International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 06 Issue: 04 | April - 2022 Impact Factor: 7.185 ISSN: 2582-3930

Air Quality Detection Using Land Coverage

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• Abstract

Air pollution has become one of the world's most serious issues, as It has a negative impact on human health, animal health, and the environment. In India, today, Air pollution is the largest health problem. The most important factor is the air quality which influences directly on the incidence of diseases and is also responsible for reducing the life's quality. On the measurement and analysis of the parameters of the air, taking appropriate decisions in a time depends, which creates an urge for the detection of air quality in real-time. Using coloured images of the earth's surface, a full-level study of key pollutants and their sources may be performed. These detection systems are critical components in any project that involves monitoring air quality and managing pollutant concentrations in specific locations. Based on a Land coverage analysis, we provide a method for cost-effective assessment of essential environmental parameters in this project. This program is designed to assess the quality of local air.

Keywords :- Land coverage, CNN (Convolution Neural Network), Air quality monitoring, Satellite image

• INTRODUCTION

The energy consumption of the world has increased very speedily due to the growth of the economy, populations increase, and industrialization in last 50 years. This rising energy demand can be attributed to the continued use of fossil fuels. The burning of fossil fuels produces a huge amount of Carbon dioxide (CO2), which is a greenhouse gas that contributes to global warming and increases temperature of the earth's surface. It also emits various pollutants into the atmosphere, including sulphur dioxide (SO2), carbon monoxide (CO), nitrogen oxides (NOx), and particulate matter (PM) (PM2.5 andPM10) These air pollutants can be reason for both minor and long lasting effects on human health by affecting different types of systems and body parts. These effects may be responsible for acute upper respiratory irritation, heart diseases, infection in respiratory system, lung cancer, and asthmatic attacks also. It has also been noticed that exposure to these pollutants for long time can cause premature mortality and can reduce life span. For example, in European cities, almost 90% of the citizens are exposed to pollution levels that exceed WHO air quality recommendations, and, as a result, it is concluded that in the European Union average life span of human is about 8.6 months less compared to others. The public living in particular should be aware of quality of air in their locality by monitoring pollution and should impel the local in charge employees to take decisions and steps towards air pollution reduction .

• LITERATURE SURVEY

In [1], The author Chia-an-Ku investigated the decrease in air quality of urban areas due to urbanisation and increased energy consumption, which affects massive emissions of air pollutants, using an integrated method to investigate the spatiotemporal relationship between air quality and urban Land use patterns. These changes are difficult to study by the traditional methods. To overcome this problem author uses various methodologies and studied various landscapes in urban and rural areas; compares the results and changes that happens in the past 10-20 years. After applying multiple regression analysis they found that air quality in the urban area decreases over the years. The air pollutants like NO2, PM10, CO, CO2, and O3 are found in more numbers near urban areas. The reason behind this is that various construction work going on, vehicles, transportation, deforestation, etc factors are there. It is also possible, according to the author, that it will become very serious in the following years.

In [2], Varsha Khandekar and Pravin Srinath, authors of the Machine Learning technique for air quality forecasting and study on real-time air quality monitoring, noted that air pollution is a big concern, with the Delhi air pollution issue being an emergency. To tackle this type of situation they conducted a study to develop some modern air quality

detection models. During this study, they developed a model called the air quality forecasting model which consists of machine learning technology. In this model, we have provided the air quality index, meteorological data, and climate data to the central air quality detection system. This system is built on a three-layered neural network known as an artificial neural network (ANN). This ANN gives the air quality levels and proper classification. They also observe that neural networks are faster than regression and handle large dimension nonlinear data, are less expensive and achieve accuracy is average to high. So the air quality forecasting model becomes effective due to neural networks and detects the air pollution effects and helps to reduce it.

In [3], Chandana R. Deshmukh, Praveena Gandhi Vidyavastu, Aditya C.R., and Nayana D.K. construct a model that identifies air pollution in the atmosphere in their paper Detection and prediction of air pollution using Machine learning Models. For that, they focused on particulate matter(PM10) which is the main source of air pollution. In this model, the author uses logistic regression from machine learning technology. We have to provide data set that contains temperature, wind speed, dew-point, Pressure, pm2.5 concentration; and from this logic function present in logistic regression generates log-odds which are used to present the probabilities and based on that system classifies the data polluted or not. This strategy aids both the general public and the meteorological service in detecting and forecasting pollution levels. This model also focuses on the data source of small areas and rural areas.

