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Augmenting Navigational Guidance by Incorporating Local Regulations in Effect

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ABSTRACT

Users often use map applications to get directions to travel from one location to another. Sometimes, temporary local guidance from public authorities that is in effect at the time of travel may impact availability and use of specific transportation modes. Currently, users must already know of such short or long term guidance from local authorities or must seek it separately because it is typically not available within the map application that provides travel directions. This disclosure describes techniques to provide travel directions with routing options and optimization that are based on criteria other than distance and travel time. Such additional criteria used for routing guidance can be based on current information from relevant external sources, such as travel advisories from public bodies.

KEYWORDS

- Public health
- Physical distance
- Social distancing
- Route optimization
- Route selection
- Public transportation
- Travel intent
- Travel directions
- Online maps
- Navigation

BACKGROUND

Users often use map applications to get directions to travel from one location to another. Users can ask for such directions to match the desired travel mode, such as walking, biking, driving, or using public transportation. Typically, map applications provide directions that minimize the total travel duration. However, sometimes the user is offered alternatives, such as biking a certain section of the route instead of walking.

Sometimes, temporary local guidance from public authorities that is in effect at the time of travel impacts availability and use of specific transportation modes. For example, during a public health emergency, governments can impose restrictions on the use of public transportation to avoid creating crowded enclosed environments that are conducive for the transmission of microbes. In another example, public bodies can offer guidance that can help choose between different transportation options based on their community impact. For instance, travelers can be encouraged to choose public transportation to help reduce carbon emissions. Currently, users must already know of such short or long term guidance from local authorities or must seek such information separately since it is not available within the map application that provides travel directions.

DESCRIPTION

This disclosure describes techniques to provide travel directions with routing options and optimization that are based on additional criteria beyond distance and travel time. Such additional criteria used for routing guidance can be based on current information from relevant external sources, such as travel advisories from public bodies.

For instance, if local authorities issue an advisory requiring citizens to maintain a safe distance from others to help combat a pandemic of an infectious disease, routing options are provided that take into account the extent to which each presented routing option permits keeping away from others encountered en route. Similarly, routing options can be based on other criteria such as reducing carbon emissions to help meet regional and individual sustainability targets. If the user permits, the routing guidance can be further customized based on the reason for the travel, such as grocery shopping, commuting to work, etc.

