

AGGREGATION RISK DETERMINATION METHOD AND APPARATUS, COMPUTER-READABLE MEDIUM, AND ELECTRONIC DEVICE

CROSS-REFERENCE

[0001] This disclosure claims priority to Chinese Patent Application No. 202011622829.7, titled "Aggregation risk determination method and apparatus, computer readable media, and electronic device", and filed on December 31, 2020, the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD

[0002] The present disclosure relates to the technical field of data processing and, more specifically, to a method for determining an aggregation risk, an apparatus for determining an aggregation risk, a computer-readable medium and an electronic device.

BACKGROUND

[0003] With the rapid development of social economy, the urbanization process of the country continues to advance, the urban population is increasing, and pedestrian density is often high in urban public transport, living facilities and other areas. In the case of infectious diseases and other special situations that are easy to spread, such situations with high pedestrian density are easy to cause hidden dangers such as excessive spread.

[0004] At present, in order to avoid the above excessive spread, a large number of staff are often required to manually obtain the Epidemiological survey report, and then manually delineate the position and crowd with aggregation risk. This manual processing process not only requires a lot of manpower, but also has the problem of low processing efficiency. In the case of low processing efficiency, the problem of uncontrolled spread is also likely to arise.

SUMMARY

[0005] According to a first aspect of the present disclosure, there is provided a method for determining an aggregation risk, including: obtaining trajectory data of each monitoring object and establishing a trajectory database based on each of the trajectory data, the trajectory data including a trajectory position; determining contact data corresponding to each of the monitoring object based on the trajectory database, the contact data including a contact position and a contact object corresponding to the contact position; determining an aggregation position in the trajectory database

according to the contact position and the contact object, and determining an aggregation event level corresponding to the aggregation position; determining a target monitoring object in the monitoring objects and determining a set of risk positions according to target trajectory data and target contact data of the target monitoring object; and determining an aggregation risk level corresponding to each risk position in the set of risk positions according to the target contact data and the aggregation event level.

[0006] According to a second aspect of the present disclosure, there is provided an apparatus for determining an aggregation risk, including: a database establishing module, configured to obtain trajectory data of each monitoring object and establish a trajectory database based on each of the trajectory data; the trajectory data including a trajectory position; a contact data determination module, configured to determine contact data corresponding to each of the monitoring object based on the trajectory database; the contact data including a contact position and a contact object corresponding to the contact position; a first level determination module, configured to determine an aggregation position in the trajectory database according to the contact position and the contact object, and determine an aggregation event level corresponding to the aggregation position; a position determination module, configured to determine a target monitoring object in the monitoring objects and determine a set of risk positions according to target trajectory data and target contact data of the target monitoring object; a second level determination module, configured to determine an aggregation risk level corresponding to each risk position in the set of risk positions according to the target contact data and the aggregation event level.

[0007] According to a third aspect of the present disclosure, there is provided a computer-readable medium on which a computer program is stored, where the program, when executed by a processor, implements any one of the above-mentioned method.

[0008] According to a fourth aspect of the embodiments of the present disclosure, there is provided an electronic device, including: a processor; and a storage device for storing one or more programs, where when the one or more programs are executed by one or more processors, the one or more processors are caused to implement any one of the above-mentioned method.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. 1 schematically illustrates a flowchart of a method for determining an aggregation risk in an exemplary embodiment of the present disclosure;

[0010] FIG. 2 schematically illustrates a flowchart of a method for determining contact data in an exemplary embodiment of the present disclosure;

[0011] FIG. 3 schematically illustrates a flowchart of a method for determining an

aggregation position and an aggregation event level in an exemplary embodiment of the present disclosure;

[0012] FIG. 4 schematically illustrates a flowchart of a method for determining a set of risk positions in an exemplary embodiment of the present disclosure;

[0013] FIG. 5 schematically illustrates a flowchart of a method for determining an aggregation risk level corresponding to each risk position in the set of risk positions in an exemplary embodiment of the present disclosure;

[0014] FIG. 6 schematically illustrates a schematic diagram of a composition of an apparatus for determining an aggregation risk in an exemplary embodiment of the present disclosure; and

[0015] FIG. 7 schematically illustrates a schematic diagram of a structure of a computer system suitable for implementing an electronic device of an exemplary embodiment of the present disclosure.

