drivers' actual routes in order to minimise the deviation for improving routing results; b. how to efficiently and effectively learn drivers' raw trajectory data, which is of great volume and can be noisy, for improving routing results; and c. how to improve the routing such that it works well in different countries or geographical regions despite hyper-local situations (e.g., in southeast Asia, traffic rules, road conditions and regulations vary significantly in each country).

[07] A need therefore exists to provide methods and devices that seek to overcome or at least minimize the above mentioned challenges and provide accurate route planning.

SUMMARY

[08] According to a first aspect of the present disclosure, there is provided a method for route deviation quantification of a suggested route. The method comprises: obtaining a ground truth route based on a filtered trajectory obtained from a historical trajectory on a map, the filtered trajectory including an inferred location of origin and an inferred location of destination, wherein the inferred location of origin and the inferred location of destination are at least a threshold distance away from a location of origin and a location of destination, respectively; obtaining a suggested route generated based on the inferred location of origin and the inferred location of destination; quantifying a deviation of the suggested route from the ground truth route by calculating an offcourse ratio of a combined length of road segments in the suggested route that are matched to corresponding road segments in the ground truth route to a combined length of road segments in the ground truth route.

[09] According to a second aspect of the present disclosure, there is provided a device for route deviation quantification of a suggested route. The device comprises a processor module and a memory module including computer program code. The memory module and the computer program code are configured to, with the processor module, cause the device to: obtain a ground truth route based on a filtered trajectory obtained from a historical trajectory on a map, the filtered trajectory including an inferred location of origin and an inferred location of destination, wherein the inferred location of origin and the inferred location of destination are at least a threshold distance away from a location of origin and a location of destination, respectively; obtain a suggested route generated based on the inferred location of origin and the inferred location of destination; and quantify a deviation of the suggested route from the ground truth route by calculating

an offcourse ratio of a combined length of road segments in the suggested route that are matched to corresponding road segments in the ground truth route to a combined length of road segments in the ground truth route.

[010] According to a third aspect of the present disclosure, there is provided a method for vehicular route learning. The method comprises: retrieving a training data set corre-

sponding to historical trajectories on a map; wherein the training data set comprises a collection of data points, wherein each data point corresponds to one of the historical trajectories on the map and contains: an inferred location of origin and an inferred location of destination of the one of the historical trajectories, wherein the inferred location of origin and the inferred location are at least a threshold distance away from a location of origin and a location of destination, respectively, a suggested route connecting the inferred location of origin and the inferred location of destination generated based on a map and a speed profile, and a corresponding ground truth route of the one of the historical trajectories; optimising the speed profile of the map to achieve a minimised average offcourse ratio for the training data set; wherein the optimizing the speed profile comprises: for each suggested route in the training data set, calculating an offcourse ratio of a combined length of road segments in the suggested route that are matched to corresponding road segments in the corresponding ground truth route to a combined length of road segments in the corresponding ground truth route to quantify a deviation between the suggested route and the corresponding ground truth route; aggregating calculated offcourse ratios and determining an average offcourse ratio for all the suggested routes in the training data set, and updating the speed profile for the map.

[011] According to a fourth aspect of the present disclosure, there is provided a system for vehicular route learning. The system comprises a processor module and a memory module including computer program code. The memory module and the computer program code are configured to, with the processor module, cause the system to: retrieve a training data set corresponding to historical trajectories on a map; wherein the training data set comprises a collection of data points, wherein each data point corresponds to one of the historical trajectories on the map and contains: an inferred location of origin and an inferred location of destination of the one of the historical trajectories, wherein the inferred location of origin and the inferred location are at least a threshold distance away from a location of origin and a location of destination, respectively, a suggested route connecting the inferred location of origin and the inferred location of destination generated based on a map and a speed profile, and a corresponding ground truth route of the one of the historical trajectories; optimise the speed profile of the map to achieve a minimised average offcourse ratio for the training data set; wherein the optimizing the speed profile comprises: for each suggested route in the training data set, calculating an offcourse ratio of a combined length of road segments in the suggested route that are matched to corresponding road segments in the corresponding ground truth route to a

combined length of road segments in the corresponding ground truth route to quantify a deviation between the suggested route and the corresponding ground truth route; aggregating calculated offcourse ratios and determining an average offcourse ratio for all the suggested routes in the training data set, and update the speed profile for the map.

BRIEF DESCRIPTION OF THE DRAWINGS

[012] Embodiments and implementations are provided by way of example only, and will be better understood and readily apparent to one of ordinary skill in the art from the following written description, read in conjunction with the drawings, in which:

[013] Figure 1 is a schematic diagram of a computing device. The computing device can be implemented as a device for route deviation quantification or a system for vehicular route learning, according to embodiments of the present application.

[014] Figure 2 is a schematic diagram of a device for route deviation quantification, according to an embodiment.

[015] Figure 3 is a block diagram of a device for route deviation quantification module, according to another embodiment.

[016] Figure 4 is a flow chart illustrating a method for route deviation quantification, according to an embodiment.

[017] Figure 5 is an exemplary diagram showing raw GPS data and pre-processed GPS data, according to an embodiment. The pre-processed GPS data can be used in a routing-metric computation module to evaluate suggested routes suggested by a route engine module as shown in Figure 2. The evaluation result produced by the routing-metric computation module can further be used for downstream applications, e.g. vehicular route learning.