

METHOD AND DEVICE FOR DETERMINING AREAS OF INTEREST BASED ON GEOLOCATION DATA

TECHNICAL FIELD

This application relates to the field of Internet technologies, and in particular, to a method and a device for determining an area of interest based on geolocation data.

BACKGROUND

Nowadays, applications based on geolocation data, especially maps based on geolocation data, have become increasingly popular.

In practice, users may expect to find areas of interest on maps. For example, users expect to go shopping, find entertainment, or have meals in areas of interest; and correspondingly, merchants also expect to set up stores in the areas of interest. Therefore, according to these needs of the users, the areas of interest are generally marked on maps.

In existing technologies, the areas of interest are usually determined by human. However, the efficiency of determining the areas of interest by human is relatively low, and the costs are also relatively large due to the use of labor.

SUMMARY

This application provides a method and a device for determining an area of interest based on geolocation data, to resolve the existing problem of relatively low efficiency and relatively large costs for determining the area of interest.

According to an embodiment of this application, a method for determining an area of interest based on geolocation data is provided, where the method includes:

- gridding an area on a map to be processed;

- for each block in the gridded area, counting a block value within a preset duration, the block value being a quantity of users that report geolocation data in the corresponding block;

- selecting block values greater than a preset threshold from the counted block values;

- determining anchor points according to the blocks corresponding to the selected block values;

- calculating, according to the anchor points and based on a preset algorithm, a curve encompassing all of the anchor points; and

determining an area in the curve as an area of interest.

Optionally, the gridding an area on a map to be processed specifically includes:

dividing the area on the map to be processed into at least one block according to a preset side length.

Optionally, the anchor point is a central point of the block.

Optionally, the method further includes:

obtaining types of Points of Information (POIs) within the area in the curve;

obtaining the quantities of the POIs of same types; and

determining a type of POIs of the largest quantity as a type of interest for the area of interest.

Optionally, the method further includes:

obtaining POIs in the area on the map after the anchor points are determined in the blocks corresponding to the selected block values, wherein

the calculating, according to the anchor points and based on a preset algorithm, a curve encompassing all of the anchor points specifically comprises:

calculating, according to the POIs and the anchor points and based on the preset algorithm, the curve encompassing all of the anchor points and POIs.

Optionally, the preset algorithm is a convex hull algorithm; and

the curve is a convex hull curve.

Optionally, the convex hull algorithm includes a graham algorithm, a jarvis algorithm, a center method, a level method, or a quickhull algorithm.

According to an embodiment of this application, a device for determining an area of interest based on geolocation data is provided, where the device includes:

a processing unit for gridding an area on a map to be processed;

a counting unit for counting a block value within a preset duration for each block in the gridded area, the block value being the quantity of users that report geolocation data in the corresponding block;

a selection unit for selecting block values greater than a preset threshold from the counted block values;

a first determining unit for determining anchor points according to the blocks corresponding to the selected block values;

a calculation unit for calculating, according to the anchor points and based on a preset algorithm, a curve encompassing all of the anchor points; and

a second determining unit for determining an area in the curve as an area of interest.

Optionally, the processing unit is specifically for:
dividing the area on the map to be processed into at least one block according to a preset side length.

Optionally, the anchor point is a central point of the block.

Optionally, the device further includes:

an obtaining subunit for obtaining types of Points of Information (POIs) within the area in the curve;

a counting subunit for obtaining the quantities of the POIs of same types; and

a determining subunit for determining a type of POIs of the largest quantity as a type of interest for the area of interest.

Optionally, the device further includes:

an obtaining subunit for obtaining POIs in the area on the map after the anchor points are determined in the blocks corresponding to the selected block values, wherein

correspondingly, the calculation unit is specifically for:

calculating, according to the POIs and the anchor points and based on the preset algorithm, the curve encompassing all of the anchor points and POIs.

Optionally, the preset algorithm is a convex hull algorithm; and

the curve is a convex hull curve.

Optionally, the convex hull algorithm includes a graham algorithm, a jarvis algorithm, a center method, a level method, or a quickhull algorithm.

