SMART WASTE MANAGEMENT SYSTEM USING LSTM

Abstract

It is a key technique which will address many issues in the transportation of waste material and also optimize the time and other resources required in it. The system will enable each of the recycling container to report its filling level and remaining capacity. The main objective of this system is to predict or estimate the expected time for emptying the contents of the container or bin, when the filling level of the container is above certain threshold. This system will avoid unnecessary transportation of vehicles/bins without breaking the threshold and overfilling requirements. Nevertheless, the effectiveness of this Smart waste management system depends on the status of filling level predictions. There are various technical implementations for acquiring a high-quality prediction. The analysis of operation of Smart waste management system disclosed that one of the main difficulties in an accurate detection of emptying the container based on the measurements from sensor devices which are attached onto the bin.

Authors

Pericharla Raja Ramesh
Department of Master of Computer Application
Chaitanya Bharathi Institute of Technology
Hyderabad, Telangana, India
rajaramesh7410@gmail.com

Dr. B. Indira
Department of Master of Computer Application
Chaitanya Bharathi Institute of Technology
Hyderabad, Telangana, India
bindira_mca@cbit.ac.in

I. INTRODUCTION

In order to quickly solve address problems, an Auto ML method was suggested. The paper uses the Auto ML method and data-driven methodology used with existing solutions to industrial problems. Optimized Waste transport can show good results by keeping the bin cleaned and the waste should be removed at proper time as there are many bins located across various areas.

II. LITERATURE SURVEY

There is a wide variety of applications that show the success of ML and increased the demand for developing many more ML systems which can be used by common people in their day-to-day life. In order to be efficient, these systems require a very good algorithm, excellent feature selection and data preprocessing methods, better data sets and good selection of hyper parameters. Most recently, Auto ML handled this problem with optimized Bayesian techniques. In that work, they introduced a novel AutoML systems using scikit-learn, which used 15 classifiers, 14 feature extraction and 4 data preprocessing techniques, that lead to a structured hypothesis space with 110 hyper parameters. Their systems, auto sklearn, improved existing AutoML methods by considering the previous performance on same kind of datasets and also by building ensemble models evolved during optimization. Their systems also won the challenges known as LearnAutoML and their extensive analysis on above 100 different datasets shown that it significantly excelled the past works in AutoML. They also demonstrated the performance improvements due to their effective contributions. - **[**1]

There are various ML algorithms are there where for each hyper parameters, there is another possibility. Considering the continuous selection of algorithms and hyper parameters are the isolated issues found previously. This was addressed using fully AutoML by Bayesian optimization. Knowing the various feature selection techniques, classification (WEKA), extending over two ensemble methods, ten meta methods, twentyseven base classifiers and setting classifiers for each hyper parameter. There are twentyone popular data sets from UCI repository, KDD CUP ZERONINE, different MINIST data sets and CIFAR TEN, they showed better classification then selection or hyper parameters methods. This approach will help common user to get the best ML algorithm for their applications with better performance. - [2]

It explains reusage of waste, and how we can get the raw materials and by-products. They introduced “polluter pays principle" and the "extended producer responsibility". They found waste management to be the five-step “waste hierarchy”, established in the Waste Framework Directive. It builds a procedure for managing and discarding waste. - [3]

III. RELATED WORK AND METHODOLOGY

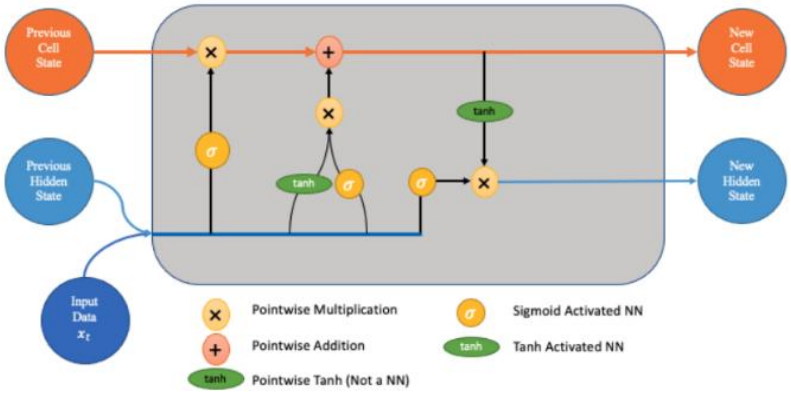
Many techniques for getting a best predictions. So, we propose a data-driven for making better detections for emptying. Also considering the statistical methods with ML

Algorithms. Statistical data is used in ML Algorithms for analysis. Previously they have used many conventional algorithms like ANN, KNN, LR, DT, RF, CNN.

As Time Stamp is an important parameter for this work, LSTM (Long Short-Term Memory) may perform very well as it is used for processing time series data. That means LSTM process entire sequences of data by getting useful info about data(previous) for processing of data points(new).

LSTM dependencies:

1. Cell State
2. Hidden State
3. Input Data
4. LSTM has 3 gates:
5. forget-gate,
6. input-gate,
7. output-gate.



Step: 1: Forget Gate

- Here we get bits of the useful cell state, given both the hidden state(previous) and input data(new).
- Hidden state (Previous) and input data(new) are sent to a Sigmoid NN.
- After training the network, irrelevant tend to 0 and relevant tends to 1.
- Output sent up for point wise multiplication so the irrelevant data is multiplied with 0 and relevant with 1.
- In short, forget gate says which pieces of the long-term memory must be forgotten.

