By contrasting Random Forest with Convolutional Neural Networks, a novel location intelligence-based smart waste management system is developed.

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ABSTRACT

Aim: The aim of the research work is to classify an end user's Smart Waste Management system using random forest and conventional neural networks. **Materials and Methods:** The categorizingis performed by adopting a sample size of n = 10 in random forest and sample size n=10 in conventional neural networks was iterated 20 times for efficient and accurate analysis on labeled images with G power in 80% and threshold 0.05%, CI 95% mean and standard deviation. **Results and Discussion:** The analysis of the results shows that the random forest has a high accuracy 91.96% comparison with the conventional neural networks algorithm (81.87). There is a statistically significant difference between the study groups with $p<0.05$. **Conclusion:** Prediction in classifying an end user's waste management system shows that the random forest appears to generate 91.96% better accuracy than the waste system conventional neural networks algorithm.

Keywords: Smart Waste Management, Novel Location Intelligence, Classification Algorithms, Data Mining, Automated Machine Learning, Recycling Stations.

INTRODUCTION

The purpose of the research is to improve the accuracy of detection of Smart Waste Management systems advanced using Novel location intelligence with Automated Machine Learning algorithms using Classification Algorithms (Kumar, Naveen Ananda Kumar, and Chimmani 2019). An efficient strategy for facing the challenge of Smart Waste Management for Recycling Stations should address several directions including building a structured process for waste disposal and maximizing the recycling of waste using Data mining (Dias et al. 2021). When implementing these steps economical and environmental aspects should be taken into account for Recycling Stations. Waste transportation greatly affects both aspects and its optimisation can significantly increase the positive effects using Novel location intelligence based Classification Algorithms (El Haggar 2010). At the same time, Data mining is a clear requirement that in order to keep recycling stations clean they should be emptied at the right time. It is non-trivial to fulfill this requirement in a scenario with several hundreds of recycling stations that are spread over a large geographical area. The Government of India has taken initiative to set up 100 smart cities which consist of a

market, offices, institutions and various small or large scale homes and societies associated with Recycling Stations.. The major application sources of waste are collected from households and reused accuracy was (Rong et al. 2021) found based on the Automated Machine Learning algorithms.

Forecasting waste management system cases in and around the world are sequence by comparing machine learning algorithm 1894 journals from IEEE Xplore digital library 985 articles from ScienceDirect,780 articles from Google Scholar 786 articles from Random forest and Convolutional neural networks are highly correlated parts in detection of waste management based on Classification Algorithms (Sengupta and Agrahari 2017). Among all the articles and journals the most cited papers are the latest statistics that have recorded the countries people have been affected. It can be used to reduce pollutants in the water which in turn decrease water contamination using Novel location intelligence(Alther 2002) scarcity of clean water. ML can be leveraged to detect the amount and composition of toxic contaminants since ML works as optics,which can increase the efficiency of waste management systems using Novel location intelligence (Sandhu and Kamaljeet 2021). The water quality can be continuously monitored and it is possible to get real time data on the quality through machine learning and big data.neural networks and ML will reduce the energy costs which otherwise increases when using conventional methods (Dawn et al. 2020). (Venu and Appavu 2021; Gudipaneni et al. 2020; Sivasamy, Venugopal, and Espinoza-González 2020; Sathish et al. 2020; Reddy et al. 2020; Sathish and Karthick 2020; Benin et al. 2020; Nalini, Selvaraj, and Kumar 2020)

Previously our team has a rich experience in working on various research projects across multiple disciplines(Venu and Appavu 2021; Gudipaneni et al. 2020; Sivasamy, Venugopal, and Espinoza-González 2020; Sathish et al. 2020; Reddy et al. 2020; Sathish and Karthick 2020; Benin et al. 2020; Nalini, Selvaraj, and Kumar 2020).The methods which were used before have less accuracy on detecting Smart Waste management systems. It will allow each recycling container to report its filling level (Holmes 1983).The accurate emptying detection is a very important prerequisite for the accurate emptying time prediction. Similarly the detection of waste management systems using Artificial neural networks is lagging to find the waste with less diseases. In order to sequence the methods and techniques in this research k-nearest neighbors generally fares better than artificial neural networks (El Haggar 2010; IEEE Staff 2019). It also takes more time to train an Artificial neural networks algorithm for detecting waste in the peoples with less diseases especially from Classification Algorithms . The aim of the research work is to improve the accuracy of waste detection using a novel Smart Waste Management system with machine learning algorithms to frame that the detection of waste with Artificial neural networks has higher accuracy compared to K-nearest neighbors(Attia, Soori, and Ghaith 2021)