In the embodiments of this application, an area on a map to be processed is gridded; for each block in the gridded area, a grid value of the block are counted within a preset duration, the grid value being the quantity of users that report geolocation data in the corresponding block; block values greater than a preset threshold are selected from the counted block values; anchor points are determined according to the blocks corresponding to the selected block values; a curve encompassing all of the anchor points is calculated according to the anchor points and based on a preset algorithm; and an area in the curve is determined as an area of interest. In this way, a server can automatically determine areas of interest on the map by using geolocation data actually reported by users, to avoid low efficiency and high costs caused by manually demarcating the areas of interest, thereby improving efficiency and reducing costs for determining the areas of interest.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a flowchart of a method for determining an area of interest based on geolocation data according to an embodiment of this application;

FIG. 2 is a schematic diagram of an area on a map according to an embodiment of this application;

FIG. 3 is a schematic diagram obtained after the area on the map is gridded according to this application;

FIG. 4 is a schematic diagram of an area on a map marked with blocks values according to this application;

FIG. 5 is a schematic diagram of selected blocks values according to this application;

FIG. 6 is a schematic diagram of a coordinate system established according to this application;

FIG. 7 is a schematic diagram of an area of interest determined according to anchor points according to this application;

FIG. 8 is a schematic diagram of the area on the map shown in FIG. 2 marked with POIs;

FIG. 9 is a schematic diagram of an area of interest determined according to the POIs and the anchor points according to this application;

FIG. 10 is a hardware structural diagram of an equipment which includes a device for determining an area of interest based on geolocation data according to this application; and

FIG. 11 is a schematic module diagram of a device for determining an area of interest based on geolocation data according to an embodiment of this application.

DETAILED DESCRIPTION OF THE INVENTION

Exemplary embodiments are described in detail herein, and examples of the exemplary embodiments are shown in the accompanying drawings. When the following descriptions relate to the accompanying drawings, unless indicated otherwise, same numbers in different accompanying drawings represent same or similar elements. The implementations described in the following exemplary embodiments do not represent all implementations consistent with this application. On the contrary, the implementations are merely examples of devices and methods that are described in detail in the appended claims and that are consistent with some aspects of this application.

The terms used in this application are for the purpose of describing specific embodiments only and are not intended to limit this application. The singular forms of "a" and "the" used in this application and the appended claims are intended to include the plural forms as well,

unless the context clearly indicates otherwise. It should be further understood that the term "and/or" used in this specification refers to and includes any or all possible combinations of one or more associated listed items.

It should be understood that although the terms such as "first," "second," and "third," may be used in this application to describe various information, the information should not be limited to these terms. These terms are only used to distinguish information of the same type. For example, without departing from the scope of this application, the first information may also be referred to as the second information, and similarly, the second information may also be referred to as the first information. Depending on the context, the word "if" used herein may be interpreted as "while" or "when," or "in response to determination."

In the existing technologies, areas of interest on maps are generally obtained through manual division. Because manual division is usually easily affected by subjective mapping, edges of finally obtained areas of interest have relatively large errors. For example, places that are not areas of interest may be easily put into the areas of interest, or places that belong to areas of interest may not be put into the areas of interest.

To resolve the foregoing problem, FIG. 1 shows a flowchart of a method for determining an area of interest based on geolocation data according to an embodiment of this application. This embodiment is described from the perspective of a server, and the method includes the following steps.

Step 110: grid an area on a map to be processed.

In this embodiment, the area on the map to be processed may be selected manually, such as circled on the map by staff.

The area on the map to be processed may also be determined by the server according to a list of regions. The list of regions may be preset, and various regions are included in the list. For example, a region A, a region B, and a region C are included in the region list, where areas of interest in the region A have been determined; and the server may determine, according to the list, that the region B is an area to be processed. After areas of interest of the B region have also been determined, the server may determine the region C as an area to be processed.

The gridding of the area may include: dividing, by the server, the area on the map to be processed into at least one block according to a preset side length.

The preset side length may be an empirical value manually preset.

