International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169
Volume: 4 Issue: 3 236 - 239

Optimal Maps

Prof. Era Johri
Department of Information Technology
K.J. Somaiya College of Engineering
Mumbai, India
erajohri@somaiya.edu

Dhaval Popat
Department of Information Technology
K.J. Somaiya College of Engineering
Mumbai, India
d.popat@somaiya.edu

Arnaja Sen
Department of Information Technology
K.J. Somaiya College of Engineering
Mumbai, India
arnaja.sen@somaiya.edu

Hardik Shah
Department of Information Technology
K.J. Somaiya College of Engineering
Mumbai, India
hns@somaiya.edu

***Abstract*—** Speed and safety have become complementary terms now. Everywhere people are rushing to get the things done meeting the deadlines. Shortest routes always become a prime priority to reach destination. But can taking shortest routes on road transport be considered as good? In this paper, we talk about the psychology of a driver mapping to the facts like accident prone areas, traffic and many more. We will suggest optimal routes to the user in Google Maps integrating it to other factors like climatic conditions, human behavior, accident prone areas and many more. Our system will integrate many inputs from various systems, real time and using the big data analytics we will predict the best possible route for the user in safe and speedy way. The cognitive process involved will update our predicate logic in knowledge database to store the best possible way to predict the driver's behavior next time and suggest the best possibility for driving in a more convenient and user friendly manner.

Keywords- *Internet of Things, Global Positioning System, Data Stream Model, Artificial Intelligence, Google maps, Crimes and accidents analysis system, Traffic signaling*

*****

I. INTRODUCTION

In this paper, we talk about a complete automated system that will input the destination place where the user may want to go depending upon the habits, requirements or by user's choice. Our starting point of journey will be decided as per the coordinates generated by the Global Positioning System (GPS) embedded in the mobile phones or any other similar type of device which supports GPS. Our system will take input from the various sources like GPS traffic signalling, user's driving habits and many more and will suggest the best route based on distance between source and destination, real time traffic status and the time required to reach the destination. The system will highlight three feasible routes but the best amongst them will be highlighted with red colour and the other two with blue colour. The real time traffic status and the time required to reach the destination will be shown to the user for all the three routes which will enable the user to make a better decision in the selection process.

Our system is marked with the additive further information on lane and road names, famous skyscrapers and milestones, real time and typical traffic information. Users will not only be able to find for the specific site or location but they will also get turn-by-turn driving directions for various different routes and thus users can instantly cast the navigation attribute for getting quick directions of the route. Users can use their current routes or setup new routes to dispatch data to GPS Navigation devices and thus they can schedule the trip from home only.

This system has the capability to provide directions between various points that assist the users to alter their routes. It also provides the traffic data in real time to unveil the speed of the various vehicles on the roads. Besides users can also get the direction to one or multiple locations and also can customize the directions by altering the travel time to find the best route available. Users can also see tangled route of the roads at a glance.

A rough estimate time is also provided for each route and users can handily exchange between map and satellite view, or users can go for a hybrid view that covers the information available in the map view onto the satellite view. It also provides the street view feature that enables the users to get the broad and wide view of the buildings and areas encompassing a particular lane.

Therefore Google Maps are changing the way in which users see the world from various perspectives and it is a great innovation of modern era technology and a great milestone that such vast and huge amount of data seems to be readily accessible. This paper aims at demonstrating the various new and advanced features in detail and also the use of various algorithms to predict the results.

II. THEORY

In this paper, we follow the motto of driving fast and driving safe. For this, we propose a system which will accept the destination of the user and the source will be selected automatically with the help of GPS. Moreover, the source will continue changing constantly after every few seconds as the user drives to facilitate real-time monitoring. The system will predict the best route based on the time required to reach the destination, number of traffic signals on the route and safety of

the route. Once the user drives on any route, irrespective of whether that route is predicted best or not, the color of that route will be changed to red and all other routes will be automatically displayed in blue color to suggest alternate options. Information of only that route will be displayed which is selected by the user. In case of any deviation from the route which is taken by the user, the best route will again be predicted for the user by using the current location as the source and the previously predicted best route will be deleted before the new prediction so that user does not gets redirected to the previously driven route. This will also prevent the user from getting confused with the previous route suggested. In case of any future possibility for diversion on the route ahead, the above process of predicting three routes will be repeated by taking the point of diversion as the source. If any of the three newly predicted routes is better than the current route, then its color will be displayed in red and other two will be blue. But if any of the three newly suggested routes is not better than the current route, then all the three routes predicted due to diversion will be in blue color.

