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Automated Traffic Controller using logistic regression: A Solution to Inefficient Traffic Management Systems

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Abstract

Automated traffic controller using logistic regression uses vehicle motion detection and prediction which is a complex problem that require analyzing and understanding the motion of a vehicle over time. Analyzing and predicting relationships between dependent and independent variables is possible using logistic regression, a widely used statistical method which makes it a suitable tool for this task. This paper is directly related to the traffic monitoring where the process of collecting data on traffic flow, vehicle movement, and other related variables to analyze and optimize traffic management. Furthermore, by combining the information from multiple logistic regression models, traffic monitoring systems can provide a more comprehensive view of the traffic conditions across a larger area. This information can be used it identify trends in traffic flow, predict future traffic patterns, and make more informed decisions about traffic management. In conclusion, Prediction of vehicle motion using logistic regression is an essential component of traffic monitoring systems.

Introduction

Manual traffic control systems are used widely across the world, yet these systems are based on fixed time intervals for traffic lights toggling between red to green and green to red. This means that vehicles must wait for extended periods of time, even when the traffic density is low or non-existent. This results in an average waiting time that is longer than necessary, leading to wasted resources such as fuel, time, and money. This has an overall negative economic impact, as resources are not being used efficiently or effectively. Economic losses due to traffic congestion are: loss of time, fuel costs, and health costs. To improve the traffic flow Automated traffic controller using logistic regression uses vehicle motion detection and prediction which is a complex problem that require analyzing and understanding the motion of a vehicle over time. Logistic regression is a widely used statistical method that can be used to analyze and predict the relationship between dependent and independent variables, making it a suitable tool for this task. This paper is directly related to the traffic monitoring where the process of collecting data on traffic flow, vehicle movement, and other related variables to analyze and optimize traffic management. Furthermore, by combining the information from multiple logistic regression models, traffic monitoring systems can provide a more comprehensive view of the traffic conditions across a larger area. This information can be used to identify trends in traffic flow, predict future traffic patterns, and make more informed decisions about traffic management. In conclusion, vehicle motion detection and prediction using logistic regression is an essential component of traffic monitoring systems. By accurately detecting and predicting vehicle motion, logistic regression models can help optimize traffic management, reduce congestion, and improve overall traffic flow.

Literature Survey

Paper 1

Automatic Traffic Signal Controller for Roads by Exploiting Fuzzy Logic

Intelligent traffic signal controllers are an absolute necessity due to the constantly growing number of road users and the limited resources available. In order to better meet this growing demand, traffic control algorithms must be simulated and improved However, there are some restrictions on the application of intelligent traffic control.For instance, avoiding traffic congestion is good for the environment and the economy because it reduces delays, the number of stops made, pollutant emissions, fuel consumption, etc. However, better traffic flow may also stimulate demand. Traffic congestion can be avoided by optimising traffic light switching, which also boosts road capacity and traffic flow. The traffic conditions will be periodically questioned by the fuzzy controller to determine whether to continue or cease a current phase. The research demonstrates that switching from a traditional traffic control system to one based on fuzzy logic can significantly minimise traffic congestion delay.[1]

Paper 2

Dynamical tracking of surrounding objects for road vehicles using linearly-arrayed ultrasonic sensors

For advanced driver assistance systems to function properly, traffic participants must be accurately detected and tracked. This study uses numerous linearly arranged ultrasonic sensors to demonstrate a centralised object tracking method for surrounding objects in situations with moving traffic. An ultrasonic sensor model that takes into account object shapes, materials, distances, and orientations is created specifically for the traffic environment. It comprises detection scope, chance of detection, and ranging error. To conduct object tracking at each step, a centralised filter is created to selectively fuse new data that are collected using the Extended Kalman Filter (EKF) from certain sensors.Simulations are used to verify the usefulness of the suggested method, which is found to have better tracking performance than the conventional triangle localization method, as well as more consistent and less error-prone tracking, particularly when the item is entering or exiting the detection region[2]

Paper 3

Moving object tracking method based on ultrasonic automatic detection algorithm

There are several uses for ultrasonic ranging systems. Ultrasonic sensors are used to measure the motions of motion objects in order to realise exact positioning, and after that, their 2D coordinates should be set. Complicated computations will result from this, which will subsequently cause measurement inaccuracies due to poorly constructed programmes. The goal of this study is to develop a system for autonomously tracking moving objects. On a tiny turntable, two ultrasonic sensors are chosen and individually built at the same distance from the origin along the coordinate axes X and Y. Complex mathematical problems can be resolved by controlling the turntable to locate the moving object using tracking techniques.It is possible to carefully manage timing period and effectively eliminate measure error due to irregular delay from traditional instructions with the help of well-designed control instruction sequences. Studies demonstrate the effectiveness of these programmes and methodologies in parameter gathering and status control systems for moving objects.[3]