For example, FIG. 2 is a schematic diagram of an area on a map according to this

application. The area on the map has a length of 1300 meter (m) and a width of 1050 meter (m). It is assumed that the preset side length is 200 m, that is, the area on the map is divided into several blocks based on the side length of 200 m. FIG. 3 is a schematic diagram obtained after the area on the map is gridded. As shown in FIG. 3, the side length of each block in the area is 200 m, and by gridding, the area on the map may be divided into blocks of the same size. As shown in FIG. 3, portions on the edges of the area on the map having sides shorter than the preset side length may not be gridded. Alternatively, portions having sides shorter than the preset side length may also be gridded. This is not limited herein.

In another embodiment, the gridding of the area on the map may further include: dividing, by the server, the area on the map to be processed into a preset quantity of blocks. The preset quantity may be an empirical value manually preset. For example, the area on the map is divided into 100 blocks.

Step 120: for each block in the area, count a block value within a preset duration, the block value being the quantity of users that report geolocation data in the corresponding block.

In this embodiment, the reported geolocation data may be uploaded by a mobile terminal of a user through an application installed in the mobile terminal.

For example, in a mobile payment scenario, a mobile terminal of a user may complete a payment process jointly with an interacting party in a same place. The interacting party may be a user holding another mobile terminal, or may be a fixed terminal device. The process may involve a third party providing a payment service besides the two or more interacting parties. The third-party provider may provide a security interaction service while providing this type of third-party payment services.

The third-party payment service provider may set up its own website or provide a server dedicated to handling payment, for example, a payment platform. In this way, two or more payment parties may complete payment by using the service provided on the payment platform. For example, the payment platform may be eBay or Alibaba. The mobile terminal and/or the fixed terminal may access, through the Internet, a payment platform provided by the third-party payment service provider, and complete a particular process of payment by using the payment platform. In addition, for convenience and security, the mobile terminal and/or the fixed terminal may be installed with a dedicated client (e.g., an application). For example, an application provided by the third-party payment service provider may be installed to complete payment efficiently.

The geolocation data is a location of the mobile terminal on which the client is installed.

For example, the geolocation data may include coordinate information of the geolocation of the mobile terminal, recorded by a positioning device of the mobile terminal. A common positioning device may use the USA Global Positioning System (GPS) satellite navigation system, the Europe "Galileo" satellite navigation system, the Russia Global Navigation Satellite System (GLONASS), or the China "BeiDou" satellite navigation system, or a combination thereof. This type of coordinate information for positioning is also referred to as mobile positioning. Moreover, generally, the reported geolocation data further carries a reported timestamp. The timestamp may be a time at which the positioning device determines the geolocation data; or a time at which the client on the mobile terminal reports the geolocation data.

The geolocation data may be obtained through conversion by a network device based on features of signals of the mobile terminal on which the client resides. For example, a network operator may use signals of the mobile terminal to calculate the geolocation data of the mobile terminal based on base station positions according to a base station coverage principle. In the latter location calculation, generally, the mobile terminal measures downlink pilot signals of different base stations to obtain a time of arrival (TOA) of the downlink pilot signal of each base station or a time difference of arrival (TDOA) among the downlink pilot signals of the different base stations, and generally uses the measurement results and coordinates of the base stations to calculate the location of the mobile terminal according to a triangulation algorithm. In practice, three or more base stations may be used. There are multiple algorithms in existing technologies which are relatively complex. Generally, the more base stations are measured, the higher precision the measurement has. Thus, positioning performance is significantly improved.

In addition, the geolocation data may further be obtained by combining the method of the positioning device on the mobile terminal and the positioning method based on base stations. In this way, the obtained geolocation data may be more accurate.

Generally, the uploaded geolocation data is represented by longitudes and latitudes of the locations. According to the longitude and latitude of the location of each terminal, it may be determined within which block in the area on the map the location of the terminal indicated by the uploaded geolocation data is. Moreover, a block value for each block within a preset duration may be determined according to the timestamps in the geolocation data.

The preset duration may be an empirical value manually preset, such as, one day. That is, a block value for each block within one day may be determined, i.e., the quantity of users that report location information in each grid are counted.

By counting the quantity of users, the popularity of the area corresponding to each block within the preset duration may be actually reflected. A larger block value indicates that more users are in the block, and an area corresponding to the block tends to be an area of interest; on the contrary, a smaller block value indicates that fewer users are in the block, and an area corresponding to the block is likely not an area of interest.

