

CLAIMS

1. A computer-implemented location information processing method, comprising:

obtaining, from a plurality of user terminals of a plurality of users, transaction information of the plurality of users using a service provided by a service provider, the transaction information comprising a plurality of pieces of location information of the plurality of users, wherein the location information comprises latitude and longitude information of the plurality of the user terminals when the user terminals scan a two-dimensional code or a barcode provided by the service provider;

clustering the plurality of pieces of location information into at least one area;

determining a transaction attribute corresponding to each area in the at least one area, the transaction attribute comprising a number of users in a corresponding area and/or a number of transactions of users using the service in the corresponding area;

determining a service dispersity of the service provided by the service provider according to the number of areas in the at least one area and the transaction attribute corresponding to each area, comprising determining, according to an information entropy value of the transaction attribute, the service dispersity of the service provided by the service provider; and

determining, according to the service dispersity, whether the two-dimensional code or the barcode was scanned offline or online by the plurality of user terminals.

2. The computer-implemented method according to claim 1, wherein the obtaining, from the plurality of user terminals of the plurality of users, transaction information of the plurality of users using a service provided by a service provider comprises:

obtaining transaction information of the plurality of users using the service provided by the service provider within a pre-determined period.

3. The computer-implemented method according to claim 1, wherein, before the clustering the plurality of pieces of location information into at least one area, the method further comprises:

removing location information exceeding a pre-determined range from the plurality of pieces of location information comprising the latitude and longitude information.

4. The computer-implemented method according to claim 1, wherein the clustering the plurality of pieces of location information into at least one area comprises:

5 using a GEOHASH algorithm or a DBSCAN algorithm to cluster the plurality of pieces of location information into the at least one area.

5. The computer-implemented method according to claim 1, wherein the determining a service dispersity of the service provided by the service provider comprises determining the service dispersity using the following equation:

$$10 \quad \text{Spread}(b_i) = \frac{\sum_{i=1}^m \frac{b_i}{\sum_{j=1}^m b_j} * \ln\left(\frac{b_i}{\sum_{j=1}^m b_j}\right)}{\ln(m)}$$

where $\text{Spread}(b_i)$ represents the service dispersity, $i, j = 1, \dots, m$, m represents the number of areas, b_i represents a transaction attribute corresponding to the i^{th} area, and b_j represents a transaction attribute corresponding to the j^{th} area.

6. The computer-implemented method according to claim 1, wherein the determining a
15 service dispersity of the service provided by the service provider comprises determining the service dispersity using the following equation:

$$\text{Spread}(b_i) = \frac{1 - \sum_{i=1}^m \left(\frac{b_i}{\sum_{j=1}^m b_j}\right)^2}{1 - \frac{1}{m}}$$

20 where $\text{Spread}(b_i)$ represents the service dispersity, $i, j = 1, \dots, m$, m represents the number of areas, b_i represents a transaction attribute corresponding to the i^{th} area, and b_j represents a transaction attribute corresponding to the j^{th} area.

7. A location information processing apparatus, comprising:

an obtaining unit configured to obtain, from a plurality of user terminals of a plurality of users, transaction information of the plurality of users using a service provided by a service

- provider, the transaction information comprising a plurality of pieces of location information of the plurality of users, wherein the location information obtained by the obtaining unit comprises latitude and longitude information of the plurality of the user terminals when the user terminals scan a two-dimensional code or a barcode provided by the service provider;
- 5 a clustering unit configured to cluster the plurality of pieces of location information into at least one area;
- a determining unit configured to determine a transaction attribute corresponding to each area in the at least one area, the transaction attribute comprising a number of users in a corresponding area and/or a number of transactions of users using the service in the corresponding area; and
- 10 a processing unit configured to determine a service dispersity of the service provided by the service provider according to the number of areas in the at least one area and the transaction attribute corresponding to each area, comprising determining, according to an information entropy value of the transaction attribute, the service dispersity of the service provided by the service provider,
- 15 wherein the processing unit is further configured to determine, according to the service dispersity, whether the two-dimensional code or the barcode was scanned offline or online by the plurality of user terminals.
8. The apparatus according to claim 7, wherein the obtaining unit is configured to:
- obtain transaction information of the plurality of users using the service provided by the
- 20 service provider within a pre-determined period.
9. The apparatus according to claim 7, further comprising:
- a removing unit configured to remove location information exceeding a pre-determined range from the plurality of pieces of location information comprising the latitude and longitude information.
- 25 10. The apparatus according to claim 7, wherein the clustering unit is configured to:

cluster the plurality of pieces of location information into the at least one area by using a GEOHASH algorithm or a DBSCAN algorithm.

11. The apparatus according to claim 7, wherein the processing unit is configured to determine the service dispersity using the following equation:

$$5 \quad \text{Spread}(b_i) = \frac{\sum_{i=1}^m - \frac{b_i}{\sum_{j=1}^m b_j} * \ln \left(\frac{b_i}{\sum_{j=1}^m b_j} \right)}{\ln(m)}$$

where $\text{Spread}(b_i)$ represents the service dispersity, $i, j = 1, \dots, m$, m represents the number of areas, b_i represents a transaction attribute corresponding to the i^{th} area, and b_j represents a transaction attribute corresponding to the j^{th} area.

12. The apparatus according to claim 9, wherein the processing unit is configured to
10 determine the service dispersity using the following equation:

$$\text{Spread}(b_i) = \frac{1 - \sum_{i=1}^m \left(\frac{b_i}{\sum_{j=1}^m b_j} \right)^2}{1 - \frac{1}{m}}$$

where $\text{Spread}(b_i)$ represents the service dispersity, $i, j = 1, \dots, m$, m represents the number of areas, b_i represents a transaction attribute corresponding to the i^{th} area, and b_j represents a transaction attribute corresponding to the j^{th} area.

15 13. One or more non-transitory computer-readable storage media storing instructions executable by a computing device, wherein execution of the instructions causes the computing device to perform the method of any of claims 1-6.