Our proposed system will also have a facility of providing landmark names along with the distance for taking any turns on the route to ease user while driving. This will help the user in understanding which turn should be taken in case the distance between two turns on the road is very less. Through this feature driver will drive hustle free and confidently.

Users will have an option to login to our system so that it would be possible to monitor user behavior and predict the user patterns. Even if the user does not follow the best predicted route, this information of new route based on user's choice will be stored in our database and used in predicting next time the user drives on the same route.

III. TIME PREDICTION

In this system, we will integrate time prediction feature which will accept values like user's speed, traffic signal data [3], real-time traffic on roads, etc and will compute minimum time required to reach the destination safely. The system will calculate these results for each route possible for a user to reach the destination and will repeat these calculations constantly at real-time. The following conventional formula for speed and time will be used for normal time taken calculations.

Time = Distance / Speed

Every time the average of the maximum speed limit on the route and the user's speed will be used for calculating the time required to reach the destination using a particular route. As the user drives, real-time monitoring of the user's speed will be done using GPS. The system will take into consideration traffic status on that route by reading values of traffic on that particular road by some traffic estimation system. As the speed of the user will be dependent on the traffic on that particular route, it is necessary to closely monitor the user's speed.

The speed of the user will be calculated by observing the rate at which the coordinates of the user are changing in the GPS. Our system will also provide alert to the driver when the speed limit is attained, both minimum and maximum on road pertaining to the safety of the driver.

The total number of traffic signals on the route for which time is predicted will be extracted from our database. The time required to reach each of the traffic signals from the current location of the user is calculated. This calculated time will be used to predict when the user will reach each of the traffic signals. Traffic light data which comes from traffic signaling system is used to make future predictions for traffic lights.

In this paper, we consider yellow or orange light equivalent to a green light since it allows the user to cross the signal. If the user can successfully cross the signal (i.e. light is green when the user reaches the traffic signal), then no extra time will the added to the time required to reach the destination, but if the light is red, then the time remaining for the light to turn green will be added to the earlier time. If the user is about to miss the green light just by a few seconds then it will calculate the required speed to catch the green light and suggest the user to increase their speed (which would be within the speed limit) to the predicted result for avoiding the delay.

Predicted time to reach the destination will be updated every few seconds by our system to the user by real-time monitoring. The best route and the time required to reach the destination will be user dependent.

IV. SAFE ROUTE

Safety of the user is also a prime concern while predicting the best route taking into consideration the number of accidents and crimes which have taken place on those routes. Closed Circuit Television (CCTV) cameras are used to get the accident and crime related data. Exact location on the route and time of the day will be considered for predicting the safety of the route. If the user is driving on the unsafe route, our system will predict at what point the user should change their direction in order to reach the destination safely. However, if the user chooses to drive on an unsafe route, our system would make an alert indicating unsafe location on the route and safety measures will be suggested to the user. Safety measures include a reduction in speed at the accident-prone areas and increase in speed, closure of windows and door locking in the crime-prone areas.

First the data is extracted from the CCTV, stored in the database and data sets are created considering only the attributes which would be required in the prediction process.

For accurate prediction of future crimes and accidents occurrences, the following steps are carried out:

- A data cleaning algorithm is used to clean the dataset.
- Clustering and classification algorithms are explored to identify patterns from historical data.
- The data is fed into the neural network and the neurons are trained using appropriate algorithms.

The cleaning of data is performed as per the following two steps:

Step 1: Implement an iterative routine that removes data records that are not important for analysis.

Step 2: Implement a missing data handling procedure that fills in missing records in the dataset [6].