Step 130: select block values greater than a preset threshold from the counted block values.

In this embodiment, the preset threshold may be an empirical value preset manually.

In the foregoing example of FIG. 3, after the quantity of users that report geolocation data in each block are counted, the block value for each block may be obtained. FIG. 4 is a schematic diagram of an area on a map marked with block values. In FIG. 4, for clarity, the map in FIG. 3 is omitted, and only blocks are retained.

Assuming that the preset threshold is 200, a block corresponding to a block value greater than 200 is selected. FIG. 5 is a schematic diagram of the selected block value. As shown in FIG. 5, the blocks corresponding to the block values greater than 200 are labeled with serial numbers p0 to p9 respectively.

Step 140: determine anchor points in the blocks corresponding to the selected block values.

In this embodiment, the anchor point may be a central point of the block having a selected block value.

In another embodiment, the anchor point may be any of other points in the block, e.g., a vertex of the block, a point at 1/2 or 1/3 of the way from the vertex to the central point. This is not limited in this application.

It should be noted that, the anchor point may also be determined in the following manner. For block values of two neighboring blocks, where one is greater than a preset threshold, and the other one is less than the preset threshold, the anchor point may be determined based on a ratio of the two block values.

For example, when one block value is 100, and the other block value is 300, the anchor point may be set at 1/3 of the way from the block with the value of 300 to the block with the value of 100.

Step 150: calculate according to the anchor points and based on a preset algorithm, a curve encompassing some or all of the anchor points.

In this embodiment, the preset algorithm may be used to calculate the curve encompassing all anchor points. Generally, a point set $X \{X_1, X_2, \dots, X_n\}$ may be labeled

on a two-dimensional plane, and after the outermost points are connected, a curve encompassing all points in the point set X may be formed.

In an embodiment, the preset algorithm may be a convex hull algorithm, and the curve may be a convex hull curve.

In this embodiment, the convex hull algorithm is used in a real-number vector space, and for a given point set $X \{X_1, X_2, \dots, X_n\}$, an intersection S of all convex sets including the point set X is referred to as a convex hull of X . The convex hull of X may be formed by a linear combination of all points $(X_1, \dots, X_n)$ in X .

Simply, in a point set on a two-dimensional plane, a convex hull is a convex polygon formed by connecting the outermost points, and the convex polygon may include all points in the point set.

The convex hull algorithm may include a graham algorithm, a jarvis algorithm, a center method, a level method, or a quickhull algorithm.

The graham algorithm is used as an example below for description. Based on the blocks with selected block values shown in FIG. 5, a coordinate system is established as shown in FIG. 6.

In practice, the coordinates of each point in the point set $\{p_0, p_1, p_2, p_3, p_4, p_5, p_6, p_7, p_8, p_9\}$ are formed by longitudes and latitudes, where the longitudes are on an X axis, and the latitudes are on a Y axis. In this embodiment, for ease of description, the coordinates are simplified as integers. In FIG. 6, it is assumed that coordinates of p_0 are $(1, -2)$; coordinates of p_1 are $(1, 2)$; coordinates of p_2 are $(1, -2)$; coordinates of p_3 are $(1, 2)$; coordinates of p_4 are $(1, -2)$; coordinates of p_5 are $(1, 2)$; coordinates of p_6 are $(1, -2)$; coordinates of p_7 are $(1, 2)$; coordinates of p_8 are $(1, -2)$; and coordinates of p_9 are $(1, -2)$.

An operation process of the convex hull algorithm is described in detail as follows.

A1: select a point from all points as a base point.

Specifically, the selecting a base point may be performed in any one of the following manners.

First: a point with the minimum Y coordinate in all points may be selected as a base point. If there are two or more points with the minimum Y coordinate, a point with the minimum X coordinate is selected.

Second: a point with the minimum X coordinate in all points may be selected as a base point. If there are two or more points with the minimum X coordinate, a point with the minimum Y coordinate is selected.

Third: a point with the maximum Y coordinate in all points may be selected as a base

point. If there are two or more points with the maximum Y coordinate, a point with the maximum X coordinate is selected.

