ISSN: 2321-2152

IJMECE

International Journal of modern electronics and communication engineering

E-Mail
editor.ijmece@gmail.com
editor@ijmece.com

www.ijmece.com

ISSN2321-2152

www.ijmece .com

Vol 11, Issue.3 july 2023

PREDICTION OF AIR POLLUTION USING MACHINE LEARNING

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ABSTRACT

Due to human activities, industrialization and urbanization air is getting polluted. The major air pollutants are CO, NO, C6H6,etc. The concentration of air pollutants in ambient air is governed by the meteorological parameters such as atmospheric wind speed, wind direction, relative humidity, and temperature. Earlier techniques such as Probability, Statistics etc. were used to predict the quality of air, but those methods are very complex to predict, the Machine Learning (ML) is the better approach to predict the air quality. With the need to predict air relative humidity by considering various parameters such as CO, Tin oxide, nonmetallic hydrocarbons, Benzene, Titanium, NO, Tungsten, Indium oxide, Temperature etc, approach uses Linear Regression (LR), Support Vector Machine (SVM), Decision Tree (DT), Random Forest Method (RF) to predict the Relative humidity of air and uses Root Mean Square Error to predict the accuracy.

INTRODUCTION

The Environment describe about the thing which is everything happening in encircles the Environment is polluted by human daily activities which include like air pollution, noise pollution. If humidity is increasing more than automatically environment is going more hotter. Major cause of increasing pollution is increasing day by day transport and industries there are 75 % NO or other gas like CO, SO2 and other particle is exist in environment.. The expanding scene, vehicles and creations square measure harming all the air at a feared rate. Therefore, we have taken some attributes data like vehicles no., Pollutants attributes for prediction of pollution in specific zone of Delhi. The Environment is nothing but everything that encircles us. The environment is getting polluted due to human activities and natural disaster, very severe amongthem is air pollution. The concentration of air pollutants in ambient air is governed by the meteorological parameters such as atmospheric wind speed, wind direction, relative humidity, and temperature. If the humidity is more, we feel much atmosphere. Urbanization is one of the main reasons for air pollution because, increase in the transportation facilities emits more pollutants into the atmosphere and another main reason for air pollution is Industrialization. The major pollutants are Nitrogen Oxide (NO), Carbon Monoxide (CO), Particulate matter (PM),SO2 etc. Carbon Monoxide is produced due to the deficient Oxidization of propellant such as petroleum, gas, etc. Nitrogen Oxide is produced due to the ignition of thermal fuel; Carbon monoxide causes headaches, vomiting; Benzene is produced due to smoking, it causes respiratory problems; Nitrogen oxides causes dizziness, nausea; Particulate matter with a diameter 2.5micrometer or less than that affects more to human health.Measures must be taken to minimize air pollution in the environment. Air Quality Index(AQI), is used to measure the quality of air. Earlier classical methods such as probability, statistics were used to predict the quality of air, but those methods are very

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complex to predict the quality of air. Due to advancement of technology, now it is very easy to fetch the data about the pollutants of air using sensors. Assessment of raw data to detect the pollutants needs vigorous analysis. Convolution Neural networks, Recursive Neural networks, Deep Learning,Machine learning algorithms assures in accomplishing the prediction of future AQI so that measures can be taken appropriately.Machine learning which comes under artificial intelligence has three kinds of learning algorithms, they are the Supervised Learning, Unsupervised learning, Reinforcement learning. In the proposed work we have used supervised learning approach. There are many algorithms under supervised learning algorithms such as Linear Regression, Nearest Neighbor, SVM, kernel SVM, Naive Bayes and Random Forest. Compared to all other algorithms Random forest gives better results, so our approach selects Random Forest to predict the accurate air pollution.

LITERATURE SURVEY

Ishan et.al [1] described the benefits of the Bidirectional Long - Short Memory[BiLSTM] method to forecast the severity of air pollution. The proposed technique achieved better prediction which models the long term, short term, and critical consequence of

PM2.5 severity levels. In the proposed method prediction is made at 6h, 12h, 24h. The results obtained for 12h is consistent, but the result obtained for 6h, and 24h are not consistent. Chao Zhang et.al [2] proposed web service methodology to predict air quality. Theyprovided service to the mobile device, the user to send photos of air pollution. The proposed method includes 2 modules a) GPS location data to retrieve the assessment of the quality of the air from nearby air quality stations. b) they have applied dictionary learning andconvolution neural network on the photos uploaded by the user to predict the air quality. The proposed methodology has less error rate compared to other algorithms such as PAPLE, DL, PCALLbut this method has a disadvantage in learning stability due to this the results are less accurate. Ruijun Yang et.al [3] used the Bias network to find out the air quality and formed DAG from the data set of the town called as shanghai. The dataset is dived for the training and testing model. The disadvantage of this approach is they have not considered geographical and social environment characteristics, so the results may vary based on these factors. TemeseganWalelignAyeleet.al [4] proposed an IoT based technique to obtain air quality data set. They have

used Long Short-term Memory [LSTM] technique in-order to predict the air quality the proposed technique achieved better accuracy by reducing the time taken to train the model. But still, the accuracy can be improved by compared other techniques such as the Random forest method NadjetDjebbriet.al [5] proposed artificial based Regressive model which is nonlinear to predict 2 major air pollutants.