While considering filling missing values, initially, all the fields are analyzed for empty values. If all the attributes have empty values for a particular record, then the entire record is considered as irrelevant and is deleted. MV (Micali Vazirani) algorithm is applied to the remaining records.

A. *Crime Prediction*

A hybrid algorithm based on the two clustering techniques, K-means and DBSCAN (Density-Based Spatial Clustering Application with Noise) algorithm, is employed for clustering [4].

The hybrid algorithm clusters the data for a particular route into m groups where m is predefined input – crime type, the number of clusters and number of iterations. From the clustering result, the area crime trend for each type of crime will be identified for each year. The similar type of crime activities are grouped together. The cluster which contains a higher number of criminal activities is referred to as a crime hotspot [5]. These hotspots will be shaded dark in our system.

The next task is the prediction of future crime trends. This involves tracking crime rate changes from one year to the next and using data mining to project those changes into the future. The method employed here involves using the clusters produced above and then applying "next year" cluster information to classify records. To the clustered results, a classification algorithm is applied to predict the future crime pattern. The classification is performed to find in which category a cluster would be in the next year. This allows us to build a predictive model for prediction of next year's records using this year's data. The C4.5 decision tree algorithm can be used for this purpose. The generalized tree can be used to predict the unknown crime trend for the next year. The output will be safe, moderate or unsafe route.

B. *Accident Prediction*

The data in the data sets is classified on the basis of the location where the accident has occurred, time of the day, season and type of accident [2]. Decision trees are used for classifying the data from the data sets which are constructed using ID3 tree algorithm.

The data is classified into the following injury classes [1]:

- No injury
- Possible injury
- Capacitating injury
- Non-capacitating injury
- Fatal injury

Then the classified data is fed into the neural networks and backpropagation algorithm is applied to train the neurons and predict the future occurrence of accidents. The output will be safe, moderate or unsafe route depending on the type of injury occurring mostly along the stretches of the route.

V. Artificial Intelligence

Data is coming into our system from different sources like accident and crime analysis systems, GPS, traffic signaling and many more. Data Stream Model to collect information from various sources and will file Ad-hoc queries on the data. A large archival store will archive the streams and working store will contain only the information required to answer the queries [7]. A sliding window of each stream will be stored in the working store to support a wide variety of ad-hoc queries.

The data which will not be relevant for our system will be discarded. Relevant information generated will be stored as predicate logic in our knowledge based system for future purposes to predict user's behavior.

If a user is following a particular route which is not predicted best by our system and if later some other user follows the same pattern then our system will recognize it and highlight that route in yellow color.

VI. Best Route

The best route will be considered as the one which will take minimum predicted time to reach the destination. If the difference between the predicted time for any two routes is less than or equal to 15 minutes, then the best route is computed using the following formula:

RESULT = (T + N) * A * C

T: Time required reaching the destination (in minutes).
N: Number of traffic signals between source and destination on the route.
A, C: Values of A and C depends on whether the route is safe, moderate or unsafe.

TABLE I. Weights taken for Accidents and Crimes

A: Accidents	C : Crimes
Safe (0.1)	Safe (0.1)
Moderate (0.5)	Moderate (0.6)
Unsafe (1.0)	Unsafe (1.1)

The best route is the one for which the value of RESULT is minimum. If the value of RESULT for two routes is same, we will use previous predicate knowledge from our database to predict one of them as the best route.

VII. Examples

R1 and R2 are the only two possible routes that are available to reach the same destination from the current location of the user.

- Case 1: R1 takes 25 minutes to reach the destination with 4 traffic signals and R2 takes 30 minutes to reach the destination with 1 traffic signal and both the routes are safe.
  R1: (25 + 4) * 0.1 * 0.1 = 0.29
  R2: (30 + 1) * 0.1 * 0.1 = 0.31
  Best route is R1

- Case 2: Further in Case 1, if R1 takes 28 minutes to reach the destination.
  R1: (28 + 4) * 0.1 * 0.1 = 0.32
  R2: (30 + 1) * 0.1 * 0.1 = 0.31
  Best route is R2

- Case 3: R1 and R2 take 25 minutes to reach the destination with no traffic signals. R1 is unsafe with respect to accidents and R2 is unsafe with respect to crimes. No other route is possible.
  R1: (25 + 0) * 1.0 * 0.1 = 2.5
  R2: (25 + 0) * 0.1 * 1.1 = 2.75
  Best route is R1 as accidents are considered less dangerous by us since they can be avoided with careful driving and our system will alert the user and give suggestions to avoid accidents successfully.

