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Air Quality Detection using Land Coverage Machine Learning Techniques- CNN

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Abstract: *Air pollution is one of the world's most dangerous issues, as it has negative consequences for human health, animal health, and the environment system. In today's India, air pollution is one of the most serious environmental health threats. The most important factor that directly increases the occurrence of diseases and lowers the quality of life is the air quality in all places. The ability to make suitable judgments in a timely manner is dependent on the monitoring and analysis of air quality factors, necessitating the development of real-time air quality detection. It is possible to do a detailed level analysis of key pollutants and their sources using colour images of the earth's surface. These detection devices are critical components in a variety of specialised area projects for sensing 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. These applications are used to assess the quality of local air.*

Keywords: Pre-Processing, CNN (Convolutional Neural Network)

I. INTRODUCTION

Over the last 50 years, global energy consumption has risen quickly as a result of economic expansion, population growth, and industrialization. The increased use of fossil fuels is mostly to blame for the rise in energy demand. The combustion of fossil fuels emits a large amount of carbon dioxide (CO2), a greenhouse gas that contributes to global warming by raising the Earth's surface temperature. It also produces a variety of air pollutants, including carbon monoxide (CO), sulphur dioxide (SO2), nitrogen oxides (NOx), and particulate matter (PM) (PM2.5 and PM10). The impact of these air pollutants on human health are both acute and chronic, affecting a variety of systems and organs. These side effects might range from modest upper respiratory irritation to chronic respiratory and cardiovascular disease, lung cancer, severe respiratory infection, and asthma attacks. Long-term exposures have also been associated to an increased risk of death and a shorter life expectancy. For example, over 90% of the human population in European cities is exposed to pollution levels that exceed World Health Organization (WHO) air quality recommendations, resulting in an estimated 8.6- month reduction in average life expectancy in the European Union. The public should be aware of their air quality through pollution monitoring, ultimately pressuring local and international authorities to take measures to reduce air pollution, such as traffic and industrial activity regulation, and land use management.

II. LITERATURE SURVEY

David A. Wood et.al[1] It is feasible to recognize the impacts of lock-down actuated impacts in the CLAB file and a portion of its part toxins during 2020. Nine AI and three profound learning calculations are contrasted in their capacities with anticipate CLAB from the meteorological factors on managed and concealed bases. Expectation results for 2019 and 2020 are particular for yearly and quarterly time spans. Top to bottom expectation anomaly investigation utilizing a straightforward information matching calculation gives understanding to the couple of information records for which CLAB isn't precisely anticipated from ground-level meteorological information.

Abdellatif Bekkar et.al[2] In this paper, they carried out a profound learning answer for foresee the hourly gauge of PM2.5 fixation in Beijing, China, in light of CNN-LSTM, with a spatial-fleeting component by consolidating authentic information of poisons, meteorological information, and PM2.5 focus in the contiguous stations. They analyzed the distinction in exhibitions among Deep learning calculations like LSTM, Bi-LSTM, GRU, Bi-GRU, CNN, and a half and

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half CNN-LSTM model. Test results show that our strategy "crossover CNN-LSTM multivariate" empowers more precise expectations than every one of the recorded customary models and performs better in prescient execution.

Ritu Chauhan et.al[3] The proposed review, is carried out on two stages where the main stage centers around preprocessing and information investigation, while the Second stage is utilized to test the model precision where the information has been ordered on exact models. The general model is executed utilizing Python programming and prearranging language. Further, the comprehensive outcome investigation were executed and accumulated to find the most significant level of CO, SO2 and NO2 levels in beyond five years among the various urban areas of India from 2015-2020. The urban areas with most significant level of air contaminations and PM2.5 and PM10 impacts on the general Indian urban communities. Regardless, the precision of the model is estimated to decide the pertinence of calculation.

R. Janarthanan et.al[4] The mean, mean square blunder and standard deviation are separated utilizing the Gray Level Co-event Matrix (GLCM). The blend of Support Vector Regression (SVR) and Long Short-Term Memory (LSTM) based profound learning model is utilized to arrange the AQI values. The proposed profound learning model gives a precise and explicit incentive for AQI on the city's predefined area contrasted with the current strategies. The forecast precision is worked on in the proposed profound learning technique, which will alert people in general to lessen to a satisfactory level. The profound learning instrument predicts the AQI esteems precisely and assists with arranging the metropolitan city for economical turn of events. The normal AQI worth have some control over the contamination level by joining street traffic light coordination, empowering individuals to utilize public transportation, and establishing more trees on certain areas.

