

### Claims

1. Communications server apparatus for generating navigable map data, the communications server apparatus comprising a processor and a memory, and being  
5 configured, under control of the processor, to execute instructions stored in the memory:  
to generate a series of journey trace data sets, each journey trace data set comprising data representing a user journey, each journey trace data set being derived using geolocation transmissions from a communications device of a user  
10 undertaking the user journey;  
to aggregate the series of journey trace data sets to generate route image data comprising data representing a network of navigable routes; and  
to generate, from the route image data, the navigable map data, the navigable map data comprising data representing a series of geolocations  
15 corresponding to the network of navigable routes.
2. Communications server apparatus according to claim 1, configured to generate a journey trace data set by:  
forming a first group of geolocation transmissions from journey traces having  
20 a common starting location and a common destination location;  
depending on accuracy values for geolocation transmissions within the first group, determining a weighted shortest path from the common starting location to the common destination location or generating a density-based extracted trace from the common starting location to the common destination location; and  
25 defining the journey trace data set using either the weighted shortest path or the density-based extracted trace.
3. Communications server apparatus according to claim 2, configured for the first group of geolocation transmissions to be formed from a second group of

geolocation transmissions from journey traces having the common destination location but different starting locations.

4. Communications server apparatus according to any preceding claim,  
5 configured to filter geolocation transmissions if a number of geolocation transmissions in the first group of geolocation transmissions is less than a predefined minimum number.
5. Communications server apparatus according to any preceding claim,  
10 configured to filter geolocation transmissions if spatial distribution of geolocation transmissions in the first group of geolocation transmissions satisfies a threshold criterion.
6. Communications server apparatus according to any one of claims 2 to 5,  
15 configured to determine the weighted shortest path by:
  - deriving weightings for geolocation transmissions in the first group using the accuracy values;
  - defining the common starting location as a geographical cell; and
  - forming an overall group of weighted geolocation transmissions from plural  
20 user journeys starting in the geographical cell.
7. Communications server apparatus according to claim 6, configured to determine the weighted shortest path by:
  - identifying a centre of the geographical cell; and
  - 25 defining the weighted shortest path between the centre of the geographical cell and the common destination location using the overall group of weighted geolocation transmissions.
8. Communications server apparatus according to claim 2, configured to  
30 determine the density-based extracted trace by:

- determining a group of geographical cells within which the geolocation transmissions of an overall group of geolocation transmissions were transmitted from;
- generating a density image data set for the overall group of geolocation transmissions;
- 5 deriving a skeleton data set of merged geolocation transmission points from the density image data set;
- generating connections between merged geolocation transmission points in the skeleton data set;
- 10 defining a centre of a geographical cell as a starting location; and
- determining a shortest path of geolocation transmission points between the starting location and the common destination location, the shortest path defining the density-based extracted trace.
- 15 9. Communications server apparatus according to claim 8, configured to generate the density image data set by:
- dividing the group of geographical cells into area portions;
- deriving weightings for geolocation transmissions in the overall group using accuracy values of the geolocation transmissions in the overall group;
- 20 determining an overall weighting value for geolocation transmissions generated from within an area portion; and
- determining a corresponding density value for the area portion using the overall weighting value.
- 25 10. Communications server apparatus according to claim 1, configured to aggregate the series of journey trace data sets by generating aggregated journey trace image data using journey trace data for multiple journey traces, the journey trace image data being representative of journey trace density.

11. Communications server apparatus according to claim 10, wherein the multiple journey trace data sets comprise data representative of user journeys from multiple geographical cells to a common destination location.
- 5 12. Communications server apparatus according to claim 10 or claim 11, configured to perform skeleton extraction processing on the journey trace image data, thereby to derive the data representing the network of navigable routes.
- 10 13. Communications server apparatus according to claim 1, configured to generate the navigable map data by correlating the data representing sections of routes in the network of navigable routes with geolocations and/or with known thoroughfares.
- 15 14. Communications server apparatus according to claim 13, configured to associate geolocations with one another thereby to generate the navigable map data.
- 20 15. A method, performed in a communications server apparatus for generating navigable map data, the method comprising, under control of a processor of the server apparatus:
- generating a series of journey trace data sets, each journey trace data set comprising data representing a user journey, each journey trace data set being derived using geolocation transmissions from a communications device of a user undertaking the user journey;
- 25       aggregating the series of journey trace data sets to generate route image data comprising data representing a network of navigable routes; and
- generating, from the route image data, the navigable map data, the navigable map data comprising data representing a series of geolocations corresponding to the network of navigable routes.
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16. A computer program product comprising instructions for implementing the method of claim 15.
17. A computer program comprising instructions for implementing the method of  
5 claim 15.
18. A non-transitory storage medium storing instructions, which when executed by a processor, cause the processor to perform the method of claim 15.