International Journal of Scientific Research in Science and Technology
Print ISSN: 2395-6011 | Online ISSN: 2395-602X (www.ijsrst.com)
doi : https://doi.org/10.32628/IJSRST229151

# Environment Feature and Obstacle Position Prediction Using Long Short-Term Memory

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**Article Info**
Volume 9, Issue 1
Page Number : 280-286

**Publication Issue**
January-February-2022

**Article History**
Accepted : 08 Feb 2022
Published : 17 Feb 2022

## ABSTRACT

Congestion management and procedural knowledge require obstacle prediction of network based on large amounts of dataset. Traditional time series forecasting approaches struggle to create effective prediction models since time series analysis in prediction of network traffic is very unstable time parameter and is also non linear in nature, which may cause a very low forecast accuracy. Hence the define usage of LSTM ie. Long Short Term Memory Recurrent Neural Network has been developed as very important alternative for Neural Network (NN) efficiency. The paper proposed to develop an efficient method in combination with genetic algorithm (GA) and of Long Short Term Memory Recurrent Neural Network (LSTMs) in prediction of environment features and positions of obstacles. The combination of both will be comprises of two sections, one with LSTM which is used for feature extraction and GA is used to enhance hyper parameters extracted for the LSTMs networks. The method assumes the higher prediction accuracy as compared to previous research study with decrease in prediction of errors, with categorization of complex changes with considered data; this is done by comparing the ARIMA i.e. Auto Regressive Integrated Moving Average and LSMTs.

**Keywords :** Long short-term memory recurrent neural networks, Genetic algorithm, Network traffic prediction

## I. INTRODUCTION

In this era of massive knowledge, computing (AI) is maybe the foremost essential task of technology. AI has created plenty of progress, particularly in machine learning, data processing, laptop vision, skilled systems, tongue process, robotics, and doable technologies, since its origination fifty years ago[1]. Obstacle prediction is a very important space of motion planning. the utilization of a statistic analysis model may be a common theme in recent add this space. the foremost prevailing branch of AI is machine learning. Optimization algorithms, deep learning, artificial neural network systems, and scientific theory are number of the opposite forms of AI. The Environment feature and obstacle

prediction have been most prevalent areas in today research, especially in the field of prediction of motion and navigation. Major issue in LMS is that swapping into the convergence speed with tracking of traffic performance. One major issue with LMS is to make substitution between speed and its performance in tracking. While using LMS in prediction of traffic there is chance of conflict between prediction of errors and prediction of delays. The main phase or steps in size decreases the prediction delay but can emerge the problem in convergence, which will lead to increase in error prediction, on other side for lower step the decrease in size reduces the predictions of delay but the it may give rise to problem of convergence which cause to increase prediction errors. There are many models developed and proposed to explore the similar properties of network traffic categorization and prediction of network traffics. The current models like support vector machine (SVM) , auto regressive integrated moving average (ARIMA), are used as linear model in strong data, which cannot be explained or exploited, and encapsulating complicated non-linear connections [2].

The use of GA is based on to enhance the issues; the algorithms are not affected or disturbed by the presence of noise as compared to other AI algorithms. Genetic Algorithms are used in exploring of large spaces and multimodal spaces of applications [3]. The proposed system in this paper mainly focus on application of genetic algorithm along with LSTM for prediction of environment obstacles, we have observed from previous research that genetic algorithm can be used to enhance the parameter in hyper stages of LSTM method. We assume that the combination of two genetic algorithm and LSTM can be used to server mapping into input and output variable. The second pat applicable for genetic algorithm can used to optimize the hyper parameter used in model of LSTM. The environment data problem replacement is used to estimate environment information at a certain intersection based on data from a nearby intersection. NN (Neural Network) based approach is applicable for predicting the motion. The main answer to resolve the problem of motion prediction can be done viva integrating multilayer perception(MLP) network or cascades deep learning network(DLN) , forward network(CFN), are mainly worn intended for checking the prediction performance[4].The paper mainly focus on the deep study of motion prediction analysis with problem identification using genetic algorithm and LSTM.

The different analyzed method for prediction of motion can be applied, we have observed that combining the GEO satellites and Auto Regressive Integrated Moving Average (ARIMA) model the motion calculation accuracy can be maintained .The method can also use grey model to analyze the prediction performance. Another method we learned was combination of ARIMA and grey model with different parameter weights can be used to analyze the network motion performance [5]. But these models require an high end expensive combination of GEO satellites for prediction of motion, therefore we analyze that combination of LSTMS and GA can reduce the motion errors and delays. The need of using GA-LSTMs for motion prediction is because pervious method are prone for problem of over fitting and it cannot be always efficient for prediction of motion performance in certain application[6].