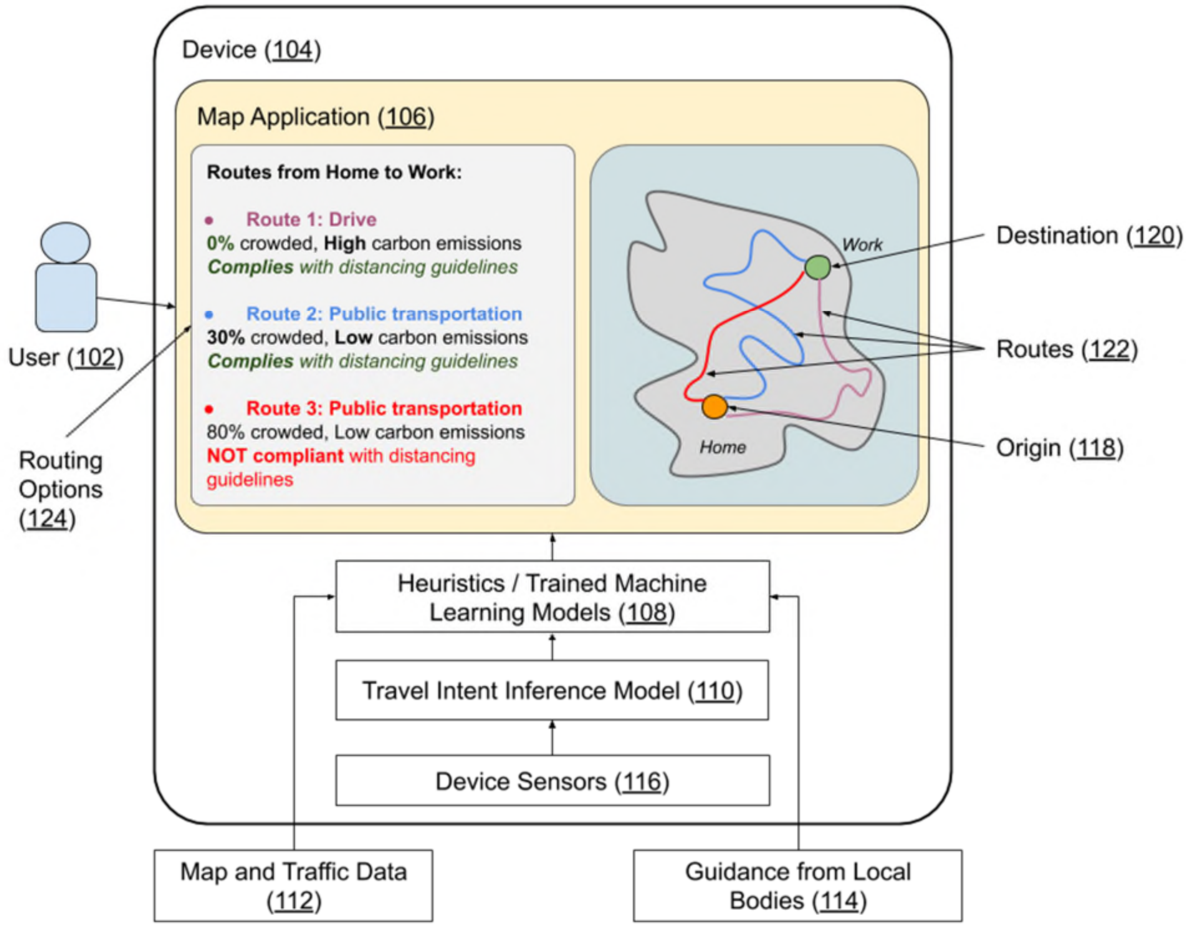

Fig. 1: Routing options based on local regulatory guidance and travel intent

Fig. 1 shows an example of operational implementation of the techniques described in this disclosure. A user (102) invokes a map application (106) on a device (104) to seek travel routes (122) to commute to work (120) from home (118) during a pandemic. The various routing options (124) shown to the user include indicators denoting the likelihood that the user will be able to maintain a prescribed distance from others encountered along the route, along with expected carbon emissions.

The user can use the indicators along with the other parameters to make an informed route choice. The presented routing options are determined using heuristics and/or trained machine learning models (108) based on map and traffic data (112) combined with guidance from local bodies (114) as well as the user's travel intent inferred with permission using a trained machine learning model (110). With user permission, the intent inference model can employ appropriate contextual information, such as data from one or more device sensors (116).

Calculating and selecting the routing options shown to the user can be based on a number of pieces of information related to the additional criteria incorporated within the operation. For example, the ability to maintain distance from others along a route can be determined based on factors such as: number of individuals likely to be encountered en route; number of individuals at origin, destination, and transfer points; number of trips a particular vehicle makes each day; how well ventilated is the cabin of the transport vehicle, e.g., is it an enclosed space or open; the regions traversed by the transportation vehicle; etc. The vehicles can include private as well as public transportation. For instance, for users traveling from one place to another with their own cars, the indicator can be zero to reflect no chances of running into others. In contrast, the indicator would show higher values for other more travel means, such as biking, public transportation, walking along a thoroughfare, etc. In such cases, the value of the indicator is higher with increase in the extent of crowds along the route.

Users seek navigational guidance for a variety of purposes. For instance, a user may be seeking directions for required travel (e.g., commuting to work), fulfilling a need (e.g., grocery shopping), leisure (e.g., hiking), etc. If the user permits, the user's intended activity for undertaking the travel can be inferred using a trained machine learning model to consider appropriate factors, such as the origin, destination, routines, relevant contextual information, etc.

Based on the inferred intention of the user and relevant regulatory guidance from local bodies, the presented routing options can encourage the user to choose an optimal option that is respectful of current local guidance by highlighting or recommending it. For instance, the user can be recommended choosing public transportation for commuting to work, driving a private vehicle for leisure activities, and walking for shopping at the nearby store. Whenever a routing option is recommended, the user is provided an explanation for suggesting the choice.