DETAILED DESCRIPTION

[0016] The exemplary embodiments will now be described more fully with reference to the accompanying drawings. However, the exemplary embodiments can be implemented in a variety of forms and should not be construed as being limited to the examples set forth herein; rather, the provision of these embodiments makes the present disclosure more comprehensive and complete and conveys the concepts of the exemplary embodiments in a comprehensive manner to those skilled in the art. The features, structures or characteristics described may be combined in one or more embodiments in any suitable manner.

[0017] In addition, the accompanying drawings are only schematic illustrations of the present disclosure and are not necessarily drawn to scale. In the drawings, the same reference signs indicate the same or similar parts, and thus repetitive descriptions of them will be omitted. Some of the block diagrams shown in the accompanying drawings are functional entities and do not necessarily correspond to physically or logically separate entities. These functional entities may be implemented in software form, or in one or more hardware modules or integrated circuits, or these functional entities are implemented in different networks and/or processor apparatuses and/or microcontroller apparatuses.

[0018] In the context of events prone to spread, such as the COVID-19, overspreading is easy to occur due to overcrowding of pedestrians. Taking infectious diseases as an example, it is assumed that a certain diagnosed patient has traveled several times before being diagnosed, in order to find other people who may be infected by the diagnosed patient as quickly as possible, it is often

necessary to manually obtain the Epidemiological survey report to determine the position and crowd to be controlled. Sometimes, it is also necessary to use media and other means to publicize the occasion where the patient appears, and then to determine the people who may be infected by relying on the spontaneous report of pedestrians. The above method not only requires a lot of manpower, but also has the problem of low processing efficiency, which leads to the problem of uncontrolled spread.

[0019] Based on one or more of the above problems, the present exemplary implementation provides a method for determining an aggregation risk. The method may be applied in a process of analysing and controlling various events easy to spread. Referring to FIG. 1, the above method of determining an aggregation risk may include steps S110 to S150 as follows.

[0020] In step S110, trajectory data of each monitoring object is obtained, and a trajectory database is established based on each trajectory data.

[0021] The trajectory data of the monitoring object includes a position where the monitoring object is located at at least one time point. For example, the trajectory data of monitoring object A may include being at a railway station at 12:00 on January 1.

[0022] In an exemplary embodiment, when obtaining the trajectory data of the monitoring object as described above, registration data from different data sources may be obtained, and the registration data includes a registered position of each monitoring object at a certain time. By integrating the registration data from different data sources according to a dimension of the monitoring object, the positions of each monitoring object at different times may be obtained, and thus the trajectory data of each monitoring object may be determined.

[0023] The registration data may include ride information of various travel systems such as immigration, train, domestic flight, ship, intra-city bus, taxi, city railway, shared bicycle, or health code scanning, access registration system, ticketing system data, or hospital visit records, shopping registration of shopping scenarios such as pharmacy, mobile phone Bluetooth pairing records, etc. By collating the above registration data according to time and position, and then integrating them according to the dimension of the monitoring object, the trajectory data of the monitoring object can be obtained. For example, when a monitoring object is travelling on a train, according to the ride information, it can be determined that the monitoring object is located at the train departure station when the train leaves and at the train arrival station when the train arrives. At this point, the trajectory data of the monitoring object, the departure time - departure station and the arrival time - arrival station, can be obtained.

[0024] In step S120, contact data corresponding to each monitoring object is determined based on the trajectory database.

[0025] The above contact data may include a contact position and a contact object corresponding to the contact position. For example, if monitoring subject B and monitoring subject C go to the same pharmacy at the same time to buy medicine, for monitoring subject B, the contact data may include pharmacy (contact position) - monitoring subject C (contact object).

[0026] In an exemplary embodiment, the above trajectory data may also include attribute data corresponding to the trajectory position, such as the time of arrival at the trajectory position, the time spent at the trajectory position, an area covered by the trajectory position, etc. At this point, with reference to FIG. 2, the determination of the contact data corresponding to each monitoring object based on the trajectory database may be achieved by the following process.

[0027] In step S210, an intersection of the trajectory data of each monitoring object is calculated in the trajectory database to determine a common position existing between each monitoring object and other monitoring object(s).

[0028] In step S220, the attribute data corresponding to the common position is selected based on a predetermined contact rule, and the contact data is determined based on the selecting result.

[0029] Specifically, the intersection of trajectories existing between respective monitoring objects may be calculated in the trajectory database to determine the common position where each monitoring object co-occurs with other monitoring object(s); then the attribute data corresponding to the common position is selected based on the predetermined contact rule, and the contact data is determined based on the selecting result.