The paper [4], In Effective Monitoring of an air quality network, the author Raoudha Baklouti and Ahmed Ben Hamida studied that air pollution is the most dangerous impact on human health. So this paper deals with fault detection in air quality monitoring networks. They developed a non-linear principal component analysis(NPCA) based Exponentially weighted Moving average(EWMA)-generalized likelihood ratio test(GLRT) for FD(fault detection) of an AQMA: air quality monitoring network. In this developed technique, NPCA mode is constructed using a non-linear function and EWMA-GLRT is applied using the model to enhance the fault detection ability. This technique showed improved detection with lower FAR and MDR when compared to the classical PCA technique.

• SYSTEMS ARCHITECTURE

There are basic steps to perform this Proposed system and they are as follows:

Step 1:

First, it is mandatory to sign up into the system. After successful sign up you have to log in to access the service.

Step 2:

After the successful login into the system, download the satellite colored picture of the earth's surface from the valid Website. This uploaded picture is converted into color percentage means getting the ratio of colored area and picture area. Using this ratio we can determine the forest area, industrial area, road area, and house areas.

Step 3:

The important step is pre-processing the image. It enhances some picture properties that are useful for subsequent processing by improving image data that suppresses undesired distortions.

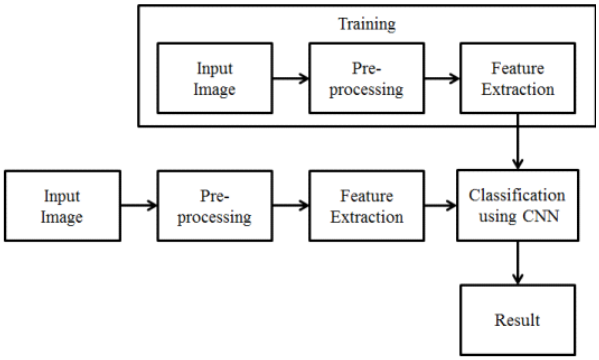

Fig 1: Proposed System

Step 4:

Extraction and matching features are based on comparing parts of the image. The feature Extraction technique is used to extract common features from a large set of data of images.

Step 5:

Dataset is forwarded to CNN. CNN performs classification. After classification and calculating the quality of air from the input image, we get the result on the webpage using Django Framework.

- **ALGORITHM**

Artificial Intelligence is a bridge between the capabilities of humans and machines. Researchers and hobbyists alike work on a variety of facets in the field to achieve incredible results. The field of computer vision is one of several such disciplines. The purpose of this science is to allow a computer to see and interpret the world like humans do, and to apply that knowledge to a variety of tasks like Recognition of images and videos, analysis and classification o images, media reconstruction, recommendation systems, natural language processing, and so on are all examples of image and video processing.

Significant improvements in Computer Vision with Deep Learning have been built and developed over time, mostly through the use of a single algorithm called a Convolutional Neural Network.

ConvNet or CNN that is a Convolutional Neural Network is a Deep Learning method which can take an image as input, give importance (learnable weights and biases) to distinct aspects/objects in the image, distinguish one from the other and compare the parts of the image for classification. CNN is generally used to analyze visual images by processing data with a grid-like topology. It is also called as ConvNet.

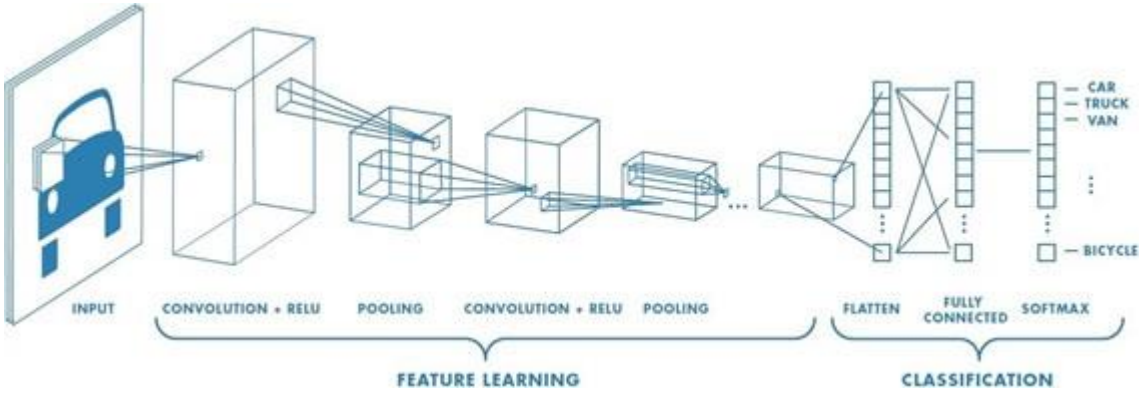

Fig Architect CNN

For the classification of objects in a picture, pre-processing is critical. The CNN algorithm has a number of filters for filtering out common features.