In addition, users can be provided the option to specify additional inputs pertaining to the criteria incorporated for determining routing options. For instance, the user can indicate that only routes with crowding below a certain threshold are acceptable. In response, the routing calculations are carried out to give preference to less crowded routing options. Similarly, the user can indicate preferences for other desired criteria, such as carbon emissions associated with the travel option.

Implementing the techniques described above involves estimating the values for the additional criteria incorporated for routing guidance. The estimates are derived based on relevant heuristics and/or by use of appropriately trained machine learning models. The heuristics and/or machine learning model use underlying data processing pipelines for traffic and mapping data, augmented with information from local bodies. The information from local bodies can include appropriate parameters such as effective periods, covered regions, affected travel modes, constraints, limits, etc. For instance, the information can specify that public transport may not be used for leisure travel anywhere in a particular region, e.g., a county, during the current month.

When a user seeks navigational guidance to travel from one location to another, routes connecting the origin and the destination are determined using standard routing algorithms. Further, the data processing pipeline provides relevant guidance from local bodies that matches the travel mode suited for the user's intended activity, inferred with the user's permission. For routes that involve public transportation, the data processing pipeline can further provide the entire route of the public transportation vehicle that serves a given route.

With user permission, the heuristics and/or trained machine learning models are used to rank the matching routes returned by the standard routing algorithm based on the extent to which each route meets limitations and constraints of the local bodies, the user's inferred activities, and/or user specified preferences. For instance, routing options that are expected to be more crowded than what the user desires can be removed, and the remaining options can be sorted by the levels of expected crowding along the route.

Relevant information pertaining to each presented routing option is shown within the user interface (UI) that presents navigational guidance. For instance, the UI can indicate inferred likelihood that the route adheres to local guidelines in effect along with an explanation, such as expected number of people and sizing constraints making it infeasible to respect the prescribed separation between individuals. In addition to route-specific information, the UI can provide information on the vehicle servicing the route, such as previous traversal through a highly crowded area. Moreover, the user's intention for the travel inferred with the user's permission can be shown next to the requested navigational guidance. The user can be provided options to correct any incorrect inferences, and such corrections are used to refine the underlying model for future inferences.

Route selection and UI presentation can be extended to cover routes crossing multiple regions, each with its own local guidance. The user can seek navigation guidance via any suitable input mode such as voice, typing, selecting points on a map, etc. The threshold values used during the operation of the various trained machine learning models can be provided by the developers, specified by the users, and/or determined dynamically at runtime.

The techniques described in this disclosure can be incorporated within any application, platform, or device that provides maps and guidance and directions for navigating between places. The techniques can enhance the utility of navigational guidance by making it efficient to find and choose optimal routes compliant with current local guidelines and restrictions. Further, the techniques can enhance outcomes related to important collective societal matters such as public health, sustainability, etc.

Further to the descriptions above, a user may be provided with controls allowing the user to make an election as to both if and when systems, programs or features described herein may enable collection of user information (e.g., information about a user’s social network, social actions or activities, profession, a user’s preferences, or a user’s current location), and if the user is sent content or communications from a server. In addition, certain data may be treated in one or more ways before it is stored or used, so that personally identifiable information is removed. For example, a user’s identity may be treated so that no personally identifiable information can be determined for the user, or a user’s geographic location may be generalized where location information is obtained (such as to a city, ZIP code, or state level), so that a particular location of a user cannot be determined. Thus, the user may have control over what information is collected about the user, how that information is used, and what information is provided to the user.

CONCLUSION

This disclosure describes techniques to provide travel directions with routing options and optimization that are based on criteria other than distance and travel time. Such additional criteria used for routing guidance can be based on current information from relevant external sources, such as travel advisories from public bodies. If the user permits, the routing guidance can be further customized based on the reason for the travel. Implementing the techniques described above involves estimating the values for the additional criteria incorporated for routing guidance. The estimates are used to filter and rank the matching routes returned by the standard routing algorithm based on the extent to which each route meets limitations and constraints of the local bodies, user's inferred activities, and/or user specified preferences. The user interface (UI) that presents navigational guidance shows relevant information pertaining to each presented routing option.