12. The computer program product of claim 8, wherein the parameter comprises a requested image score.

13. The computer program product of claim 8, wherein the Processor Component is deployed in a cloud.

14. The computer program product of claim 8, wherein the machine learning model implements a convolutional neural network algorithm.

15. A computer system comprising a processor and one or more computer readable storage media, and program instructions collectively stored on the one or more computer readable storage media, the program instructions executable by the processor to cause the processor to perform operations comprising:

detecting by a Detection Component of an Image Monitoring System an image of a subject;

responsive to detecting the image, sharding by a Sharding Component of the Image Monitoring System the image into an image shard based on a key point;

training by a Processor Component of the Image Monitoring System a machine learning model to generate an image score of the image shard based on a parameter and the image shard wherein the subject is anonymous to the Processor Component; and

determining by a Score Aggregator Component of the Image Monitoring System a monitoring action of the subject based on the image score.

16. The computer system of claim 15, wherein the image score is in part based on a characteristic of an adjacent image shard.

17. The computer system of claim 15, wherein the Processor Component is selected based on a confidence score.

18. The computer system of claim 15, wherein the key point comprises a feature of the subject.

19. The computer system of claim 15, wherein the parameter comprises a requested image score.

20. The computer system of claim 15, wherein the machine learning model implements a convolutional neural network algorithm.

* * * * *