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Survey on Big Data Visualization Framework for Vehicle Scene Classification

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Abstract

In every sphere of life Big Data will be transformative. Data Visualization and Analytics plays important role in decision making in various sectors. It is important to analyze the various information of the vehicle for the collision mitigation. In vehicle for the collision prevention the Sensor's, Camera information's are taken and analyzed for the various purposes. It is important to identify various scenes for sensor performance evaluation. Signals in a vehicle are transmitted through CAN (Controller Area Network) buses from Sensor's, control units and signals for actuators. If the Radar fails to record certain information, the Camera data are analyzed to obtain the result. The paper represents the survey on how to obtain the data from the Radar, CAN and GPS(Global Positioning System) to develop the data visualization framework andusing deep learning analyze the performance of the vehicle data for different scene classification.

Keywords:- *Data visualization, CAN (Controller Area Network), deep learning, GPS (Global Positioning System).*

INTRODUCTION

Big Data has become topic of interest for all the industries including, Academics, IT Companies, and governments. These corporations are launching research programs to address Big Data visualization. One of the major aspects of Big Data analysis is to find interesting pattern in huge data set, but actually the result of the analysis is usually raw numbers and by

those numbers it is very difficult to interpret anything. But if those numbers are represented visually then it becomes much easier for our brain to find meaningful patterns and take decision accordingly [3]. Businesses are so overwhelmed by the amount and variety of data cascading into and through their operations that they struggle just to store the data—much less analyze, interpret, and present it in meaningful ways. Businesses are increasingly turning to visualization-based data discovery tools. Data visualization is easy and quick way to convey messages and represent complex things. Extrinsic camera calibration for vehicle systems has been used for various purposes such as collision mitigation. Using the vanishing point Camera orientation is estimated. Object detection and semantic segmentation are two strongly scorrelated and complementary tasks for better performance [7]. Pedestrian detection method with deep learning is used to classify the various scenes, like this many other scenes are predicted such as highway, city etc. Signal in vehicle are transmitted through the CAN buses and it is used to log the vehicle information for the analysis. Visualization is a display way to make the abstract things or processes into graphic and images [8]. Using the GPS data road horizontal and vertical curves are selected as the research target. The highway trucks operation speed are analyzed using this data [9]. The paper describes the methods to extract the vehicle data and create framework to visually analyze the data.

LITERATURE SURVEY

[1] To address the Big Data challenges Government agencies and large corporations are launching many research programs. For presenting essential information in vast amounts of data visualization is very effective. The graphics and visualization community discovered many Big Data tools for the representation. New tools for conventional data mining and statistical analysis are needed to maximize the utilization of vast amount of data for scientific advancement. The paper also discuss about the data cube that fits in a tablet or smart phone memory for billions of entrance, the information structure is called as nanocube and also pseudo code to compute and query a nanocube. Visualization based data discovery tools allow business users to disparate data sources to create analytical views with flexibility. The main key features of Visualization-based Data Discovery Tools are to enable real-time data analysis, it supports real-time formation of dynamic reports, Allow end users to interact with data, Hold data in-memory and allow users

to share and collaborate securely. Visualization based data discovery tools presented by the "three Vs" of big data such as Volume, Variety and Velocity. Data size and column composition play an important role when selecting graphs to represent data. AT &T's Nanocubes project is designed for the users to interact with massively with large data sets. Apache Hadoop is open source software for the distributed processing of large data sets. Apache Hadoop has two main subprojects MapReduce and HDFS. The paper represents the MapReduce algorithm for the data analysis and Visualization based data discovery tools and nanocubes technology.