[0030] It should be noted that in determining the contact data, the common position may be determined as the contact position when the common position and the corresponding attribute data satisfy the predetermined contact rule, and then all the monitoring objects to which the attribute data satisfying the predetermined contact rule belong are determined as the contact objects.

[0031] For example, it is supposed that one predetermined contact rule is that there is another monitoring object that scans the code at the same position as the monitoring object and the scanning is performed 3 minutes before or after the time that the monitoring object scans the code, then that position is determined to be the contact position, and that another monitoring object is the contact object corresponding to that contact position. At this time, if monitoring object D scans the code at common position 1 at 12:03 on a certain day, and monitoring object E scans the code at common position 1 at 12:05, both the scanning time and the scanning position comply with the above predetermined contact rules. At this time, for monitoring object D, it can be determined that common position 1 is a contact position and monitoring object E is a contact object of monitoring object D. For monitoring object E, it can be determined that common position 1 is a contact position

and monitoring object D is a contact object of monitoring object E.

[0032] In addition, the contact time of the monitoring object and the contact object may be determined based on the intersection of the residence time of the monitoring object and the contact object at the respective contact positions. After the contact time has been determined, the contact time may be associated with the contact data so that the user can visually see the contact time between the monitoring object and the respective contact object.

[0033] For example, when there is a scanning entry time and a scanning exit time, the scanning exit time – the scanning entry time is directly used as a residence time, and then an intersection is determined by the residence time; furthermore, in a case that there is only the scanning entry time without the scanning exit time, an estimated time may be determined by a length of the residence time after subtracting the current scanning entry time from the next scanning entry time for a different position. For example, the contact time may be counted as 0.5 day when the residence time exceeds 12 hours; for another example, in the case that there is only the scanning entry time without the scanning exit time, the next scanning entry time for a different name (e.g. a different name 100 metres away) is used, and the current contact time is obtained by subtracting the scanning entry time from the next scanning entry time for the different name and then dividing by 2.

[0034] It is noted that in some embodiments, it is also possible to calculate the contact time between the monitored object and other monitored object(s) based on the attribute data before determining the contact data, and use the contact time as part of the attribute data, and then set a predetermined contact rule relating to the contact time to select the attribute data, and then determine the contact data based on the selecting result.

[0035] In an exemplary embodiment, due to the different characteristics of the trajectory data obtained from different sources or different positions, the corresponding set contact rules may also differ. Therefore, before selecting the attribute data corresponding to the common position based on the preset contact rule, all trajectory positions in the trajectory database may be classified and identified according to a preset normalisation table. The predetermined contact rules corresponding to different classifications are set in advance, and when selecting, different predetermined contact rules may be chosen for selecting based on the classification and identification of each trajectory position. For example, the trajectory data may be classified into one or more of the following types: scanning code for travel, immigration, intra-city transportation, shopping, fever clinic, outpatient clinic, hospitalization, train, aeroplane, etc.

[0036] In step S130, an aggregation position is determined in the trajectory database according to the contact position and the contact object, and an aggregation event level corresponding to the aggregation position is determined.

[0037] In an exemplary embodiment, referring to FIG. 3, the above determination of the aggregation position in the trajectory database according to the contact position and the contact object, and the determination of the aggregation event level corresponding to the aggregation position may include steps S310 to S320 as follows.

[0038] In step S310, the contact position and the contact object are selected according to a predetermined aggregation rule, the aggregation position is determined in the contact positions based on the selecting result, and the contact object corresponding to the aggregation position is determined.

[0039] In an exemplary embodiment, in determining the aggregation position, the contact position and the contact object may be selected according to the predetermined aggregation rule, and then the contact position satisfying the predetermined aggregation rule is determined as the aggregation position among the contact positions where the contact occurs based on the selecting result. At the same time, the contact object satisfying the predetermined aggregation rule is determined as the contact object corresponding to that aggregation position.

[0040] It should be noted that similar to the setting of the contact rule, the above-mentioned predetermined aggregation rule and event level rule may also be set differently depending on the trajectory position. When selecting and determining the aggregation event level, different rules corresponding to different categories are set in advance, and then different rules may be chose according to the classification and identification of each trajectory position, to carry out the above selecting process and the process of determining the aggregation event level.

[0041] For example, the predetermined aggregation rule may include: at different positions that are within a range of 100m or at the same position, more than 1 person stays at the same point in time or within the same time range (e.g. within 10 minutes), then this position is the current aggregation position for all the people who stay here, and the people who stay at the same point in time or within the same time range (e.g. within 10 minutes) are the contact objects corresponding to the current aggregation position. By setting the predetermined aggregation rule, the aggregation position of each monitoring object and the contact object for each aggregation position can be derived. It is to be noted that one monitoring object may have more than one aggregation position, and the contact object for each aggregation position may be different.