- Case 4: R1 takes 15 minutes to reach the destination with no traffic signal but is unsafe with respect to accidents and safe with respect to crimes. R2 takes 30 minutes to reach the destination with 5 traffic signals but is safe.
  R1: (15 + 0) * 1 * 0.1 = 1.5
  R2: (30 + 5) * 0.1 * 0.1 = 0.35
  Best route is R2.

- Case 5: Further in Case 4, if R1 is unsafe and R2 is moderate for accidents.
  R1: (15 + 0) * 1 * 0.1 = 1.5
  R2: (30 + 5) * 0.5 * 0.1 = 1.75
  Best route is R1.

- Case 6: R1 takes 70 minutes to reach the destination with 2 traffic signals but is unsafe with respect to both accidents and crimes. R2 takes 90 minutes to reach the destination with 2 traffic signals but is safe with respect to both accidents and crimes.

  Best route is R1 since the difference between the times required to the destination by R1 and R2 is more than 15 minutes, hence the formula will not be used to predict the best route.

TABLE II. SAMPLE DATA

Case number	R1				R2				Best route
	T	N	A	C	T	N	A	C	
1	25	4	Safe	Safe	30	1	Safe	Safe	R1
2	28	4	Safe	Safe	30	1	Safe	Safe	R2
3	25	0	Unsafe	Safe	25	0	Safe	Unsafe	R1
4	15	0	Unsafe	Safe	30	5	Safe	Safe	R2
5	15	0	Unsafe	Safe	30	5	Moderate	Safe	R1
6	70	2	Unsafe	Unsafe	90	2	Safe	Safe	R1

VIII. CONCLUSION

In this paper, we have proposed the optimal routes which will help the users to reach the destination quickly without compromising their safety. A number of factors like user's speed, speed limits, real-time monitoring, number of traffic signals, delay caused due to traffic lights, real-time traffic on the roads, accident and crime occurrences, user's behavior and predicate logic have been included. Big data analytics is used to handle enormous amount of data which is obtained through miscellaneous sources. We have tried to achieve high computational processing by using efficient algorithms and applying them to big data so that we get the required result in a minimal amount of time. Nowadays using maps to find directions has become an inevitable part of our lives, the above system if implemented would benefit users in a multiple number of ways.

IX. REFERENCES

[1] Miao Chong, Ajith Abraham and Marcin Paprzycki, "Traffic Accident Data Mining Using Machine Learning Paradigms,", Informatica 29, 2005, pp. 89-98.

[2] Olutayo V.A and Eludire A.A, "Traffic Accident Analysis Using Decision Trees and Neural Networks," I.J. Information Technology and Computer Science, 2014, 02, 22-28.

[3] Paul Krijger, "Traffic light prediction for TomTom devices," Master's Thesis, Eindhoven University of Technology, Eindhoven, Netherlands , July 7, 2013.

[4] A. Malathi and Dr. S. Santhosh Baboo, "Algorithmic Crime Prediction Model Based on the Analysis of Crime Clusters," Global Journal of Computer Science and Technology, Volume 11 Issue 11 Version 1.0 July 2011.

[5] Sukanya.M, T.Kalaikumaran and Dr.S.Karthik, "Criminals and crime hotspot detection using data mining algorithms: clustering and classification", International Journal of Advanced Research in Computer Engineering & Technology (IJARCET), ISSN: 2278 – 1323 Volume 1, Issue 10, December 2012.

[6] Han, Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann 3rd Edition.

[7] Jure Leskovec, Anand Rajaraman and Jeffrey D. Ullman, "Mining of Massive Datasets," Cambridge University press, 2014.