[2] The road occupancy, vehicle speed, accident detection, traffic collision and weather information are calculated to extract the traffic information. These are big data obtained from the social sites and mobile phone GPS signals. The Hadoop and HBase are used to store and analyze the big data. The paper proposes the new architecture for distributed processing that enables big data processing on the road traffic data with specially weather information and its related information analysis. The Traffic Accident Surveillance and Analysis System contains the information of all collision cases including the collision time, severity, type of collision and number of involved vehicle, these are used for the collision analysis. The collision rate would be calculated by aggregating the number of collision and the exposure for all similar traffic condition. For the wide-range coverage of weather conditions automatic weather systems used. The three processing method generating conditional weather patterns using CCTV video data, calculating the similarity, and generating the weather information is introduced that extracts weather information using CCTV video data. The variations in the edge attribute and value of the HSV data on sunny, rainy and cloudy days are determined by analyzing the video data. The road traffic big data analysis processing framework is implemented. First, aggregate the flow, speed data, weather data and aggregated collision data in Traffic Accident Surveillance and Analysis System. Second, weather data and collision analysis data are made by integrating flow, speed, weather information and collision data. Finally, collision probability obtained using the collision rate model algorithm and intermediate spot probability. For the future, this framework supports scalability, interoperability and extensibility

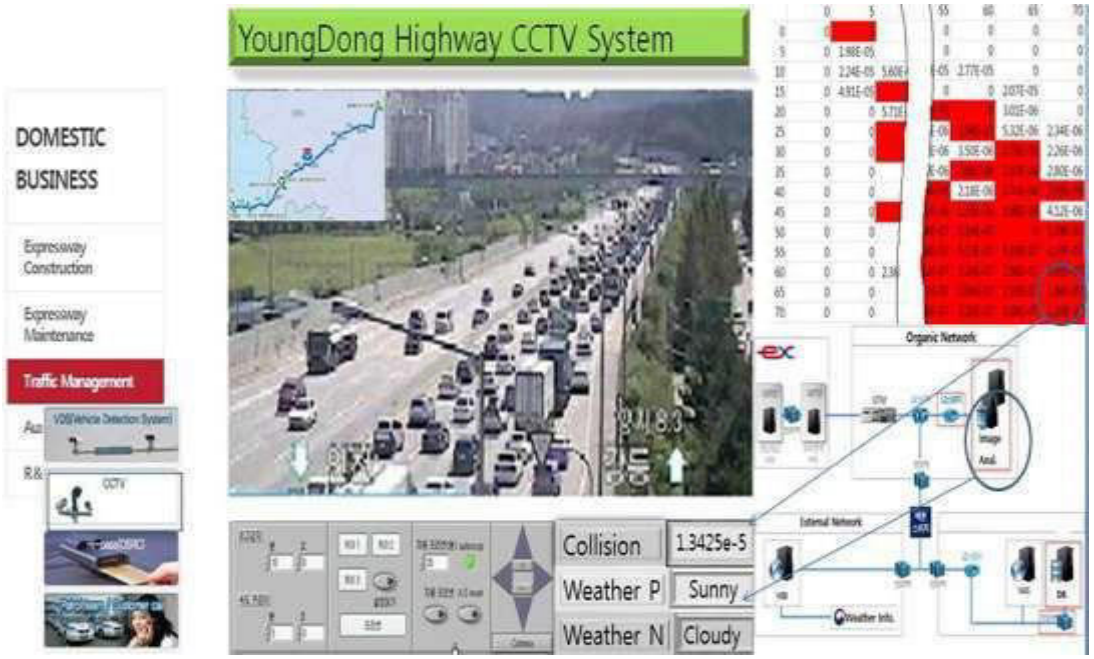

Fig 1.Illusion of Collision Probability and Weather Data

[3] In every sphere of life Big Data will be transformative. To process and analyze the data the pattern needs to be found to represent the data visually. Data Visualization and Analytics plays an important role in various sector for decision making. The paper discuss about the importance of data visualization and challenges related to review the big data tools. Big data is interesting topic for all the industries including IT companies and Governments. The rate of growth of data has increased recent years for the factors like Internet of Things, sensors in environment and digitalization of all the offline record of the industry and hospitals. Due to vast volume and high magnitude of big data it is difficult to visualize. Some of the big data problems are Information loss, large image perception, High rate of image change and high performance requirements. The most popular visualization tools are Tableau, Microsoft Power BI, Plotly, Gephi and Excel 2015. The tolls are compared on the basis of various attributes such as Open source, Interactive visualization, Client type, MOOCS, API. The factors should be considered while choosing the tools are limits/demerits, comparison of visualization techniques. The paper reviewed the popular visualization tools and observed the merits and demerits. Before choosing the visualization tool the business might know their requirements and the tool should be chosen according to that. The tools mentioned above are quite promising for the visualization.