Step: 2: Input Gate

- This step determines the new info added to long-term memory.
- This step involves tanh-memory network (new) and the sigmoid- input gate. (Both NN)
- The both inputs hidden sate(previous) and input data are sent above NN.
- The tanh activated NN knows to combine the hidden state(previous) and input data(new) to get a ‘new memory vector(updated)’.
- It doesn’t actually check if the new input data is even worth remembering.
- So, σ filters components of the ‘new memory vector’ which are worth retaining.
- The result from these NN is sent to pointwise multiplication and added with previous state.

Step: 3: Output Gate

- Hidden state (new) will be decided by output gate, it takes newly updated cell state, hidden state (previous) with input data.
- Hidden state (previous) and input data (new) are set to the sigmoid NN.

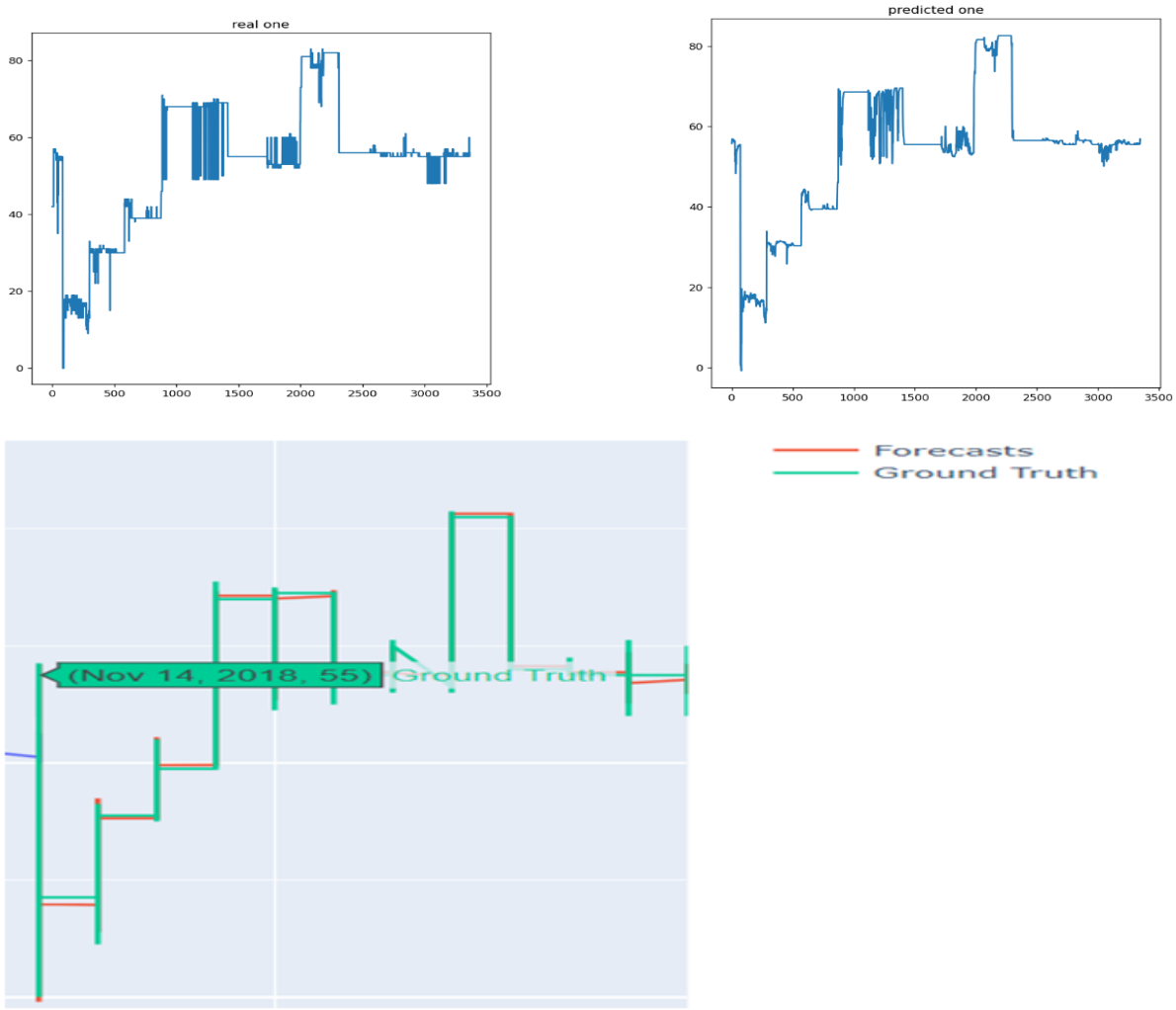
- Newly updated cell state is fed to tanh non-NN.
- The above two points are sent to point wise multiplication to get the new Output Hidden State.

Final Step:

- Finally, we need output from hidden state.
- At last, we add a linear layer for only once.

IV. RESULT ANALYSIS

The predicted results from LSTM model showed a greater accuracy as compared to other algorithms.



V. CONCLUSION & FUTURE ENHANCEMENTS

We don’t know inaccuracy detection of emptying affects filling level predictions. This model can be further optimized like by combinations of different algorithms or by use of some different kind of parameters. We cannot predict emptying time during festivals,

elections, etc. because for that we need separate analysis. Odor sensor can be implemented to detect the odor from the waste.

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