Fourth: a point with the maximum X coordinate in all points may be selected as a base point. If there are two or more points with the maximum X coordinate, a point with the maximum Y coordinate is selected.

In this embodiment, the second manner is used, that is, a point with the minimum X coordinate is selected. Because p0 and p9 both have the minimum X coordinate, then a point with the minimum Y coordinate is selected, that is, p0 is selected as the base point.

A2: sort the other points according to cosine values of included angles between the X axis and vectors formed by the other points and the base point.

In this embodiment, for any triangle, the square of any side is equal to the sum of the squares of the other two sides minus twice the product of the two sides and the cosine of the included angle of the two sides.

Assuming that three sides of an triangle are a, b, and c, and three angles of the triangle are A, B, and C, the cosine values of the angles can be calculated by using the following formulas:

$$\cos A = \frac{(b^2 + c^2 - a^2)}{2bc} \quad \text{formula 1}$$

$$\cos B = \frac{(a^2 + c^2 - b^2)}{2ac} \quad \text{formula 2}$$

$$\cos C = \frac{(a^2 + b^2 - c^2)}{2ab} \quad \text{formula 3}$$

where the range of the cosine values is $[-1, 1]$. In the Cartesian coordinate system, the cosine values are positive while in the first and fourth quadrants, negative while in the second and third quadrants, and 0 on the X axis or the Y axis.

After the cosine values of included angles of the vectors formed by all other points and the base point are obtained through calculation according to the foregoing formulas, the cosine values are sorted in a descending order, and an order of the points corresponding to the cosine values may be, e.g., p0, p1, p2, p4, p3, p5, p6, p7, p8, p9.

A3: scan through the points according to the sorted order, and retain the points with a vector product greater than 0 to obtain a convex hull curve.

In this embodiment, the vector product is a binary operation of vectors in a vector space, and can be calculated as follows:

$$|\overline{AB} \times \overline{BC}| = |\overline{AB}| \cdot |\overline{BC}| \cdot \sin \theta$$

formula 4

where $\sin \theta$ is a sine value of a vector AB and a vector BC, and a result of the vector product may be a positive value, a negative value, or 0.

When a vector product of the vector AB and the vector BC is greater than 0, it indicates that the vector AB is in the clockwise direction of the vector BC; and the point B is retained.

When the vector product of the vector AB and the vector BC is less than 0, it indicates that the vector AB is in the anticlockwise direction of the vector BC; and the point B is deleted, and points A and C are connected to form a vector AC.

When the vector product of the vector AB and the vector BC is equal to 0, it indicates that the vector AB is collinear with the vector BC; and the point B is deleted, and points A and C are connected to form a vector AC.

Steps (1-14) of the scanning include the following, as shown in FIG. 6.

1: First, connect p0 and p1 to form a vector p0p1.

2: Connect p1 and p2 to form a vector p1p2.

Because a vector product of the vector p0p1 and the vector p1p2 is 0, p1 is deleted, and p0 and p2 are connected to form a vector p0p2.

3: Connect p2 and p4 to form a vector p2p4.

Because a vector product of the vector p0p2 and the vector p2p4 is greater than 0, p2 is retained.

4: Connect p4 and p3 to form a vector p4p3.

Because a vector product of the vector p2p4 and the vector p4p3 is greater than 0, p4 is retained.

5: Connect p3 and p5 to form a vector p3p5.

Because a vector product of the vector p4p3 and the vector p3p5 is less than 0, p3 is deleted.

6: Connect p4 and p5 to form a vector p4p5.

Because a vector product of the vector p2p4 and the vector p4p5 is greater than 0, p4 continues to be retained.

7: Connect p5 and p6 to form a vector p5p6.

Because a vector product of the vector p4p5 and the vector p5p6 is less than 0, p5 is deleted.

8: Connect p4 and p6 to form a vector p4p6.

Because a vector product of the vector p2p4 and the vector p4p6 is greater than 0, p4

continues to be retained.

9: Connect p6 and p7 to form a vector p6p7.

Because a vector product of the vector p4p6 and the vector p6p7 is greater than 0, p6 is retained.

10: Connect p7 and p8 to form a vector p7p8.

