Claims

1. A computer-implemented apparatus for predicting traffic conditions in respect of a specified route within a road network, the apparatus comprising a processor and a memory, and being configured, under control of the processor, to execute instructions stored in the memory to:

- receive input data representative of said specified route comprising one or more road segments between a start location and a destination selected from within a road network representing a geographical region;
- obtain a diffusion graph representative of said specified route, said diffusion graph comprising edges connected by nodes, wherein a weight associated with each edge comprises a respective transition probability representing a likelihood of traffic on a respective road segment diffusing to another road segment; and
- use a Transformer-based framework to predict a traffic condition for each segment of the route;

wherein said Transformer-based framework comprises an attention module and an input configured to receive a set of input dimensions for each segment of the route, said dimensions including at least a respective transition probability and temporal data, said Transformer-based framework further comprising an attention adjust module configured to receive each set of input dimensions and generate therefrom a weight modifier for modifying attention weights generated by said attention module based on the likelihood of a traffic state on one road segment influencing a traffic state on another road segment, wherein the attention adjust module is configured to generate the weight modifier based on distances between the road segments .

2. A computer-implemented apparatus according to claim 1, wherein each said set of input dimensions includes temporal data in the form of a day of the week and a time period represented by respective numerical values.

3. A computer-implemented apparatus according to claim 1 or claim 2, wherein each said set of input dimensions includes numerical data representative of a road type and/or a vehicle type in relation to travel along said specified route.

4. A computer-implemented apparatus according to any of the preceding claims, wherein each said set of input dimensions includes data representative of a speed of travel on a road segment and/or a length of a road segment.

5. A computer implemented apparatus according to claim 4, wherein said data representative of a speed of travel and/or said data representative of a length of a road segment is/are normalized in each said set of input dimensions.

6. A computer-implemented apparatus according to any of the preceding claims configured to receive said specified route from a routing API.

7. A computer-implemented apparatus according to any of the preceding claims, further configured to calculate a travel time in respect of said specified route based on the predicted traffic conditions.

8. A computer-implemented apparatus according to any of the preceding claims, further configured to output the predicted traffic conditions in relation to said specified route on a display.

9. A computer-implemented apparatus according to any of the preceding claims, configured to obtain an edge-based graph representative of said specified route in which each vertex represents a segment of the road network, and a vertex is connected to an adjacent vertex if it is possible to reach one respective road segment from the other, and to determine the diffusion graph using the edge-based graph.

10. A computer-implemented apparatus according to claim 9, configured to determine respective transition probabilities in the diffusion graph based on corresponding weights in the edge-base graph.

11. A communications apparatus for allocating resources to service requests related to a shared economy on-demand travel and/or transport service provision, the communications apparatus comprising a processor, a memory and a computer-implemented apparatus according to any of the preceding claims for predicting traffic conditions, and being configured, under control of the processor, to:

- receive a service request;
- identify a start location and a destination specified in said service request;
- obtain a recommended route comprising one or more road segments between said start location and said destination selected from within a road network representing a geographical region;
- identify a service provider for fulfilling said service request; and
- input said recommended route and data representative of said service provider to said apparatus for predicting traffic conditions to generate a set of predicted traffic condition data associated with said one or more road segments in said recommended route.

12. A communications apparatus according to claim 11, configured to output said predicted traffic condition data in association with said recommended route on a user display.

13. A communications apparatus according to claim 11 or 12, further configured to predict an arrival time of said service provider at said destination using the predicted traffic condition data.

14. A communications apparatus according to claim 13, further configured to allocate another service request to said service provider based on said predicted arrival time at said destination of the previous service request.

15. A communications apparatus according to any of claims 11to 14, comprising a data store in which is stored edge-based graph data for said road network, and wherein said apparatus for predicting traffic conditions is further configured to

selectively retrieve said edge-based graph data representative of a recommended route from said data store.

16. A communications apparatus according to claim 15, wherein said data store is a distributed data store comprising a plurality of memory locations, each memory location storing edge-based graph data for a different respective portion of said road network.

17. A communications system for allocating resources to service requests related to a shared economy on-demand transport and/or delivery service provision, the communications system comprising at least one user communications device and communications network equipment operable for the communications server apparatus and the at least one user communications device to establish communication with each other therethrough, and at least one service provider communications device and communications network equipment operable for the communications server apparatus and the at least one service provider communications device to establish communication with each other therethrough, the communications server apparatus comprising a processor, a memory and a computer-implemented apparatus according to any of claims 1 to 10, and being configured, under the control of the processor, to execute instructions stored in the memory to:

- receive a service request from the user communications device;
- input a start location and a destination specified in said service request to a routing API to obtain a recommended route comprising one or more road segments between said start location and said destination selected from within a road network representing a geographical region;
- identify a service provider for fulfilling said service request; and
- input said recommended route and data representative of said service provider to said apparatus for predicting traffic conditions to generate a set of predicted traffic condition data associated with said one or more road segments in said recommended route.

18. A service provider communications device for receiving data representative of service requests allocated to a service provider from a communications server apparatus via a communications network, the service provider communications device comprising a routing API, and a computer-implemented apparatus according to any of claims 1 to 10, a processor and a memory, and being configured, under control of the processor, to execute instructions stored in the memory to:

- receive data representative of a service request including a start location and a destination;
- input said start location and destination specified in said service request to said routing API to obtain a recommended route comprising one or more road segments between said start location and said destination selected from within a road network representing a geographical region; and
- input said recommended route and data representative of said service provider to said apparatus for predicting traffic conditions to generate a set of predicted traffic condition data associated with said one or more road segments in said recommended route.

19. A computer-implemented method of predicting traffic conditions in respect of a specified route within a road network, comprising the steps of:

- receiving input data representative of said specified route comprising one or more road segments between a start location and a destination selected from within a road network representing a geographical region;
- obtaining a diffusion graph representative of said specified route, said diffusion graph comprising edges connected by nodes, wherein a weight associated with each edge comprises a respective transition probability representing a likelihood of traffic on a respective road segment diffusing to another road segment; and
- using a Transformer-based framework to predict a traffic condition for each segment of the route;

wherein said Transformer-based framework comprises an attention module and an input configured to receive a set of input dimensions for each segment of the route, said dimensions including at least a respective transition probability and temporal

data, said Transformer-based framework further comprising an attention adjust module configured to receive each set of input dimensions and generate therefrom a weight modifier for modifying attention weights generated by said attention module based on the likelihood of a traffic state on one road segment influencing a traffic state on another road segment, wherein the attention adjust module generates the weight modifier based on distances between the road segments.

20. A computer program product comprising instructions for implementing the method of claim 19.

21. A computer program comprising instructions for implementing the method of claim 19.

22. A non-transitory storage medium storing instructions which, when executed by a processor, cause the processor to perform the method of claim 19.