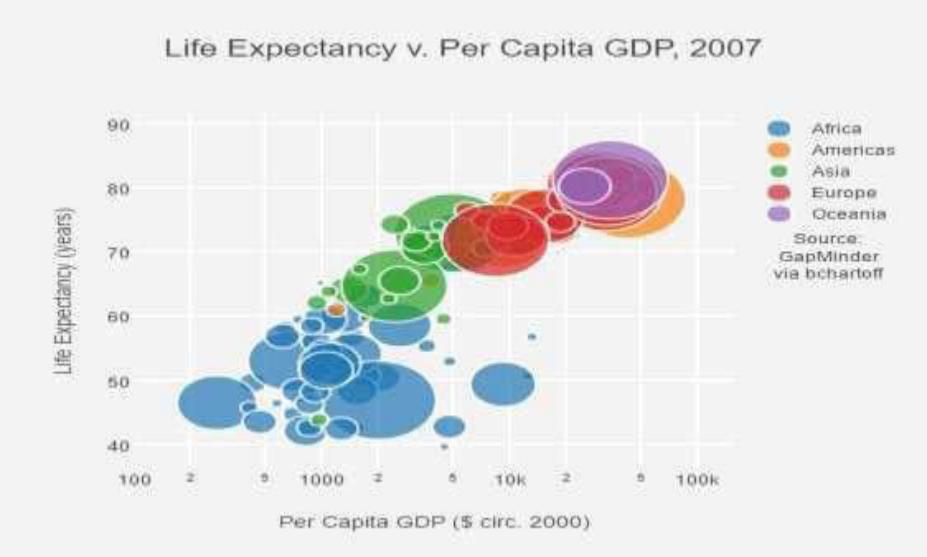

Fig: 2 Life expectancy vs per capita GDP, 2007 (bubble chart)

[4] For a safety driving the control of vehicles within the roads are required. Road edge detection is more difficult because of large variation in the road and the influence from weather and illuminations. Large video volumes are condensed to compact road profile images for the analysis. Using unsupervised learning clusters are extracted from the samples. The views of spectrum of weather/illuminations are generated from the clusters. From the stable number of clusters, the data are used for classifying the typical illuminations types briefly. Road edge detection is a fundamental capability for the drivers for modern road infrastructure. In the paper the experiments are carried out using Naturalist Driving Data taken from 110 vehicles for various types of roads like highway, urban, residential roads etc. in different seasons, weathers and times. K-mean algorithm is used to feed all the 5800 samples and compare them with the 360 trained video clips. Video clips are compressed to compact road profile images. The video mining can be used and the observations are 1. White lane marks are most reliable features to follow. 2. Human drivers should memorize road, follow front car and refer to scenes on roadside in such maneuver. 3. The data mining discriminates different weather, rather than the auto exposure camera value. The classification based on learned clusters are used for weather identification in video frames and applied to road edge detection.

[5] The paper presents to estimate the Camera Orientation using the 3 line RANSAC Algorithm. For automatic driving assistance system (ADAS)

Extrinsic camera calibration has been used in vehicle systems for various purposes. Offline calibration does not respond for unexpected camera rotation caused by vehicle collision. The improved methods for online calibration have been proposed. Camera orientation is estimated on basis of vanishing point (VP). To estimate the VP various methods are used. To estimate the Camera orientation 3 steps are followed i. Estimate the VP for z-axis, FAST+BRIEF is used to extract motion because its simple framework. ii. Three mutually orthogonal vanishing directions are detected using the Line Segment Detection and 3-line RANSAC algorithm. To estimate the robust VP's all lines in each class is classified using Singular Value Decomposition. The proposed method effectively classifies lines to three mutually orthogonal set with the result of 31.444pitch in simulation and 31.49 in real Camera. It also estimates the robust camera orientation in the vehicles as applied to ADAS system for 3D information analysis to ensure safety.