Wenjing Maoa et.al [5] In this review, They proposed a profound learning structure to foresee air quality in the accompanying 24 hours: a brain network with a fleeting sliding long momentary memory broadened model (TS- LSTME). The model incorporated the ideal delay to acknowledge sliding forecast through multi-facet bidirectional long transient memory (LSTM), including the hourly verifiable PM2.5 fixation, meteorological information, and worldly information. They applied the proposed model to foresee the following 24-hour normal PM2.5 focus in Jing-Jin- Ji district, with the most extreme air contamination in China. The proposed model would be wise to steadiness and exhibitions with high relationship coefficient R2 (0.87), contrasted with the numerous straight relapse (MLR), the help vector relapse (SVR), the conventional LSTM, and the long momentary memory broadened (LSTME) models. In addition, the proposed model can accomplish PM2.5 focus forecasts with high precision in long haul series (48 h and 72 h). They likewise tried the model to foresee O3 focus. The proposed model could be applied for other air poisons. The proposed techniques can altogether further develop air quality expectation data administrations for people in general and offer help for early advance notice and the board of territorial contaminations.

Liang Ge et.al [6] they propose a multi-scale spatiotemporal diagram convolution organization (MST-GCN), which comprises of a multi-scale block, a few spatial-worldly squares and a combination block. They initial separation the removed highlights into a few gatherings in light of their area classifications, and address the spatial connections across stations as two diagrams. Then, at that point, they consolidate the assembled highlights and the developed charts two by two to shape a multi-scale block that feeds into spatial-transient squares. Each spatial-worldly square contains a chart convolution layer and a fleeting convolution layer, which can demonstrate the spatial relationships and long haul transient conditions. To catch the gathering communications, they utilize a combination square to meld different gatherings. Broad trials on a genuine world dataset show that our model accomplishes the best exhibition contrasted and best in class and gauge models for air quality forecast.

LEI ZHANG et.al [7] they propose a profound Spatio- Temporal Orthogonal Regularization Residual CNN (ST-OR-ResNet) for air forecast. Profound Convolutional Neural Network (CNN) is introduced to catch the complex spatio-transient connection of the unique one-sided meteorological information. Leftover learning is intended to stay away from eccentric motions while preparing the organization and checking blunders. For the issue of trademark factual movement and seat point expansion in profound organization, the symmetrically regularizations are intended to balance out the back-engendering blunders, using different progressed insightful apparatuses like limited isometry property without additional issue. They then benchmark their consequences for public genuine world datasets to show that ST-OR-ResNet has preferable prescient execution over the cutting edge techniques.

Qi Liao et.al [8] They initially present structures of profound organizations (e.g., convolutional brain organizations, intermittent brain organizations, long short-termmemory brain organizations, and spatiotemporal profound organization) and their pertinence to investigate the nonlinear spatiotemporal elements across numerous sizes of air contamination. They

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then analyze the capability of profound learning methods for air quality figures in assorted viewpoints, in particular, information hole filling, expectation calculations, and enhancements of CTMs, assessments with satellite information, and source assessments for barometrical scattering gauges. At last, they bring up certain possibilities and difficulties for future endeavors on further developing air quality gauges utilizing profound learning procedures.

Qiang Zhang et.al[9] This paper proposes a profound learning and picture based model for air quality assessment. The model concentrates highlight data from scene pictures caught by camera gear and afterward groups themto gauge air quality levels. A self-management module (SCA) is added to the model and the worldwide setting data of the component map is utilized to recreate the elements by utilizing the relationship between the channel guides to upgrade the associated channel maps and work on the capacity of element portrayal. What's more, a top notch open air quality informational collection (NWNU-AQI) was gathered to work with the preparation and assessment of the model's exhibition. This paper looks at and investigates AQC-Net, Support Vector Machine (SVM), and Deep Residual Network (ResNet) on NWNU-AQI. The trial results show that AQC-Net yields more exact outcomes for air quality arrangement than different techniques.