MATERIALS AND METHODS

The research work was performed in the Image Processing Lab, Department of Computer Science and Engineering,

Saveetha School of Engineering, SIMATS. Basically it is considered that two groups of classifiers are used, namely Random forest and Conventional neural networks, which is used to classify the waste management system. Group 1 is the Random forest algorithm with the sample size of 5 and the Conventional neural networks algorithm is group 2 with sample size of 5 and they are compared for more accuracy score and precision score values for choosing the best algorithm. Sample size has been calculated and it is identified that 5 sample groups in total 10 samples with a standard deviation for Random forest= 0.11325 and Convolutional neural networks = 0.12741 (Gunjan et al. 2020).

Random Forest

Random forests are special types of Automated Machine Learning algorithms that are modeled after the human brain.That is just like how the neurons in our nervous system are able to learn from the data,similarly the RF is able to learn from the data and provide response in the form of predictions or classification. RF are linear statistical models which display a complex relationship between the inputs and outputs to discover a new pattern.A variety of tasks such as image recognition,speech recognition,machine translation as well as medical diagnosis make use of these Random forests for Recycling Stations.

Pseudocode for Random forest

Import random forest classifier
import images
Input file path [filename, pathname] = uigetfile({'*.jpg'; '*.bmp'; '*.tif'; '*.gif'; '*.png'; '*.jpeg'},
'Load Image File'
if
isequal(filename,0)||isequal(pathname,0)
warndlg('Press OK to continue', 'Warning');
else
image aqa = imread([pathname filename]);
imshow(image aqa);
title('Input');
[image aqa] = Preprocess(image aqa);
imshow(image aqa);
title('Preprocess');
image aqa = imresize(image aqa);
Compare images and resize the images;
Resize and reshape the images and form a cluster pixel;
Plot the graph for accuracy;
Plot the graph for specificity;
Accuracy of the random forest classifier;

Convolutional neural networks

Conventional neural networks is a machine learning classification algorithm used to predict the probability of a target variable 0. The nature of target or dependent variable is dichotomous, which means there would be only two possible classes. C is chosen by a number of different means. It is often a small integer and sometimes higher C values increase error rates while lower c values create less-cohesive categories. Mathematically,a Convolutional neural networks model predicts P(Y=1)as a function of X. It is one of the simplest ML algorithms that can be used for various classification problems such as waste like diseases,infection,poliyo. This variable ends up being the number of closest neighbors that a data point is evaluated against. In case of binary Convolutional neural networks the target variables must be binary always and the desired outcome is represented by the factor level 1.

Pseudocode for Convolutional neural network

```
Import conventional neural networks
classifier
import images
Input file path [filename, pathname] =
uigetfile({'*.jpg'; '*.bmp'; '*.tif'; '*.gif';
'*.png'; '*.jpeg'},
'Load Image File'
if
isequal(filename,0)||isequal(pathname,0)
warndlg('Press OK to continue',
'Warning');
else
image aqa = imread([pathname
filename]);
imshow(image aqa);
title('Input');
[ image aqa ] = Preprocess( image aqa );
imshow(image aqa);
title('Preprocess');
image aqa = imresize(image aqa);
Resize and reshape the images and form
a cluster pixel;
Get the infection image clearly by
increasing the pixel from iteration to
iteration;
Plot the graph for accuracy;
Plot the graph for specificity;
Accuracy of the k-nearest neighbour
classifier;
```

Statistical Analysis

The analysis was done using IBM SPSS version 21. It is a statistical software tool used for data analysis. For both proposed and existing algorithms 10 iterations were done with a maximum of 20 samples and for each iteration the predicted accuracy was noted for analyzing accuracy. The value obtained from the iterations of the Independent Sample T-test was performed. The independent data sets are targets, date, flag, Ids tweet text (Batoo et al. 2021). The Dependent values are sentimental chats, values, and floated text. A detailed analysis has been done on these values for finding unhappy users in the waste system.