[6] Controller Area Network (CAN) is the most common automotive data buses which are also used in industry because of electromagnetic compatibility (EMC). For demonstration the paper uses the instrument panel and its visualization are created. Demonstration panel contains gateway which simulates signals from the electronic control unit (ECU), accelerator pedal and Skoda instrument cluster. The whole application is created in visual programming language LabVIEW using FPGA module. CAN BUS communication is filtered and processed for visualization to obtain the message. CAN BUS is concerned with message filtering as well as status and message handling in object layer. It represents messages received to the object layer and accepts messages to be transmitted by the object layer. The content of a message is described by an identifier and describes the meaning of the data. In CAN network message is accepted simultaneously either by all nodes or by no node. If the bus is free, any node may start to transmit a message. Message transfer is manifested and controlled by four different frame types Data frame, Remote frame, Error frame and Overload frame. NI CompactRio hardware take care of processing of CAN bus messages for visualization with module NI 9853. Each port on the NI 9853 has pins for CAN_H and CAN_L, to which you connect the CAN, bus signals. The demonstration panel is gateway which simulates CAN message transmitted from engine control unit. The accelerator pedal position sensor detects the amount of travel of the accelerator pedal. From Skoda vehicle three messages of

CAN communication are filtered for visualization. Data from CAN BUS are acquired every 10ms and processed in LabVIEW and subsequently visualized in Skoda Octavia II instrument cluster.

[7] The paper proposes the pedestrian detection method making use of semantic labeling. Deep Learning based Semantic segmentation method is used to label the images in pixel-wise. HOG+LUV features are used to encode the high level image, using these high level features falsely detected pedestrians are eliminated easily. SegNet, is designed to be an efficient architecture for pixel-wise semantic segmentation. The SegNet architecture is trained using a large set of database. 11 common semantic classes are used for training such as building, tree, sky, car etc. The pedestrian detector is trained using the Caltech-USA dataset. Under default settings, the training dataset contains 3880 frames selected from every 30th frame of the videos. There are 1586 positive pedestrian samples in the 3880 training images. Here the two data sets are generated for the image frames. The Caltech 10x, which captures the image every 3rd frame from the Caltech video. Using Caltech 10x the detector performance is improved by 4% using the positive examples.

[8] To effectively and intuitively use the data has become the difficulty for the test data processing. Data visualization is the data displayed by the modes of graphics and images, etc. Data Visualization is the important means of the test data processing to effectively improve the data processing and interpretation capabilities. First, the test process and the requirements for the test process are introduced. Second, the technologies for the data visualization are deeply analyzed and the tolls for data visualization also included. Third, the basic flows of test data are visualized and the characteristics are deeply analyzed. Last, for dynamic geographical data visualization analysis and trajectory display are achieved. Key technologies for data visualization are Geometry-based technology, Icon-based technology, Pixel-oriented technology and Hierarchical technology. Different data visualization interactive methods affect the effect of data visualization such as Visual interaction method based on Radial layout, Focus + Context, Overview + Detail and Zooming. Traditional visualization tools include Excel, Google Spreadsheets, SAS, Hadoop, Tableau, etc. Some specific types of data tools include Gephi, ImagePlot, Treemap, Indiemapper, GeoCommons, ArcGIS, etc. Data visualization technology will be combined with data mining technology,

artificial intelligence technology, virtual reality technology, cloud computing at technical level. The test data visualization tools, platforms, systems and Web based visualization system will be more intelligent and convenient for different visual effects. ***(See Figure:-3)***

[9] For the road safety analysis short time speed data used earlier for the statistic and analysis. The influence of different parameters, such as horizontal curve radius and vertical curve slope on the actual running speed of trucks was also analyzed. The paper presents the analysis of the highway trucks operation speed from the actual operating vision. Four types of the road units are obtained from the variation law of the vehicle speed and it is used as a new method for evaluating the safety of the highway with the speed Characteristics. From the local SQL server database the vehicle data containing the range of longitude and latitude are screened. CAD road design software is used for the alignment and analyze of the road map. Using the original data editor the data are extracted and the duplicate data are eliminated. According to the standard in the paper the highway is divided into four kinds of road types straight segment, curve segment, longitudinal slope segment, curve slope segment.