Paper 4

Object recognition using horizontal array of ultrasonic sensor

The goal is to create a dependable, affordable object recognition system. The technology uses a horizontal array of ultrasonic sensors to recognise objects. The benefit of using an ultrasonic sensor is how simple it is to measure distances from nearby objects without extensive processing. When optical sensors cannot be employed or when identifying items that are difficult to identify by the approach based on light, recognition methods with an ultrasonic sensor are frequently used. In comparison to other technologies, ultrasonic sensors are also inexpensive. As a result, using an ultrasound sensor to find and identify various items appears to be a solid idea.In the study, a novel method for object detection is described that makes use of the ultrasonic sensor's reaction to objects with rough surfaces. When an object's surface is sufficiently rough, incident ultrasonic waves disperse more and may even return in part to the sensor receiver. Thus, it is now possible to recognise things that have a crucial orientation in relation to an array of ultrasonic sensors or rough surfaces.[4]

Paper 5

A comparative analysis on linear regression and support vector regression

When we look into the economy ,consumer interest, behaviour, and product earnings are the business insights needed to forecast the future of the industry using recent or historical data. With the help of statistical approaches, these insights can be produced for forecasting purposes. Depending on the needs of the data, the statistical methods can be assessed for the prediction model. Time series data are frequently used in forecasting and prediction. For greater accuracy, most applications including weather forecasting, finance, and stock market mix historical data with the most recent streaming data. Various regression frameworks and models are used to analyse data in the time series, though.In this study, the training data set is used to compare the performance of the linear regression and support vector regression models in order to select the model that will provide the best prediction and accuracy.[5]

Paper 6

Real time traffic signal control using fuzzy logic controller

Controlling traffic signals has grown to be a very difficult undertaking. Making roads decent, safe, and less time- and fuelintensive is essential. For improved traffic control, it is necessary to improvise with the traffic signal control. Such a problem is handled by traffic management systems in recent years, although they do so ineffectively because they are static. To effectively handle traffic, a system that is dynamic in nature is required. This technology enhances the effectiveness of controlling traffic at intersections. In order to better control the flow of traffic at each road crossing, this paper presents an overview of the fuzzy logic control system that is used.[6]

Paper 7

Moving object detection and direction-finding with HC-SR04 ultrasonic linear array Robotics,

Internet of Things (IoT), and Wireless Sensor Networks (WSN) are systems that require the use of embedded processor as as well as several sensors and actuators that are tailored to the application. These sensors have been designed to track a range of physical data, such as distance,pressure, temperature, humidity and inertial parameters. The sensors must be inexpensively priced in order for embedded system based applications, particularly IoT and WSN, to be widely deployed. Popular and reasonably priced, The use of HC-SR04 ultrasonic sensor are a component that are well-liked and fairly priced, and it is intended primarily to determine distances. Each unit costs (; $2). For the intent of precisely identifying and tracking lateral motion of objects, a N linear HC-SR04 module array uses a time-space framework in this proposed research.It is based on the spatial triggering of these sensors and the average of several distance measurements. The experimental findings are consistent with the underlying theory. This framework acts as the foundation for the proposal of a software approach and its execution for a project that utilises a board with an Arduino Uno and an array of N=4 HC-SR04 modules.With the help of this programme, you can identify a moving object or human body and determine its lateral movement in relation to the array line. It recognises and finds directions accurately more than 96% of the time.[7]

Methodology

Here is how the datasets are fetched from the sensors and trained,

- At first, the ultrasonic SR-04 sensors are placed in the centre of a four direction traffic junction where the sensors are connected to the Arduino UNO board for the processing of the datasets fetched from the sensors.
- After the datasets are fetched from the sensors the datasets are processed in the Arduino board.
- After the datasets are being processed in the Arduino board the datasets are extracted from the board and stored in a Microsoft Excel sheet through a tool called as PLX-DAQ (Parallax Data Acquisition).

- Then the datasets from the excel sheet are taken from the excel sheet and are trained in the Jupyter notebook.
- Logistic Regression (LR) is a machine learning algorithm often used for binary classification functions such as predicting onset in traffic congestion datasets and also the datasets are fetched using the concepts of fuzzy logic. For the Traffic dataset , LR can be used to predict the congestion flow of the current traffic scenario and help for the survey that can be used for future project such as flyover construction, controlling of the flow of traffic and many more.