## II. Literature Review

Taking into account of network factors related to security, the best step to pervent network structure from anomalous situations or activities, we can monitor the motion for unwanted activities. The most reliable solution to monitor the motion is to analyze and detect the congestions, intrusive activities or attacks. Prediction of network motion

includes the evaluation of recurrent past network data flow which is used by collecting and storing of data, by analyzing the differentiated parameter in form of behavior and patterns included in various node of network. The vital role of studying the network motion for perdition of motion data is explain in [7] by the author. We have observed that LSTM procedure which is based on process of genetic steps of algorithm can be to analyze the network motion perdition along with its performance [8], the paper also explains about the experimental result of auto regression which can be integrated with ARIMA to achieve the higher accuracy of motion prediction .The paper[3] explains that the prediction of network motion can be important for network operations to analyze its efficiency and quality guarantee. Hence author here explains the improvised LMS prediction system for prediction of motion data.

The prediction of network motions focuses on approach for improved network motion based on analyzed of past motion input sets. This leads to the efficient method for network planning and management of task. The group of RNN i.e. recurrent neural network is generally considered in data modeling of time series which is based on objective of predicting the future implemented time series depending upon the past information with its different parameter like size. RNN have similar network like [9](GRU)Gate Recurrent Unit, (LSTM)Long Short Term Memory which is efficient for capturing the patterns , long dependencies and large arbitrary size.

Advanced communication networks, such as the Internet of Things (IoT) and mobile networks, generate enormous amounts of diverse motion information. Network infrastructure management practices for data collection and data analysis confront some obstacles and difficulties in such systems, including such precision and enhance reliability analysis of massive data[10].We have studied the application of deep learning implemented in NTMA i.e obstacle Monitoring and Analysis.

Raw navigation data should be transformed into meaningful information using NTMA techniques in a series of phases. Using conventional methods for advanced analytics presents a number of obstacles and issues, involving reliability, elevated insights, and enhance reliability processing of large amounts of data is explain in[11]. Besides that, a large number of devices produce tremendous quantities of fresh data all day as a result of new paradigms like the Internet of Things (IoT) [12], so we need more process equipment to evaluate and analyze such massive amounts of raw data in a far more efficient direction in order of accessing space and time.

Moreover, Verma et al. [13] looked at true IoT data analysis. The authors reviewed the most recent network analytics techniques that are suitable for high IoT network machine learning in this paper. The foundation of real-time IoT analytics, application cases, and operating systems are also explored in that study.

Genetic Algorithms are dynamic meta heuristic methods derived from natural genetically principles. The primary premise of Genetic Algorithms is to imitate phenomena in natural systems that are required for evolution; particularly some of those who meet Charles Darwin's survival ideas is explain in [14]. Nowadays, computer internet navigation management is a hot study issue, as it aids in a variety of applications such as outlier detection, routing protocols, and symptom management. The goal in [15] is to make prediction on very small scales (just under 30 seconds). Because navigation is diverse, a functionality clustering approach is being used as the classification phase to group comparable time - series data together. According to the findings,

LSTM can be used to anticipate internet navigation with fewer errors.

In network design, reliable and actual campus internet navigation prediction is critical. The goal of this project is to conduct a vulnerability scanning of internet navigation as well as to solve prediction issues caused by the non - linearity and multidimensional dynamics of campus network navigation. For the investigation of surrounding users' network activities, an internet navigation prediction system related to the long memory (LSTM) model is provided in [16].

## III. Proposed System

The path prediction through video grabs gain lots of attention by an researchers as it can be applied in various real time application like automated driving vehicles, camera based surveillance system analysis etc. In the method so many more information /data like real time environmental surroundings, direction of moving traffic, various states of target will be required. Hence most of the path prediction methods are basically based on computer vision task like living being movement detection, their various observation factors detection. However in path prediction method current information is available but future data is not hence the previous data and current data is used to predict the future estimated path for achieving the target. This path planning strategies should consider all the aspect like minimum required time for achieving the target, minimum shortest path to cover, minimum obstacles, and least energy requirement to move the target . The path prediction work is a most challenging task in the field of computer vision system. AN general method is shown in figure(1).

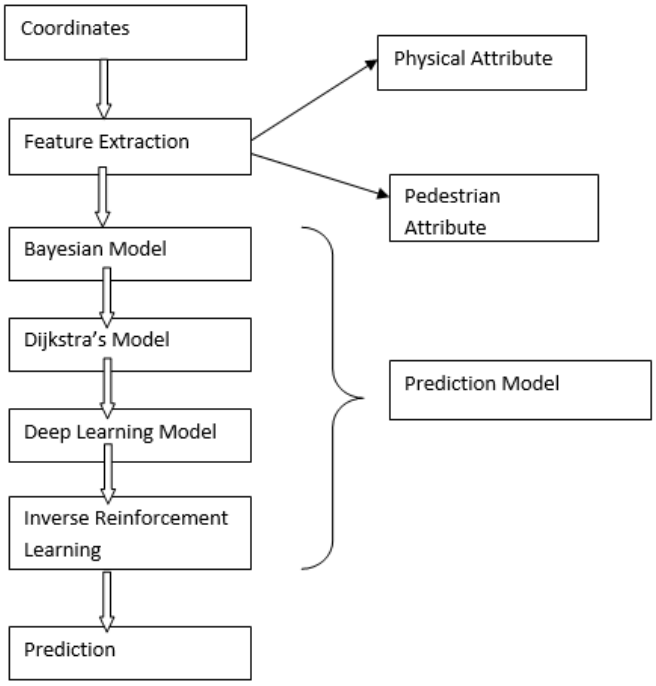


**Figure 1**. Depicts the Current States of Target Movement

## IV. Feature Extraction Approach

In this a video is taken a input to system with some additional information like the current location of the source or the sequence of frames of an location of the source over the past frames of different timing in a seconds. Information useful for the path prediction is then extracted from the sequence of frames for future path prediction. Parameters taken into account to extract the features from the input video as shown in table(1).