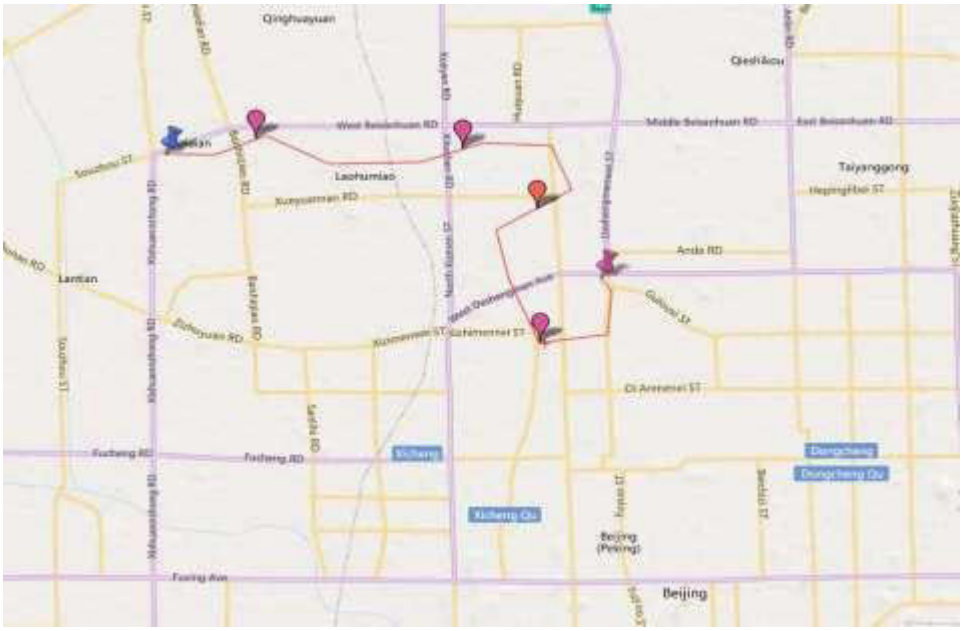

Fig 3 The visualization of trajectory of test equipment

For the curve segment, curve slope segment, straight segment and Longitudinal Slope Segment the box chart is developed to analyze the data. Based on the analysis of the Guidelines for Safety Audit of Highway and Specifications for Highway Safety Audit, the work studies the variation of the vehicles' law speed on the highway. The effect of data acquisition is good, and the data processing effect is also tested in this paper.

[10] The traditional vehicle target recognition algorithm requires recognizing the different vehicle in different environment. The paper proposes a method of vehicle target detection based on region-based fully convolutional network(R-FCN). The method is based on fully convolution network idea of deep learning, R-FCN framework and combining vehicle database in ImageNet. To optimize the network parameter online hard example mining (OHEM) is used. The repeated iterations are carried for network training and finally R-FCN model of the vehicle target detection is obtained. Comparing the method of traditional vehicle detection based on deep learning avoids the feature selection problem of the traditional detection and reducing the detection time and improving the vehicle recognition rate. The paper uses the four main types of vehicle such as buses, coupes, vans, suvs in urban roads this method achieves an average conditional rate of 87.48% for vehicle target detection. The method for vehicle target detection based on R-FCN is divided into two phases training stage and the testing stage. In training stage first select the appropriate training sample image from the ImageNet database and mark the vehicle target in the training sample. The training samples are the input into region proposal network (RPN) training until the RPN converges. The network parameters obtained through RPN training are input R-FCN model for training to obtain the vehicle target detection. Compared with the traditional vehicle target detection algorithm R-FCN object detection algorithm effectively avoids the dependence of the traditional vehicle target detection model on the artificial features, and greatly improves the recognition rate or the running speed.

CONCLUSION AND FUTURE WORK

The paper gives detail about how to extract different kind of information such as CAN, GPS vehicle data to create a framework for various scene classifications. Big Data from the vehicle can be analyzed using the various visualization tools. The vehicle parameters are collected from the above paper methods. Every scene for individual

object can be analyzed using the framework. The vehicle data are classified using deep learning. The framework is developed using the Big Data visualization concepts. The CAN details and the video details are used to develop framework for Data. Using this framework the performance of the vehicle is evaluated and analyzed, based on this analyzation the vehicle collision for ADAS is enhanced.

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