[0042] In step S320, the aggregation event level corresponding to the aggregation position is determined based on an event level rule and the contact object corresponding to the aggregation position.

[0043] In an exemplary embodiment, after determining the aggregation position, the aggregation event level corresponding to the aggregation position may be determined based on the

event level rule and the contact object corresponding to the aggregation position. Specifically, the number of the monitoring objects gathered at the aggregation position may be used as a condition for the level differentiation; the density of monitoring objects at the aggregation position may also be used as a condition for the level differentiation; furthermore, different settings may be made depending on different spreading sources, which is not specifically limited by the present disclosure.

[0044] For example, for shopping scenarios, if the number of people at a certain aggregation position exceeds 5, or if the number of contacts at a certain aggregation position exceeds 10, the aggregation event level corresponding to this aggregation position may be set as medium; for another example, for the trajectory data such as shared bicycle, if the number of people at a certain aggregation position exceeds 100, or if the number of contacts at this aggregation position exceeds 1000, the aggregation event level corresponding to the aggregation position is high.

[0045] It should be noted that in some exemplary embodiments, an aggregation event warning may also be set for the above aggregation event. For example, in the event of an intermediate or high level aggregation event, the aggregation position may be subject to prevention and control early-warning.

[0046] In step S140, a target monitoring object is determined among the monitoring objects and a set of risk positions is determined according to target trajectory data and target contact data of the target monitoring object.

[0047] In an exemplary embodiment, the target monitoring object may include a monitoring object carrying a spreading source. For example, in an infectious disease scenario, the target monitoring object may be a diagnosed patient; for another example, in a message propagation scenario, the target monitoring object may be a first source of the message.

[0048] In an exemplary embodiment, after a target monitoring object has been determined among the monitoring objects, the set of risk positions may be determined according to the target trajectory data and target contact data of the target monitoring object.

[0049] Specifically, with reference to FIG. 4, the following steps S410 and S420 may be included.

[0050] In step S410, the trajectory position(s) in the target trajectory data are added to the set of risk positions.

[0051] Specifically, the above process may be understood as: taking the target trajectory data of the target monitoring object as the subject and adding the trajectory positions included in the target trajectory data corresponding to the target monitoring object to the set of risk positions. For example, in the scenario of an infectious disease, the trajectory positions that are ever reached by

the diagnosed patient are added to the set of risk positions.

[0052] In step S420, the contact trajectory position(s) corresponding to the target contact object in the target contact data is added to the set of risk positions.

[0053] Specifically, some of the trajectory positions visited by the target monitoring object may be target contact positions, i.e. the target monitoring object made contact with the target contact object at the target contact position. At this point, the target contact person may also become a carrier, and therefore the contact position corresponding to the target contact object that is the monitoring object is also added to the set of risk positions. By way of example, in a scenario of an infectious disease, monitoring object G (target contact object), which has a contact relationship with diagnosed patient F (target monitoring object), may have a contact position (contact position between monitoring object G and monitoring object H) with another monitoring object H (contact object corresponding to the target contact object), and this contact position is also added to the set of risk positions as a risk position.

[0054] In step S150, the aggregation risk level corresponding to each risk position in the set of risk positions is determined based on the target contact data and the aggregation event level.

[0055] In an exemplary embodiment, after the set of risk positions has been determined, the aggregation risk level corresponding to each risk position in the set of risk positions may be determined according to the target contact data and the aggregation event level.

[0056] Specifically, a base risk level corresponding to the risk position may first be determined according to the aggregation event level corresponding to each risk position in the set of risk positions. For example, the base risk level may be determined as 5, 4, 3 and 2 according to high, medium, low and none of the corresponding aggregation event levels of the risk positions; and then the base risk levels are updated based on the target contact data to obtain the aggregation risk level corresponding to each risk position.

[0057] In an exemplary embodiment, with reference to FIG. 5, the updating of the base risk levels based on the target contact data may include the following steps S510 to step S530.

[0058] In step S510, the target contact objects are classified according to the number of contact positions between the target monitoring object and the target contact object to obtain a first contact object and a second contact object.