| Feature | Type |
|---|---|
| **Enviroment** | Scene Label<br>Cost<br>Global Scene Feature |
| **Target** | Location<br>Direction<br>Attribute<br>Feature Vector |

**Table 1. Feature Extraction**

It should be noted that the path selected be the human being is affected by so many factors of the environmental surroundings and the current mind state of the pedestrian .The path prediction can be improved when using the data that mostly decides how the human decides the way to go on in the current path. Hence when an video is taken from the location all the necessary data is extracted from the video for predicting the future path. This data is categorized in two ways:

A) Environment
B) Target

**A) Environment:**

In the heavy traffic flow normally every pedestrian does decides their own way & moves along a different path with considering all affect around their environmental surroundings.

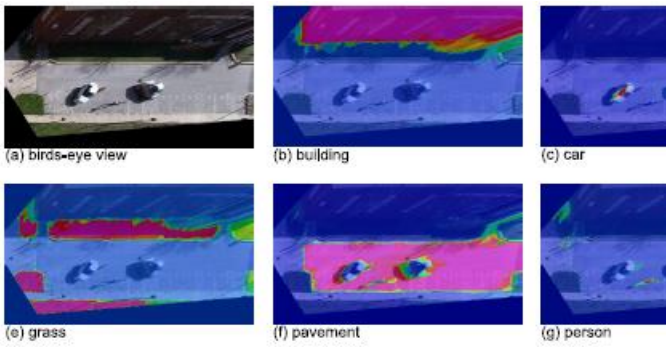


**Figure 2.** Environment Surrounding Feature Extraction

Consider an example, generally we walk in the side street for avoiding obstacles coming in our way of path (e.g., all parked vehicles & trees or dustbins kept a side in road) & we drive our own vehicles by using all the area of an path in a very common & social practice manner. All the movement of the body is dynamic in nature & affected by the environmental surrounding. Hence the various parameters (factors) is therefore can be used while predicting the future path of an target. Generally Feature vectors for creating feature maps of an pedestrian is most widely used of path prediction. Here this feature extraction process of environment can be achieved by using "CONVOLUTION NNETWORK" for future path prediction.

**1) Target**

In addition to the environmental surrounding mostly affect the source while deciding future path ,various internal observations of the target like different attributes namely age, gender, his/her internal demands are also plays an very important role for taking decision for selecting future path. Figure 3. A & B depicts the various body and head movement of pedestrian called as target features.

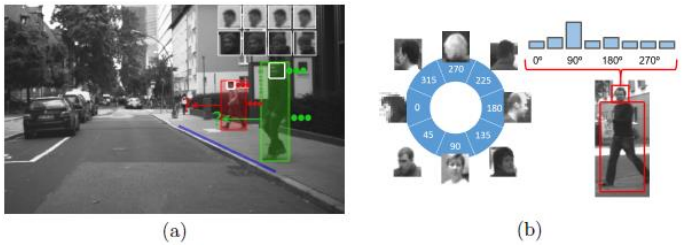


**Figure 3.** (a) Pedestrian body orientation. (b) Estimation of the orientation of the head in eight directions.

In [9] various techniques has been discussed for extracting target (source) features. Here the mostly used target feature attribute was a different orientation of the target body movement because this estimated orientation of the target can be used to predict that in which direction the target is going to move in future hence the prediction error in future process can be reduce in much extent.

Various techniques like histogram of oriented gradients (HOG) and support vector machine (SVM) has been used for this orientation. Similarly head direction is also a very important attribute for future path prediction as shown in fig (3.b) if the target head orientation is focused towards the camera of traffic light straight forward then it indicates he/she will stop on his position. Similarly its all different

orientation will indicates different future movements of the target that will definitely help to predict that in which direction the target is going to move in future.

## V. Conclusion

Obstacle prediction and environment feature identification is a very important role in the motion planning and navigation. Artificial intelligence and machine learning are the technologies that helps us for implementing the solutions for predicting the future change in the environment and that helps in predicting a obstacle types and their motion. In this work we have done the survey on various techniques available for the prediction. Long short term memory is used for the time series analysis and prediction of environment features and the obstacle class using the various parameters. In one of the section we have discussed the method along with the implementation steps and the intermediate steps considered during the simulating the system. We have found that the proposed long short term memory works efficiently in predicting the environment features and the obstacles classification in the environment under observation.

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**Cite this article as :**

Samir N. Ajani, Salim Y. Amdani, "Environment Feature and Obstacle Position Prediction Using Long Short-Term Memory ", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 280-286, January-February 2022. Available at doi : https://doi.org/10.32628/IJSRST229151
Journal URL : https://ijsrst.com/IJSRST229151