The architecture of a ConvNet is influenced by the organisation of the Visual Cortex and is akin to the connectivity pattern of Neurons in the Human Brain. Individual neurons can only respond to stimuli in a small area of the field of vision called the Receptive Field. A group of similar fields can be stacked on each other to fill the whole visual field.

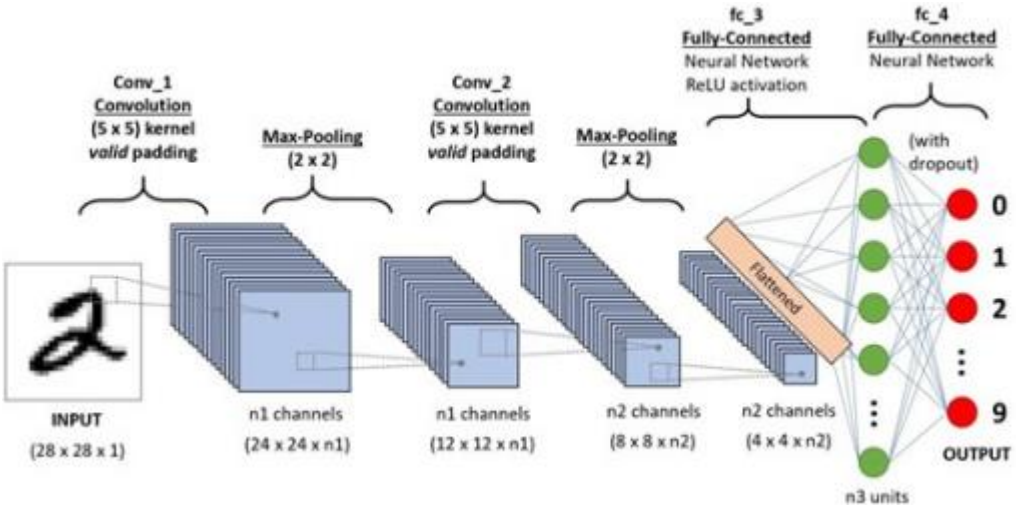

Fig A CNN Sequence

Input Image

The RGB image in the illustration has been divided into three colour planes: Red, Green, and Blue. Images can be stored in a variety of colour spaces, including Grayscale, RGB, HSV, CMYK, and others.

Convolution Layer - The Kernel

To get a 3x3x1 convolved feature, convolve a 5x5x1 picture with a 3x3x1 kernel. With a given Stride Value, the filter travels to the right until it parses the entire width. Moving on, it uses the same Stride Value to hop down to the beginning (left) of the image and repeats the process until the full image has been traversed.

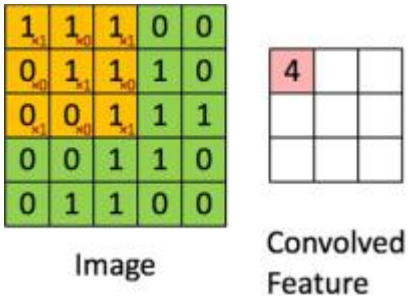

Fig Convolution

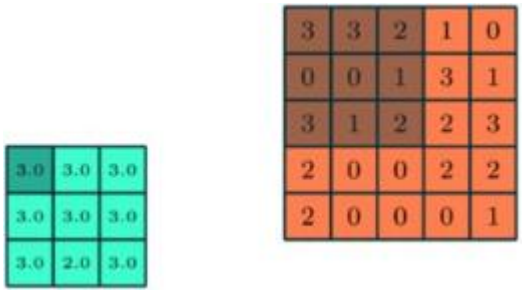

Fig 3x3 Pooling Over 5x5 Convolved Features

Pooling Layer

The Pooling layer, like the Convolutional Layer, is responsible for reducing the spatial size of the Convolved Feature. The computing capacity required to process the data is reduced as a result of dimensionality reduction. It's also beneficial for extracting rotational and positional invariant dominant features, which helps keep the model's training process running smoothly. There are two types of pooling: average pooling and maximal pooling. The maximum value from the region of the image enclosed by the Kernel is returned by Max Pooling. Average Pooling, on the other hand, returns the mean of all the values from the Kernel's section of the image.