[0059] The number of contact positions between the first contact object and the target detection object is greater than the number of contact positions between the second contact object and the target detection object. When the target contact object has only a small number of contact positions with the target monitoring object, it can be determined that the target contact object is only in point contact with the target monitoring object, while when there are a large number of contact

positions between the target contact object and the target monitoring object, it is likely that the target contact object and the target monitoring object are peers. The corresponding spread may also be different when the contact situation is different. Therefore, the target contact object may be classified based on the number of contact positions to obtain a first contact object and a second contact object. The above classification of the first contact object and the second contact object enables the process of predicting a first level of close contact and a second level of close contact.

[0060] In step S520, a first risk position is determined in the risk positions based on the first contact object, and the base risk level corresponding to the first risk position is increased by a first predetermined level.

[0061] Specifically, in case of a high number of contact positions between the target contact object and the target monitoring object, an infection is likely to have occurred, so that a first risk position (e.g., a contact position between the target monitoring object and the first contact object) needs to be determined in the risk positions and a first predetermined level is adjusted upwards to the base risk level corresponding to the first risk position. It is to be noted that the first predetermined level may also be determined according to the number of contact positions, and when the number of contact positions existing between the target contact object and the target monitoring object varies, a different first predetermined level is chose for the increase.

[0062] In step S530, a second risk position is determined in the risk positions based on the second contact object, and the base risk level corresponding to the second risk position is reduced by a second predetermined level.

[0063] Specifically, the probability of infection is relatively low when a relatively small number of contact positions exist between the target contact object and the target monitoring object. Therefore, for the risk position determined on the basis of the second contact object (e.g. the remaining risk positions in the trajectory position of the second contact object in the risk positions after removing the contact position), i.e. the second risk position, the risk level may be reduced by a second predetermined level. Similarly, the second predetermined level may be determined according to the number of contact positions, and when the number of contact positions between the target contact object and the target monitoring object varies, a different second predetermined level may be chose for reduction.

[0064] The following is an example of the above process of updating the base risk level for an infectious disease scenario.

[0065] (1) Based on target monitoring object I, target contact object J which has more than 2 contact positions with target monitoring object I, and target contact object K which has only 1 contact position with target monitoring object I, a total of 20 risk positions are determined. Among

them, 15 risk positions are the trajectory positions of the target monitoring object I and the remaining 5 risk positions are the trajectory positions of the target contact object K excluding the contact positions. 5 of the 15 trajectory positions are the contact positions of the target contact object J.

[0066] (2) According to the aggregation event levels corresponding to the 20 risk positions, the base risk levels are determined respectively, assuming that the aggregation event levels corresponding to all 20 risk positions are high, then their base risk levels are all set to 5.

[0067] (3) The base risk levels corresponding to five first risk positions that are the contact positions of the target contact object J are increased by 2, i.e. the aggregation risk levels corresponding to these five first risk positions are all 7.

[0068] (4) The aggregation risk levels of five trajectory positions of the target contact object K other than the contact position are reduced by 3, so that the aggregation risk level corresponding to each of the five second risk positions is 2.

[0069] It should be noted that when the above aggregation risk level is reduced to 0, it is removed from the risk position, i.e. the risk position is not at risk.

[0070] By analyzing the risk level of each risk position, it is possible to predict the range of positions and the impact on the position that may be involved in the spread time with the target monitoring object as the source of spread, which in turn facilitates the implementation of different prevention and control strategies or measures for different risk positions according to different aggregation risk levels.

[0071] It is to be noted that the above accompanying drawings are only a schematic illustration of the processes included in the method according to the exemplary embodiments of the present disclosure and are not intended to be limiting. It is readily understood that the processes shown above in the accompanying drawings do not indicate or limit the chronological order of these processes. It is also readily understood that these processes may be performed, for example, in a plurality of modules, either synchronously or asynchronously.

[0072] In addition, in the exemplary embodiments of the present disclosure, an apparatus for determining an aggregation risk is provided. Referring to FIG. 6, the apparatus for determining an aggregation risk 600 includes: a database establishing module 610, a contact data determination module 620, a first level determination module 630, a position determination module 640 and a second level determination module 650.

[0073] The database establishing module 610 may be configured to obtain trajectory data of each monitoring object and establish a trajectory database based on each trajectory data, the trajectory data including a trajectory position; the contact data determination module 620 may be

configured to determine contact data corresponding to each monitoring object based on the trajectory database, the contact data including a contact position and a contact object corresponding to the contact position; the first level determination module 630 may be configured to determine an aggregation position in the trajectory database according to the contact position and the contact object, and to determine an aggregation event level corresponding to the aggregation position; the position determination module 640 may be configured to determine a target monitoring object among the monitoring objects and to determine a set of risk positions according to target trajectory data and target contact data of the target monitoring object; the second level determination module 650 may be configured to determine the aggregation risk level corresponding to each risk position in the set of risk positions according to the target contact data and the aggregation event level.