Fig 1:Workflow of the system

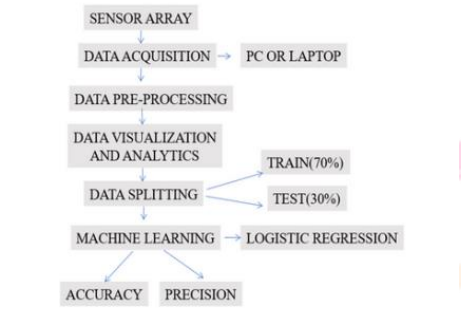

Fig 2:Flowchart of the system

Results and Discussion

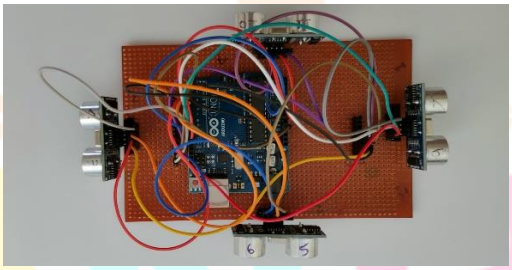

Fig 3:Circuitboard for fetching the datasets

In the above circuit board there are four sensors that are attached to the general purpose board which are facing the four direction of the traffic junction which is connected to the arduino board where the vehicle's are detected by the sensors and the datasets are collected through the sensors and the datasets are processed.

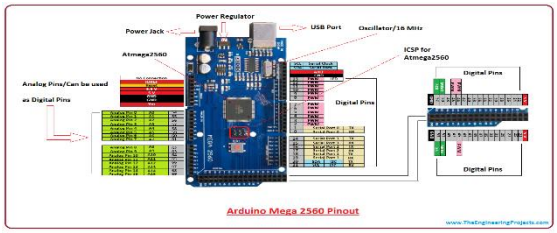

Fig 4:Pin diagram of the Arduino board

The pin diagram shows the connection of the sensors with respect to the sensors

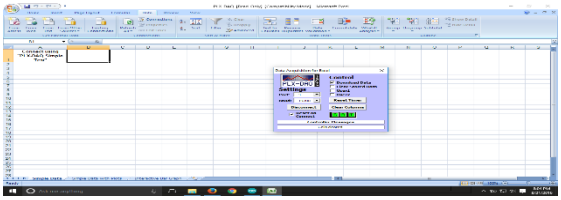

Fig 5: PLX-DAQ tool (fetching the dataset from the Arduino board)

After the datasets are being processed in the Arduino board the datasets are extracted from the board and stored in a Microsoft Excel sheet through a tool called as PLX-DAQ (Parallax Data Acquisition).

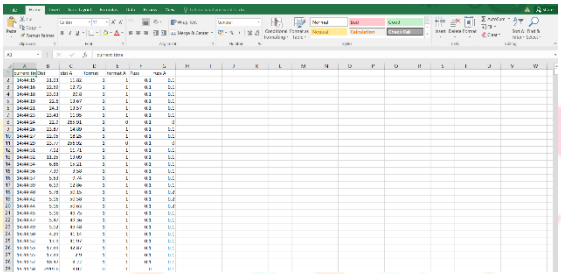

Fig 6:The datasets stored in the excel sheet

After the datasets are being processed in the Arduino board the datasets are extracted from the board and stored in a Microsoft Excel sheet through a tool called as PLX-DAQ (Parallax Data Acquisition).

Fig 7:The datasets being trained using Logistic Regression and the result is predicted ·

Logistic Regression (LR) is a machine learning algorithm often used for binary classification functions such as predicting onset in traffic congestion datasets and also the datasets are fetched using the concepts of fuzzy logic. For the Traffic dataset , LR can be used to predict the congestion flow of the current traffic scenario and help for the survey that can be used for future project such as flyover construction, controlling of the flow of traffic and many more.

Conclusion

Due to the advancement of sensor technology and its everincreasing accuracy, motion detection has become a simple task. Using ultrasonic distance measurement devices and predicting the future were the objectives of this project. An object tracking system is described in this report that calculates distances. It is capable of accurately calculating the distance between the obstruction and the ultrasonic sensor, and it is capable of interacting with other peripherals as a secondary device and communicating with the PC via its serial port if used as a secondary device. Ultrasonic sensors are mounted at different orientations, continuously collecting data on the ether, offering a cost-effective and efficient method of distance measurements without contact. After data have been collected and evaluated, they are analyzed, visualized, and used to make predictions/conclusions for the future.

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