Modules

Service Provider

In this module, the Service Provider has to login by using valid user name and password. After login successful he can do some operations such as Login, Train Data Sets and View Child Birth Prediction, View Train and Test Results, View Predicted Air Quality/Pollution Details, Find Air Quality/Pollution Prediction Ratio on Data Sets, Find Air Quality/Pollution Prediction Ratio Results, Download Trained Data Sets, View All Remote Users.

View and Authorize Users

In this module, the admin can view the list of users who all registered. In this, theadmin can view the user's details such as, user name, email, address and admin authorizes the users.

Remote User

In this module, there are n numbers of users are present. User should register before doing any operations. Once user registers, their details will be stored to the database. After registration successful, he has to login by using authorized user name and password. Once Login is successful user will do some operations like REGISTER AND LOGIN, PREDICT AIR POLLUTION TYPE, VIEW YOUR PROFILE.

IMPLEMENTATION

Information about air pollutants is obtained from the sensors, analysed, and then saved as a dataset. This dataset hasbeen pre-processed with a variety offeatures, which includes attribute selection and normalisation. Once it isavailable, the dataset is divided into a training set and a test dataset. The training dataset is then used to apply aMachine Learning algorithm.The obtained results are matched with the testing dataset and results are analysed. **Machine Learning model** Machine Learning algorithm is implemented topredict the air pollution.

MachineLearning (ML) is a subfield of ArtificialIntelligence(AI) that enables the software applications to be accurate inpredicting the outcomes without being explicitly programmed to do so. To predict the new outcomes, Machine Learning algorithms make use of existing

past data as the input. With the help of Machine Learning, a user can provide a computer program huge amount of data, and the computer will only examine that data and draw conclusions from it. KNN is the Machine Learning algorithm used for the prediction of air pollution. The K- Nearest Neighbors (KNN) algorithm is one of the types of Supervised Machine Learning algorithms. KNN is incredibly simple to design but performs quite difficult classification jobs. KNN is called the lazy learning algorithm as it lacks the training phase. Instead, it classifies a fresh data point while training on the entire dataset. It does not make any assumptions, hence it is called non- parametric learning method. Steps in KNN:

• Determine the distance between each sample of the training data and the test data.

• To determine distance, we can utilise the Euclidian or Minkowski or Manhattan distance formula.

• Sort the estimated distances in ascending order.

• Vote for the classes.

• Output will be determined based onclass having most votes.

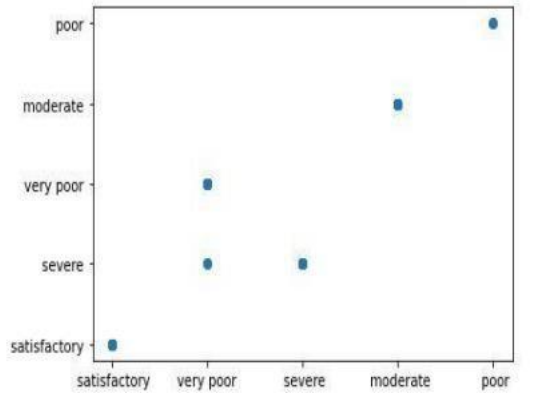
• Calculate the Accuracy of the model, if required rebuild model.

Another purpose to try to stationarize a time series is the capacity to obtain

meaningful sample statistics, such as means, variances, and correlations with other parameters. Such statistics can only be utilized to forecast behaviour in the future if a series is stationary. The sample mean and variance, for instance, will rise with sample size and consistently undervalue the mean and variance in succeeding periods if the series is increasing continuously over time. Moreover, the series' mean and variance are not specifically articulated if the mean, variance, and correlations with other variables are not. For this reason, consider caution when extrapolating regression models fitted to nonstationary data.

```
plt.scatter(y_test,KNN_predicted)
```

```
<matplotlib.collections.PathCollection at 0xf1a7f84670>
```




```
data=pd.read_csv(r'C:\Users\USER\Desktop\Air Pollution Prediction\air pollution.csv')
print(data)
```

	air	smoke	dust	quality
0	61	37	50	satisfactory
1	61	37	50	satisfactory
2	61	37	50	satisfactory
3	61	37	50	satisfactory
4	61	37	50	satisfactory
...	...	...	...	...
1114	63	36	498	severe
1115	63	36	498	severe
1116	63	36	498	severe
1117	63	37	498	severe
1118	63	36	498	severe

[1119 rows x 4 columns]