[0074] In an exemplary embodiment, the contact data determination module 620 is configured to calculate an intersection of the trajectory data of each monitoring object in the trajectory database to determine a common position existing between each monitoring object and other monitoring object(s); select attribute data corresponding to the common position based on a predetermined contact rule, and determine the contact data based on the selecting result.

[0075] In an exemplary embodiment, the contact data determination module 620 is configured to determine a contact time based on the contact data and associate the contact time with the contact data.

[0076] In an exemplary embodiment, the contact data determination module 620 is configured to classify and identify the trajectory positions in the trajectory database based on a predetermined normalization table; and determine a predetermined contact rule corresponding to the common position based on the classification and identification.

[0077] In an exemplary embodiment, the first level determination module 630 is configured to select the contact position and the contact object according to a predetermined aggregation rule, determine the aggregation position among the contact positions based on the selecting result, and determine the contact object corresponding to the aggregation position; and determine the aggregation event level corresponding to the aggregation position based on an event level rule and the contact object corresponding to the aggregation position.

[0078] In an exemplary embodiment, the position determination module 640 is configured to add the trajectory position in the target trajectory data to the set of risk positions; and add the contact position corresponding to the target contact object in the target contact data to the set of risk positions.

[0079] In an exemplary embodiment, the second level determination module 650 is configured to determine a base risk level corresponding to each risk position according to the

aggregation event level corresponding to each risk position in the set of risk positions; and update the base risk level according to the target contact data to obtain the aggregation risk level corresponding to each risk position.

[0080] In an exemplary embodiment, the second level determination module 650 is configured to classify the target contact objects according to the number of contact positions between the target monitoring object and the target contact object to obtain a first contact object and a second contact object; where the number of contact positions between the first contact object and the target detection object is greater than the number of contact positions between the second contact object and the target detection object; determine a first risk position in the risk positions based on the first contact object and increase by a first predetermined level the base risk level corresponding to the first risk position; determine a second risk position in the risk position based on the second contact object and decrease by a second predetermined level the base risk level corresponding to the second risk position.

[0081] In an exemplary embodiment, the database establishing module 610 is configured to obtain registration data from different data sources; the registration data including a registration position of the monitoring object; integrate the registration data from a dimension of monitoring object to obtain the trajectory data corresponding to each monitoring object.

[0082] The specific details of the modules in the above apparatus have been described in detail in the method section implementations and undisclosed details can be found in the method section implementation content and are therefore not repeated.

[0083] It should be noted that although in the detailed description above, reference is made to a number of modules or units of the device for action execution, this division is not mandatory. In fact, according to the implementations of the present disclosure, the features and functions of two or more modules or units described above can be specified in a single module or unit. Conversely, the features and functions of one module or unit described above may be further divided to be specified by a plurality of modules or units.

[0084] Further, FIG. 7 illustrates a schematic diagram of a structure of a computer system of an electronic device suitable for implementing the embodiments of the present disclosure.

[0085] It is noted that the computer system 700 of the electronic device illustrated in FIG. 7 is only an example and should not impose any limitations on the functionality and scope of use of the embodiments of the present disclosure.

[0086] As illustrated in FIG. 7, the computer system 700 includes a central processing unit (CPU) 701 which may perform various appropriate actions and processes according to a program stored in a read-only memory (ROM) 702 or loaded into a random access memory (RAM) 703 from

a storage portion 708. In RAM 703, various programs and data required for system operation are also stored. CPU 701, ROM 702 and RAM 703 are connected to each other via a bus 704. The input/output (I/O) interface 705 is also connected to the bus 704.

[0087] The following components are connected to the I/O interface 705: an input portion 706 including a keyboard, a mouse, etc.; an output portion 707 including, for example, a cathode ray tube (CRT), a liquid crystal display (LCD) and a speaker, etc.; a storage portion 708 including a hard disk, etc.; and a communication portion 709 including a network interface card such as a LAN card, a modem, etc. The communication portion 709 performs communication processing via a network such as Internet. The drive 710 is also connected to the I/O interface 705 as required. The removable media 711, such as a disk, a CD-ROM, a magnetic disk, a semiconductor memory, etc., are mounted on the drive 710 as required to allow computer programs read from it to be mounted into the storage portion 708 as required.