RESULTS

The dataset is provided by a social track by my hashtag, which selects the Convolutional neural networks samples from a given dataset for depressed user identity that are initialized to fram the tweets Table 1. Depressed user tweet collections for flags and datasets are framed to check with Table 2. As the sample sets are executed for a number of iterations the accuracy and precision values of Random forest and Convolutional neural networks varies for Depression prediction with a mean value= 91.9% , Std.Deviation= 4.47. Figure 1 shows the comparison of RF over CNN in terms of mean accuracy. It explores that the mean accuracy is slightly better than CNN and the standard deviation is moderately improved compared to random forest. Graphical representation of the bar graph is plotted using groupid as X-axis RFvs CNN, Y-Axis displaying the error bars with a mean accuracy of detection +/- 1 SD. Thus the model is able to work efficiently to predict depressed users from the direct feedback. The mean difference ,standard deviation difference and significant difference of RF based depressed user detection and random Convolutional neural networks based depressed user detection is tabulated in Table 3,which shows there is a significant difference between the two groups since $P<0.001$ with an independent sample T-Test. Targets, Date, Flag, Ids and Tweet Text. The dependent variables in sentimental analysis are predicted with the

help of the independent variables. The statistical analysis of two independent groups shows that the Random forest has higher accuracy mean (91.96%)compared to Convolutional neural networks.

DISCUSSION

In this research work the newly identified waste management system is highly complicated compared to the existing system (Khan, Inamuddin, and Asiri 2019). The most important features of detecting waste systems using Random forest are empirically proven to be highly effective than Convolutional networks classifiers (Andeobu, Wibowo, and Grandhi 2021; Prasad, Vithanage, and Borthakur 2019).

The core argument is that to prove that tree boosting can adaptively determine the local neighbourhoods of the model thereby taking the bias-variance trade-off into consideration during model fitting using novel nearest centroid and repostions data. Random forest further introduces some improvements which allow it to deal with the bias-variance trade-off even more carefully (Sharma 2018). It was observed that the sequential problems faced in the process of detecting Smart Waste Management systems using Novels are more risky(Andeobu, Wibowo, and Grandhi 2021). The extracted features were then fed into Automated Machine Learning classifiers to classify subjects as either a case of Waste system or a control (IEEE Staff 2019). It is found that the recent research works are based on waste(IEEE Staff 2019; Lai et al. 2017)in terms of the fair comparison of algorithms, ensemble classifiers should be treated separately, however, in the scope of the considered problem the achieved performance was the main goal. The use of single classifiers did not provide qualitative performance improvement in comparison to the optimised manually engineered model. In fact, it was only RF where all performance metrics were marginally greater than or equal to the optimised manually engineered model. Other single classifiers were either better in some metrics Expectedly, the largest gain was observed for the ensemble classifier (CNN). Thus, in the second category the only improvement was achieved with the use of the ensemble-based algorithm.

Hence the study results produce clarity in performance with both experimental and statistical analysis, but it has some limitations to the proposed work such as threshold and precision. The accuracy level of detecting waste systems using novels can still be improved by implementing Random forest techniques to predict and analyze better results while comparing with existing ML techniques. In the future, the large dataset for waste stem can be considered to validate our proposed model with respect to recent scenarios.

CONCLUSION

The advanced waste system is novel and eco-friendly by comparing Random forest classifiers over the Convolutional networks classifier. The current study focused on machine learning algorithms, Random forest over Convolutional neural networks for higher classification in detecting waste management systems. It can be slightly improved based on the random data sets analysis in future. The outcome of the study of Random forest shows 91.96% higher accuracy than Convolutional neural networks 81.87%.

DECLARATIONS

Conflict of Interests

No conflict of interest

Authors Contribution

Author JR was involved in data collection, data analysis, manuscript writing. Author DV was involved in the Action process, Data verification and validation, and Critical review of manuscript.