Because a vector product of the vector p6p7 and the vector p7p8 is less than 0, p7 is deleted.

11: Connect p6 and p8 to form a vector p6p8.

Because a vector product of the vector p4p6 and the vector p6p8 is greater than 0, p6 continues to be retained.

12: Connect p8 and p9 to form a vector p8p9.

Because a vector product of the vector p6p8 and the vector p8p9 is less than 0, p8 is deleted.

13: Connect p6 and p9 to form a vector p6p9.

Because a vector product of the vector p4p6 and the vector p6p9 is greater than 0, p6 continues to be retained.

14: Connect p9 and p0 to form a vector p9p0.

Because a vector product of the vector p6p9 and the vector p9p0 is greater than 0, p9 is retained.

Accordingly, the retained points include p0, p2, p4, p6, and p9, and a curve formed by the vector p0p2, the vector p2p4, the vector p4p6, the vector p6p9, and the vector p9p0 is a convex hull curve.

Step 160: determine an area in the curve as an area of interest.

FIG. 7 is a schematic diagram of an area of interest determined according to anchor points according to this application. The curve (e.g., the edge of the area of interest) in FIG. 7 encompasses all points in the set (p0 to p9).

According to the embodiments of the application, first, the server grids an area on a map to be processed, counts a block value for each block, selects block values greater than a preset threshold from the counted block values, determines anchor points in the blocks corresponding to the selected block values, calculates a curve encompassing all the anchor points based on a preset algorithm, and determines an area in the curve as an area of interest. In this way, the server can automatically determine areas of interest in the area on the map by using geolocation data actually reported by users, to avoid low efficiency and high costs caused by manually demarcating the areas of interest, thereby improving efficiency and

reducing costs for determining the areas of interest.

In practice, different areas of interest have different types. For example, a food plaza is generally of a catering type, a residential area is generally of a community type, etc. In the foregoing embodiments, the area of interest obtained by using the reported geolocation data does not have a type.

To resolve the foregoing problem, in a specific embodiment of this application, after the Step 160, the method may further include:

- obtaining types of Points of Information (POIs) in the curve;
- counting the quantities of POIs of same types; and
- determining a type of POIs of the largest quantity as a type of interest for the area of interest.

In this embodiment, a Point of Information (POI) is an information point provided by a map. A POI may refer to a place, such as a large-scale mall, a supermarket, a school, or a residential area.

Generally, the POI may have a type for distinguishing from other POIs of different functions, such as a catering type, a community type, a school campus type, a hospital type, a shopping type, etc.

It should be noted that, the POI may be an information point provided by the map where the area to be processed is, or by other maps.

According to this embodiment, the server may count the numbers of POIs of same types in an area of interest, and determine a type of POIs of the largest number as a type of interest for the area of interest. In this way, the type of interest may be labeled in the obtained area of interest, so that users can quickly learn of the type of the area of interest, thereby improving user experience.

In practice, the geolocation data reported by users may have errors. For example, a positioning device of a mobile terminal has a deviation in positioning, causing a deviation of the reported geolocation data. In another example, when the mobile terminal disables the positioning device, the mobile terminal is still able to upload geolocation data, but the uploaded geolocation data indicates a geolocation of the hotspot (such as WiFi) connected to the mobile terminal or of a base station. Thus, the geolocation data also has a deviation.

To resolve the foregoing problem, in a specific embodiment of this application, the method may further include:

- obtaining POIs in the area on the map after the anchor points are determined in the blocks corresponding to the selected block values (the foregoing Step 140).

Correspondingly, the Step 150 specifically includes:

calculating, according to the POIs and the anchor points and based on the preset algorithm, the curve encompassing all the anchor points and POIs.

In this embodiment, the POIs are information points provided by a map. The POIs may refer to places, such as a large-scale mall, a supermarket, a school, a residential area, etc. The POIs may represent some interests of users, and geolocation data of the POIs is generally accurate.

It should be noted that, the POIs may be information points provided by the map where the area to be processed is, or by other maps.

In this embodiment, the server calculates, according to the anchor points and the obtained POIs and based on a preset algorithm, a curve encompassing all the anchor points and POIs. A calculation process of the preset algorithm is shown in the foregoing embodiments, and will not be repeated herein.