[0088] In particular, according to the embodiments of the present disclosure, the process described below with reference to the flowchart may be implemented as a computer software program. For example, the embodiments of the present disclosure include a computer program product including a computer program carried on a computer-readable medium, the computer program including a program code for performing the method shown in the flowchart. In such an embodiment, the computer program may be downloaded and installed from a network via the communication portion 709 and/or installed from the removable medium 711. As this computer program is executed by the central processing unit (CPU) 701, various functions as defined in the methods and apparatuses of the present application are performed. In some embodiments, the computer system 700 may further include an Artificial Intelligence (AI) processor which is used to handle computational operations relating to machine learning.

[0089] It is noted that the computer-readable medium shown in the present disclosure may be a computer-readable signal medium or a computer-readable storage medium or any combination of the above. The computer-readable storage medium may, for example, be - but is not limited to - an electrical, magnetic, optical, electromagnetic, infrared, or semiconductor system, apparatus, or device, or any combination of the above. More specific examples of the computer-readable storage media may include, but are not limited to, electrical connections having one or more wires, portable computer disks, hard disks, random access memories (RAMs), read-only memories (ROMs), erasable programmable read-only memories (EPROMs or flash memories), optical fibers, portable compact disk read-only memories (CD-ROMs), optical storage devices, magnetic memory devices, or any suitable combination of the above. In the present disclosure, the computer-readable storage medium may be any tangible medium that contains or stores a program that may be used by or in

combination with an instruction execution system, apparatus, or device. And in the present disclosure, the computer-readable signal medium may include a data signal propagated in the baseband or as part of a carrier wave carrying computer-readable program code. Such propagated data signal may take a variety of forms including, but not limited to, electromagnetic signals, optical signals, or any suitable combination of the above. The computer-readable signal medium may also be any computer-readable medium other than the computer-readable storage medium, and the computer-readable medium may send, propagate or transmit a program for use by or in conjunction with an instruction execution system, apparatus or device. The program code contained on the computer-readable medium may be transmitted using any suitable medium, including but not limited to: wireless, wire, fiber optic cable, RF, etc., or any suitable combination of the foregoing.

[0090] The flowcharts and block diagrams in the accompanying drawings illustrate the architecture, functionality, and operation that may be implemented by the systems, methods, and computer program products in accordance with various embodiments of the present disclosure. In this regard, each box in the flowchart or block diagram may represent one module, program segment, or portion of code, and the module, program segment, or portion of code contains one or more executable instructions for implementing a specified logical function. It should also be noted that in some alternative implementations, the functions indicated in the boxes may also occur in a different order than that indicated in the accompanying drawings. For example, two boxes represented one after the other can actually be executed in substantial parallel, and they can sometimes be executed in the opposite order, depending on the function involved. Note also that each box in the block diagram or flowchart, and the combination of boxes in the block diagram or flowchart, may be implemented using a dedicated hardware-based system that performs the specified function or operation, or may be implemented using a combination of dedicated hardware and computer instructions.

[0091] The units described as involved in the embodiments of the present disclosure may be implemented by means of software, or by means of hardware, and the units described may also be provided in a processor. The names of these units do not, in some cases, constitute a limitation of the unit itself.

[0092] As a further aspect, the present application also provides a computer-readable medium which may be contained in the electronic device described in the above described embodiments; it may also be present separately and not assembled into the electronic device. The computer-readable medium carries one or more programs which, when executed by one of the electronic devices, cause the electronic device to implement the method as in the following embodiments. For example, the electronic device may implement the various steps as shown in

FIGs. 1 to 5, etc.

[0093] Other embodiments of the present disclosure will readily come to the mind of those skilled in the art upon consideration of the specification and practice of the present disclosure. The present application is intended to cover any variation, use or adaptation of the present disclosure that follows the general principles of the present disclosure and includes common knowledge or customary technical means in the art that are not disclosed herein. The description and embodiments are to be considered exemplary only and the true scope and spirit of the present disclosure is indicated by the following claims.

[0094] It should be understood that the present disclosure is not limited to the precise construction already described above and illustrated in the accompanying drawings, and that various modifications and changes may be made without departing from its scope. The scope of the present disclosure is limited only by the appended claims.