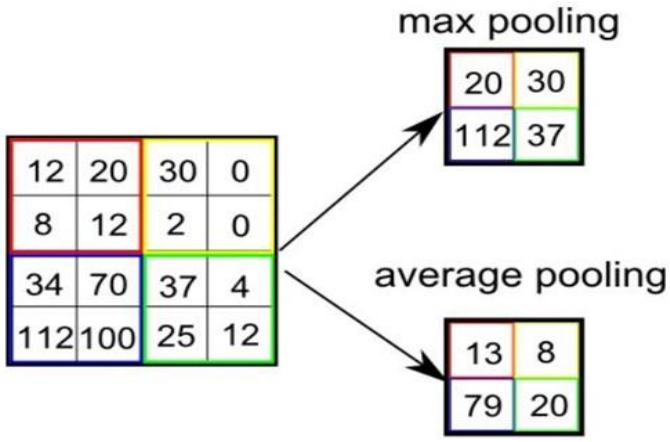

Fig Types of Pooling

Max Pooling also plays a role as a Noise Suppressant. It de-noises and reduces dimensionality while also removing all noisy activations. Average Pooling, on the other hand, is only a noise-suppression approach that minimises dimensionality. As a result, we may say that Max Pooling performs better than Average Pooling. A Convolutional Neural Network's i th layer is made up of the Convolutional Layer and the Pooling Layer. Depending on the image complexity, the number of such layers can be expanded even higher to capture even more low-level features, but at the cost of greater processing resources. We have successfully enabled the model to analyze the features after going through the aforesaid method. After that, we'll flatten the final result and input it to a standard Neural Network for categorization.

CONCLUSIONS

Currently air quality is measured at fixed station and these stations are under control of government authorithies. Advantage of these stations is various types of pollutants can be detected and reliability in measurement helps in long-term estimation of pollution. But, using these type of stations has low data resolution, which can cause improper assessment over the area of study. Also, there is need of constant supply of power and maintenance for these stations. Technique of image processing using CNN for detecting air quality is described in proposed system. This project also provides information for development and evaluation for to people.

REFERENCES

[1] Chia-An Ku, "Exploring the Spatial and Temporal Relationship between Air Quality and Urban Land-Use Patterns Based on an Integrated Method", Sustainability 2020, 12, 2964; doi:10.3390/su12072964.

[2] Effective monitoring of an air quality network. Baklouti, Raoudha; Ben Hamida, Ahmed; Mansouri, Majdi; Harkat, Mohamed-Faouzi; Nounou, Mohamed; Nounou, Hazem (2018). doi:10.1109/ATSIP.2018.8364488. @2018 IEEE.

[3] Cloud enabled air quality detection.Mehta, Yash; Pai, M. M. Manohara; Mallissery, Sanoop; Singh, Shwetanshu (2016). doi:10.1109/icbdsc.2016.7460380. @2016 IEEE

[4]machine-learning techniques for air quality forecasting and study on real-time air quality monitoring. Doi- 978-1-5386-4008-1/17/$31.00 ©2017 IEEE

[5]detection and prediction of air pollution using a machine learning model. DOI: 10.14445/22315381/IJETT-V59P238

[6] Kwonho-Lee, (2019). [IEEE IGARSS 2019 - 2019 IEEE International Geoscience and Remote Sensing Symposium - Yokohama, Japan (2019.7.28-2019.8.2)] IGARSS 2019 - 2019 IEEE International Geoscience and Remote Sensing Symposium - Estimation and Evaluation of Air Quality Degradation by the Sudden Burning Activities. , (), 7854–7856. doi:10.1109/IGARSS.2019.8898319.

[7] The Design and Implementation of Video Wireless WIFI Sensor Nodes with the Function of Air Targets Detection. Qian, Cheng-Guo; Cai, Wen-Yu (2014). , (), 222–225. doi:10.1109/wcsn.2014.52 @2014 IEEE