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Use of Artificial Intelligence Techniques to Yield Better Mobility Solutions

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ABSTRACT

The term Smart City is typically applied to urban and metropolitan areas where Information and Communication Technologies provide ways to enable social, cultural and urban development, improving social and political capacities and/or efficiency. In this paper we will show the potential of Artificial Intelligence techniques for augmenting ICT solutions to both increase the cities competiveness but also the active participation of citizens in those processes, making Smart Cities smarter and convenient for the citizens.

Keywords : Smart City, Artificial Intelligence Techniques, Mobility

I. INTRODUCTION

Advent of ICT has made almost all the fields smart and thus arises the concept of Smart Cities that refers to the smart management of the cities, their environment and socio economic infrastructure through the use of ICT. These technologies are able to move the data in faster mode and thereby helping to improve the various capacities of a city. Technology has proven to be one of the greatest possible aid in information gathering, its analysis, management and sharing with ease.

Cities have been always the centre of the social and economic exchanges and thus have attracted people from all over. This trend has caused population increase in the cities and thus mobility and transport management becomes one of the key aspects. Many smart cities solutions for mobility have focused on the empowering of the user with the ability to decide the best way to move through the transport network. However these solutions remain with limited options to let the users customize their journey with minimum convenience features. Various attributes preference of the users is ignored while planning for the mobility solutions. Moreover one of the least concerned attributes in this planning remains the environmental factors. Another aspect to be concerned with highest priority is the participation of the citizens in the mobility plan of the smart cities.

II. METHODS AND MATERIAL

Literature Review

With the use of ubiquitous devices being rampantly used , users of such devices can generate data that are useful for the decision making of the location, delay in the movement from one destination to other. Moreover, there are problems and many incidents that affect the mobility services of the roadways. Making use of the human digital trail as *humans as sensors* (Srivastava et al., 2011).This data can be feasible and reliable enough to cover the events taking place and road blockage towards the movement of transport services. Some proposals have recently appeared to exploit data generated by users to sense the cities' status, either from the individual sensoring perspective, closer to multi-agent based systems (Ellul et al., 2013) or from big data techniques applied to social network streams by combining statistical analysis with semantic interpretation (Gabrielli et al., 2013). The basic issue with the above listed methods is that there is no centralized mechanism to maintain the global perspective of the traffic movement. An ANN model for urban traffic flow was presented (Ledoux, 1997). Based on simulated data, one minute ahead predictions of the queue lengths and output flows were obtained with fairly good accuracy. It was emphasized that there is need to further investigate these techniques on experimental data. Short-term inter-urban traffic forecasts using neural

networks was investigated by Dougherty and Cobbett (1997).

In this paper, we will be presenting some concepts of Artificial Intelligence techniques that can be used to capture the data, analyze the data received from the users and may reflect the various factors affecting the mobility on the transport network to make it convenient for the users to provide better travel plans.

AI Techniques

Knowledge Engineering, Machine Learning, Sentiment Analysis, Semantic Inference, Information Diffusion to enhance mobility in the cities, by empowering users not only with means to plan their routes through the transport network smartly but also to act as sources of event information that can help build a better snapshot of the city status. Predictions can be well made by the unsupervised learning and one of the unsupervised learning that can be used on the city roads is clustering. Classes or meaningful groups of objects that share common characteristics can be clustered into one group. Those objects which are away from one group can be considered as another group.

Clustering Algorithms:

A Clustering Algorithm tries to analyze natural groups of data on the basis of some similarity. It locates the centroid of the group of data points. To carry out effective clustering, the algorithm evaluates the distance between each point from the centroid of the cluster.

The goal of clustering is to determine the intrinsic grouping in a set of unlabelled data.

Raw Data

Clustering Algorithm

Clusters of Data

K-means (Macqueen, 1967) is one of the simplest unsupervised learning algorithms that is popular to classify groups of data on the availability of the similarity. It is also a method of vector quantization.

K-means Clustering Method:

If k is given, the K-means algorithm can be executed in the following steps:

- Given set of objects can be partitioned into k non-empty subsets.
- The mean point of the current partition can be identified.
- Assign each point of the dataset to a cluster depending on the similarity.
- Computer the distances from each data point and allocate data points to the cluster where the amount of distance is found to be minimum.

Methodology

K-Means is the most general algorithm that can be used to determine any of the required scenarios by analyzing the available data. The same clustering can be applied to the traffic management to improve the mobility of the traffic.The traffic is a dynamic data as it changes from one time to time. It is highly possible that the traffic at a particular point of time is light and at other time, it might be very heavy.

Following objectives for the selection of location to install a traffic signal which can be listed as below :

Classify the location based on the traffic to detect the most populated time. Classify the location based on the most populated location Classify the locations that are most accident prone. Analyze the data to determine what kinds of traffic signals are required. The location which has the densest set of objects is considered to be the suitable location for installing the traffic signals. The centroid being selected is considered initially at random. This random selection of the centroid can be selected first from a simple dataset.

III. RESULT AND DISCUSSION

Advantages of using K-Means for traffic management:

1) Fast, robust and easier to understand.
2) Gives best result as data set are distinct or well separated from each other.

Disadvantages of using K-Means for traffic management:

1) The learning algorithm requires specification of the number of cluster centers and the traffic is the dynamic data that tends to vary.
2) If there are two highly overlapping data then k-means will not be able to resolve that there are two clusters. In an incident, when the traffic is very heavy and two clusters seem to be very near, then k-means will not be able to resolve the number of clusters.
3) The learning algorithm with different representation of data will get different results
4) The learning algorithm provides the local optima of the squared error function.
5) Randomly choosing of the cluster center cannot lead us to the fruitful result, thus if we selected the traffic signal to be installed at a point where the traffic is not suitable for judging the clusters, then the trail fails to give an optimal result.
6) Unable to handle noisy data and outliers.
7) Algorithm fails for non-linear data set and the dataset of the traffic is nonlinear as it tends to vary from time to time.

IV. CONCLUSION

This paper depicts the use of clustering algorithm, K-Means, on the traffic management to improve the mobility of the traffic. It describes a method, where if we have the traffic signals installed at the crucial points of the road; it can help in maintaining the traffic management. Thereby mobility of the traffic can be helped. We have discussed in the above paragraph about the problems in implementing K-Means in traffic management. In the next paper, we would like to emphasis on the method to select the centre of the cluster with some precise method.

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