CLAIMS:

1. A method for determining an aggregation risk, comprising:

obtaining trajectory data of each monitoring object and establishing a trajectory database based on each of the trajectory data, the trajectory data comprising a trajectory position;

determining contact data corresponding to each of the monitoring object based on the trajectory database, the contact data comprising a contact position and a contact object corresponding to the contact position;

determining an aggregation position in the trajectory database according to the contact position and the contact object, and determining an aggregation event level corresponding to the aggregation position;

determining a target monitoring object in the monitoring objects and determining a set of risk positions according to target trajectory data and target contact data of the target monitoring object; and

determining an aggregation risk level corresponding to each risk position in the set of risk positions according to the target contact data and the aggregation event level.

2. The method according to claim 1, wherein the trajectory data further comprises attribute data corresponding to the trajectory position;

the determining the contact data corresponding to each of the monitoring object based on the trajectory database, comprises:

calculating in the trajectory database an intersection of the trajectory data of each of the monitoring object to determine a common position existing between each of the monitoring object and other monitoring object;

selecting the attribute data corresponding to the common position based on a predetermined contact rule, and determining the contact data according to the selecting result.

3. The method according to claim 2, wherein the method further comprises:

determining a contact time based on the contact data, and associating the contact time with the contact data.

4. The method according to claim 2, wherein before selecting the attribute data corresponding to the common position based on the predetermined contact rule, the method further comprises:

classifying and identifying the trajectory positions in the trajectory database based on a predetermined normalization table;

determining the predetermined contact rule corresponding to the common position based on the classification and identification.

5. The method according to claim 1, wherein the determining the aggregation position in the

trajectory database according to the contact position and the contact object, and determining the aggregation event level corresponding to the aggregation position, comprises:

selecting the contact position and the contact object according to a predetermined aggregation rule, determining the aggregation position in the contact positions based on the selecting result, and determining the contact object corresponding to the aggregation position; and

determining the aggregation event level corresponding to the aggregation position based on an event level rule and the contact object corresponding to the aggregation position.

6. The method according to claim 1, wherein the determining the set of risk positions according to the target trajectory data and the target contact data of the target monitoring object, comprises:

adding the trajectory position in the target trajectory data to the set of risk positions; and

adding the contact position corresponding to the target contact object in the target contact data to the set of risk positions.

7. The method according to claim 1, wherein the determining the aggregation risk level corresponding to each risk position in the set of risk positions according to the target contact data and the aggregation event level, comprises:

determining a base risk level corresponding to each of the risk position according to the aggregation event level corresponding to each of the risk position in the set of risk positions; and

updating the base risk level according to the target contact data to obtain the aggregation risk level corresponding to each of the risk position.

8. The method according to claim 7, wherein the updating the base risk level according to the target contact data comprises:

classifying the target contact objects according to the number of contact positions between the target monitoring object and the target contact object to obtain a first contact object and a second contact object; wherein the number of contact positions between the first contact object and the target detection object is greater than the number of contact positions between the second contact object and the target detection object t;

determining a first risk position in the risk positions based on the first contact object and increasing the base risk level corresponding to the first risk position by a first predetermined level;

determining a second risk position in the risk positions based on the second contact object and decreasing the base risk level corresponding to the second risk position by a second predetermined level.

9. The method according to claim 1, wherein the obtaining the trajectory data of each monitoring object, comprises:

obtaining registration data from different data sources; the registration data comprising a registration position of the monitored object;

integrating the registration data from a dimension of monitoring object to obtain the trajectory data corresponding to each of the monitoring object.

10. An apparatus for determining an aggregation risk, comprising:

a database establishing module, configured to obtain trajectory data of each monitoring object and establish a trajectory database based on each of the trajectory data; the trajectory data comprising a trajectory position;

a contact data determination module, configured to determine contact data corresponding to each of the monitoring object based on the trajectory database; the contact data comprising a contact position and a contact object corresponding to the contact position;

a first level determination module, configured to determine an aggregation position in the trajectory database according to the contact position and the contact object, and determine an aggregation event level corresponding to the aggregation position;

a position determination module, configured to determine a target monitoring object in the monitoring objects and determine a set of risk positions according to target trajectory data and target contact data of the target monitoring object;

a second level determination module, configured to determine an aggregation risk level corresponding to each risk position in the set of risk positions according to the target contact data and the aggregation event level.

11. A computer-readable medium having a computer program stored thereon, wherein the program, when executed by a processor, implements the method according to any one of claims 1 to 9.

12. An electronic device, comprising:

a processor; and

a memory for storing executable instructions of the processor;

wherein the processor is configured to perform the method according to any one of claims 1 to 9 by executing the executable instructions.