FIG. 8 is a schematic diagram of the area on the map shown in FIG. 2 marked with POIs.

Correspondingly, FIG. 9 is a schematic diagram of an area of interest determined according to the POIs and the anchor points. Compared with the area of interest shown in FIG. 7, additional popular places are added in the area of interest shown in FIG. 9, so that the area of interest is more accurate.

According to this embodiment, the POIs may be used to modify the geolocation data reported by users, so that a finally obtained area of interest is more accurate.

Corresponding to the foregoing embodiments of the method for determining an area of interest based on geolocation data, this application further provides embodiments of a device for determining an area of interest based on geolocation data.

The embodiments of the device for determining an area of interest based on geolocation data in this application may be respectively applied to a server device. The device embodiments may be implemented by using software, or hardware or in a manner of a combination of software and hardware. Taking software implementation as an example, a device in a logical aspect is formed by a processor of the equipment in which the device resides reading corresponding computer program instructions in a nonvolatile storage into a memory for running. From a hardware level, FIG. 10 illustrates a hardware structural diagram of an equipment which includes the device for determining an area of interest based on geolocation data according to this application. In addition to a processor, a network interface, a memory, and a nonvolatile storage shown in FIG. 10, the equipment including the

device may generally further include other hardware according to the functions of determining the area of interest based on the geolocation data, and this will not be elaborated.

FIG. 11 is a schematic module diagram of a device for determining an area of interest based on geolocation data according to an embodiment of this application. This embodiment is described from the server side, and the device includes: a processing unit 610, a counting unit 620, a selection unit 630, a first determining unit 640, a calculation unit 650, and a second determining unit 660.

The processing unit 610 is configured to grid a map area to be processed.

The counting unit 620 is configured to count a block value of each block within a preset duration, the block value being the quantity of users that report geolocation data in the corresponding block.

The selection unit 630 is configured to select block values greater than a preset threshold from the block values determined for the blocks.

The first determining unit 640 is configured to determine anchor points in the blocks corresponding to the selected block values.

The calculation unit 650 is configured to calculate, according to the anchor points and based on a preset algorithm, a curve encompassing all of the anchor points.

The second determining unit 660 is configured to determine an area in the curve as an area of interest.

In an optional implementation:

the processing unit 610 is further configured to divide the area on the map to be processed into at least one block according to a preset side length.

In an optional implementation:

the anchor point is a central point of the block having the selected value.

In an optional implementation:

The device further includes:

an obtaining subunit for obtaining types of POIs in the curve;

a counting subunit for counting the quantities of POIs of same types; and

a determining subunit for determining a type of POIs of the largest quantity as a type of interest for the area of interest.

In an optional implementation:

the device further includes:

an obtaining subunit for obtaining POIs in the area on the map after the anchor points are determined in the blocks corresponding to the selected block values.

Correspondingly, the calculation unit 650 is configured to calculate, according to the POIs and the anchor points and based on the preset algorithm, a convex hull curve encompassing all of the anchor points and POIs.

In an optional implementation:

the convex hull algorithm includes a graham algorithm, a jarvis algorithm, a center method, a level method, or a quickhull algorithm.

According to the embodiments of this application, first, the server divides an area on a map to be processed, counts a block value for each block, selects block values greater than a preset threshold from the counted block values, determines anchor points in the blocks corresponding to the selected block values, calculates a curve encompassing all of the anchor points based on a preset algorithm, and determines an area in the curve as an area of interest. In this way, the server can automatically determine areas of interest in the area on the map by using geolocation data actually reported by users, to avoid low efficiency and high costs caused by manually demarcating the areas of interest, thereby improving efficiency and reducing costs for determining the areas of interest.

Reference to the implementation processes of corresponding steps in the foregoing method may be made for details of the implementation processes of the functions and effects of the units in the device. Details are not described herein again.

Because the device embodiments basically correspond to the method embodiments, for related parts, reference may be made to the descriptions in the method embodiment. The foregoing described device embodiments are merely examples. The units described as separate parts may or may not be physically separate, and the parts displayed as units may or may not be physical units, may be located in one position, or may be distributed on a plurality of network units. Some of or all of the modules may be selected according to actual needs for achieving the objectives of the solutions of this application. A person of ordinary skill in the art may understand and implement the embodiments without creative efforts.