Fig.1. Dataset details.

```
In [21]: inp = np.array([[75], [51],[48]])
         inp = inp.reshape(1, -1)
         output = KNN.predict(inp)
         output
Out[21]: array([' satisfactory'], dtype=object)

In [15]: inp = np.array([[75], [50],[148]])
         inp = inp.reshape(1, -1)
         output = KNN.predict(inp)
         output
Out[15]: array([' moderate'], dtype=object)

In [16]: inp = np.array([[68], [51],[248]])
         inp = inp.reshape(1, -1)
         output = KNN.predict(inp)
         output
Out[16]: array([' poor'], dtype=object)

In [17]: inp = np.array([[75], [51],[348]])
         inp = inp.reshape(1, -1)
         output = KNN.predict(inp)
         output
Out[17]: array(['very poor'], dtype=object)
```

Fig.2. Output results.

SCREEN SHORTS

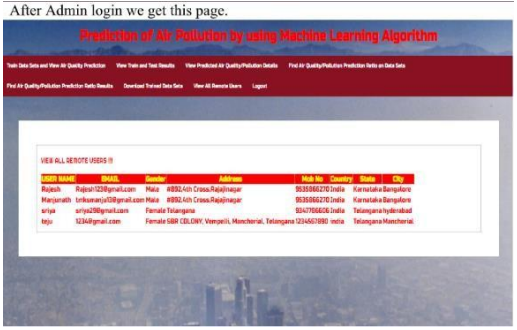
- Paste the url in any of the browser.

Fig 2: Home Page

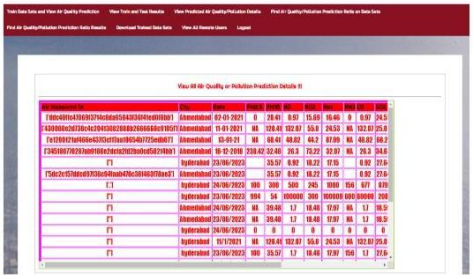
- Click on SERVICE PROVIDER and enter the username and password as Admin and click on Login.

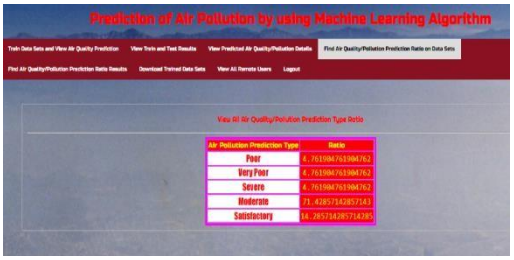
Fig 3: Admin Page

After Admin login we get this page.

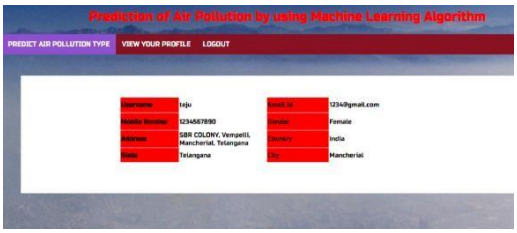


- Click on 'view predicted air quality pollution details

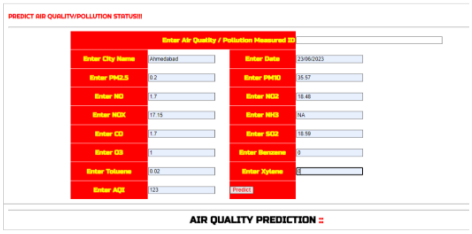


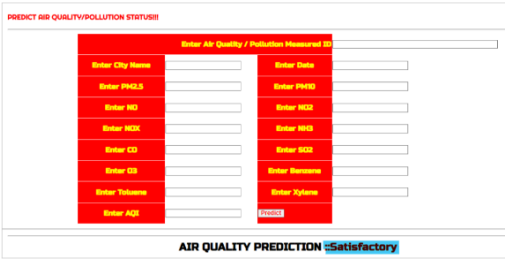


- Click on logout.
- Enter username and passwords of registered user and click on sign_in.



- Enter the values of all the gases and click on predict.





CONCLUSION

The quality of the air is determined by components like gases and particulate matter. These pollutants decrease the air quality, which can lead to serious illnesses when breathed in repeatedly. With air quality monitoring systems, it is possible to identify the presence of these toxics and monitor air quality in order to take sensible measures to enhance air quality. As a result, production rises and

health problems caused by air pollution are reduced. The prediction models built using machine learning have been shown to be more reliable and consistent. Data collecting is now simple and precise due to advanced technology and sensors. Only machine learning (ML) algorithms can effectively handle the rigorous analysis needed to make accurate and efficent predictions from such vast environmental data. In order to predict air pollution, the KNN algorithm is used, which is better suitable for prediction tasks. The Machine Learning algorithm KNN, has given the accuracy of 99.1071% in the air pollution prediction.

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