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TABLES AND FIGURES

Table 1. Waste management system data set description with five attributes which selects the random samples from a given dataset. Implement Random forest and Convolutional neural networks.

PH	HARDNESS	SOLIDS	CHLORAMINES	SULFATE
6.66	168.28	30944.36	5.85	310.93
7.05	211.04	30980.60	10.09	315.14
8.97	279.35	19460.39	6.20	431.44
227.43	103.33	22305.5	554.82	16.33
3.90	196.90	21167.5	6.99	444.47

Table 2. Group Statistics of RF with CNN by grouping the iterations with Sample size 10, Mean = 91.96 , Standard Derivation = 4.47, Standard Error Mean =1.41. Descriptive Independent Sample Test of Accuracy and Precision is applied for the dataset in SPSS. Here it specifies Equal variances with and without assuming a T-Test Score of two groups with each sample size of 10.

	Group	**N**	**Mean**	**Std.Deviation**	**Std.Error Mean**
Accuracy	RF	10	91.96	4.47	1.41
	CNN	10	81.87	2.80	.88
Loss	RF	10	2.62	.25	.08
	CNN	10	1.62	.27	.08

Table 3. Independent Sample Test of Accuracy and Precision (Calculate P-value = 0.001 and Significant value= .0001, Mean Difference= 10.098 and confidence interval = (.843- 7.578). RFand CNN are significantly different from each other.

		F	**sig.**	**t**	**df**	**sig(2-tailed)**	**Mean difference**	**Std error Difference**	**lower**	**upper**
accuracy	Equal variances assumed	.169	.686	6.048	18	.0001	10.098	1.66	6.59	13.60
	Equal variances not assumed			6.048	15.150	.0001	10.098	1.66	6.54	13.60
loss	Equal variances assumed	.307	.586	8.295	18	.0001	.9950	.1199	.74	1.24
	Equal variances not assumed			8.295	12.563	.0001	.9950	.1199	.74	1.24

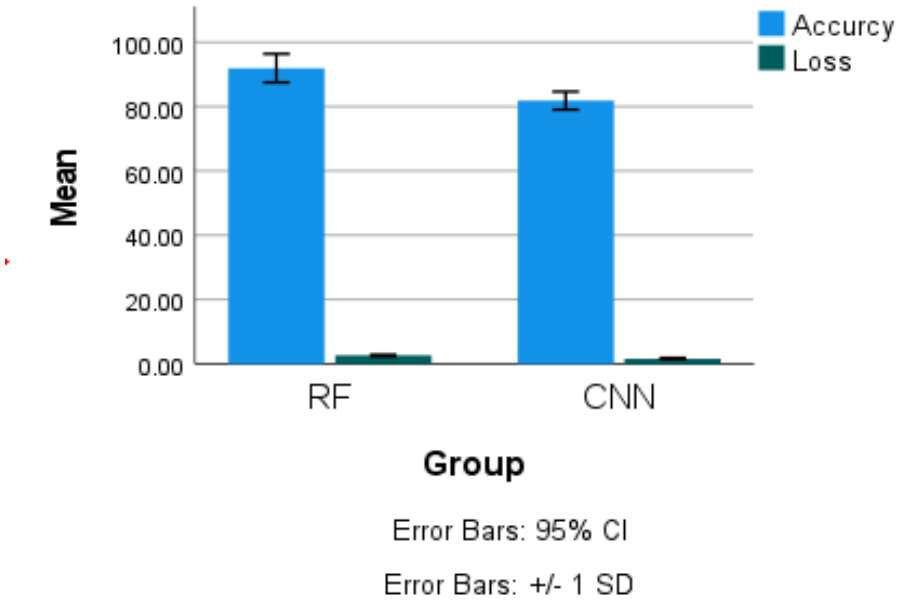

Fig. 1. Comparison of RF over CNN in terms of mean accuracy. It explores that the mean accuracy is slightly better than CNN and the standard deviation is moderately improved compared to random forest. Graphical representation of the bar graph is plotted using groupid as X-axis RFvs CNN, Y-Axis displaying the error bars with a mean accuracy of detection +/- 1 SD.