After considering the specification and practicing the present disclosure, a person skilled in the art may easily conceive of other implementations of this application. This application is intended to cover any variations, uses, or adaptive changes of this application. These variations, uses, or adaptive changes follow the general principles of this application and include common general knowledge or common technical means in the art, which are not disclosed in this application. The specification and the embodiments are considered as merely exemplary, and the scope and spirit of this application are pointed out in the following claims.

It should be understood that this application is not limited to the precise structures described above and shown in the accompanying drawings, and various modifications and changes can be made without departing from the scope of this application. The scope of this application is described by the appended claims.

CLAIMS

1. A method for determining an area of interest based on geolocation data, wherein the method comprises:

gridding an area on a map to be processed;

for each block in the gridded area, counting a block value within a preset duration, the block value being a quantity of users that report geolocation data in the corresponding block;

selecting block values greater than a preset threshold from the counted block values;

determining anchor points according to the blocks corresponding to the selected block values;

calculating, according to the anchor points and based on a preset algorithm, a curve encompassing all of the anchor points; and

determining an area in the curve as an area of interest.

2. The method according to claim 1, wherein the gridding an area on a map to be processed specifically comprises:

dividing the area on the map to be processed into at least one block according to a preset side length.

3. The method according to claim 1, wherein the anchor point is a central point of the block.

4. The method according to claim 1, wherein the method further comprises:

obtaining types of Points of Information (POIs) within the area in the curve;

obtaining quantities of the POIs of same types; and

determining a type of POIs of the largest quantity as a type of interest for the area of interest.

5. The method according to claim 1, wherein the method further comprises:

obtaining POIs in the area on the map after the anchor points are determined in the blocks corresponding to the selected block values, wherein

the calculating, according to the anchor points and based on a preset algorithm, a curve encompassing all of the anchor points specifically comprises:

calculating, according to the POIs and the anchor points and based on the preset algorithm, the curve encompassing all of the anchor points and POIs.

6. The method according to claim 1, wherein the preset algorithm is a convex hull algorithm; and

the curve is a convex hull curve.

7. The method according to claim 6, wherein the convex hull algorithm comprises a graham algorithm, a jarvis algorithm, a center method, a level method, or a quickhull algorithm.

8. A device for determining an area of interest based on geolocation data, wherein the device comprises:

a processing unit for gridding an area on a map to be processed;

a counting unit for counting a block value within a preset duration for each block in the gridded area, the block value being a quantity of users that report geolocation data in the corresponding block;

a selection unit for selecting block values greater than a preset threshold from the counted block values;

a first determining unit for determining anchor points according to the blocks corresponding to the selected block values;

a calculation unit for calculating, according to the anchor points and based on a preset algorithm, a curve encompassing all of the anchor points; and

a second determining unit for determining an area in the curve as an area of interest.

9. The device according to claim 8, wherein the processing unit is specifically for:

dividing the area on the map to be processed into at least one block according to a preset side length.

10. The device according to claim 8, wherein the anchor point is a central point of the block.

11. The device according to claim 8, wherein the device further comprises:

an obtaining subunit for obtaining types of Points of Information (POIs) within the area in the curve;

a counting subunit for obtaining quantities of the POIs of same types; and

a determining subunit for determining a type of POIs of the largest quantity as a type of interest for the area of interest.

12. The device according to claim 8, wherein the device further comprises:

an obtaining subunit for obtaining POIs in the area on the map after the anchor points are determined in the blocks corresponding to the selected block values, wherein

correspondingly, the calculation unit is specifically for:

calculating, according to the POIs and the anchor points and based on the preset algorithm, the curve encompassing all of the anchor points and POIs.

13. The device according to claim 8, wherein the preset algorithm is a convex hull

algorithm; and

the curve is a convex hull curve.

14. The device according to claim 13, wherein the convex hull algorithm comprises a graham algorithm, a jarvis algorithm, a center method, a level method, or a quickhull algorithm.