A. Masih et.al [10] The work targets featuring the fundamental standards of AI strategies and about their part in improving the expectation execution. The review takes on, 38 most important examinations in the field of ecological science and designing which have applied AI strategies during most recent 6 years. The audit led investigates a few parts of the examinations, for example, 1) the job of info indicators to further develop the expectation exactness; 2) topographically where these investigations were led; 3) the significant methods applied for contamination focus assessment or guaging; and 4) whether these procedures depended on Linear Regression, Neural Network, Support Vector Machine or Ensemble learning calculations. The outcomes got recommend that, AI methods are primarily directed in landmass Europe and America.

Moreover a factorial investigation named multicomponent examination performed show that contamination assessment is for the most part performed by utilizing troupe learning and direct relapse based approaches, while, anticipating undertakings will more often than not carry out brain organizations and backing vector machines based calculations.

III. Problem Statement

To create a system that uses image processing to provide air quality measurements in a graphical format from a satellite colored image.

IV. Proposed System

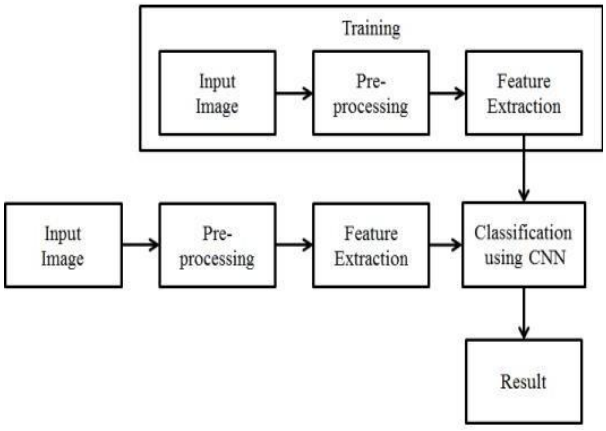

Figure 4.1: Architecture of proposed system

The basic operation is as follows: download a satellite colored image of the earth's surface, convert this image to a color percentage, and calculate the ratio of colored (such as green, brown, red, and many other) area to picture area. We may conclude or compute the forest area, industry area, road area, and house area using this ratio.

The input image (for training) and browse image of land cover for testing) are both pre-processed to remove noise. Both the input and output are intensity images, hence pre-processing is a frequent moniker for actions with images at the lowest level of abstraction. Pre-processing is used to improve image data by suppressing undesired distortions or enhancing certain

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visual qualities that are relevant for later processing. It is vital to establish a measure to compare parts of photos before addressing feature point extraction. These measurements are used to extract and match features. Aside from the basic point feature, a more complex feature is also available. The feature extraction approach is used to extract features from a huge set of visual data while maintaining as much information as feasible. To train CNN, a dataset is provided. CNN is used to classify the data. We show the result on a built webpage using the Django framework after categorizing and calculating the quality of air from the input image.

4.1 CNN

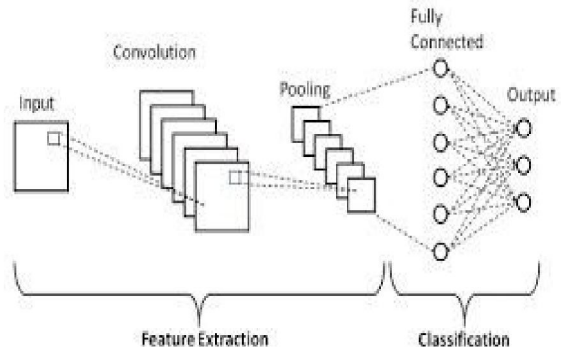

Figure 4.2: CNN Classifier

Artificial Intelligence has made significant progress in closing the gap between human and computer capabilities. 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 goal of this field is to enable machines to see and perceive the world in the same way that humans do, and to use that knowledge for a variety of tasks such as image and video recognition, image analysis and classification, media recreation, recommendation systems, natural language processing, and so on. Advancements in Computer Vision using Deep Learning have been built and developed over time, particularly through the use of one specific algorithm – the Convolutional Neural Network.

A Convolutional Neural Network (ConvNet/CNN) is a Deep Learning system that can take an input image, assign relevance (learnable weights and biases) to various aspects/objects in the image, and distinguish between them.

V. RESULTS AND DISCUSSION

Step I: Home Page

This is home Page of our system.

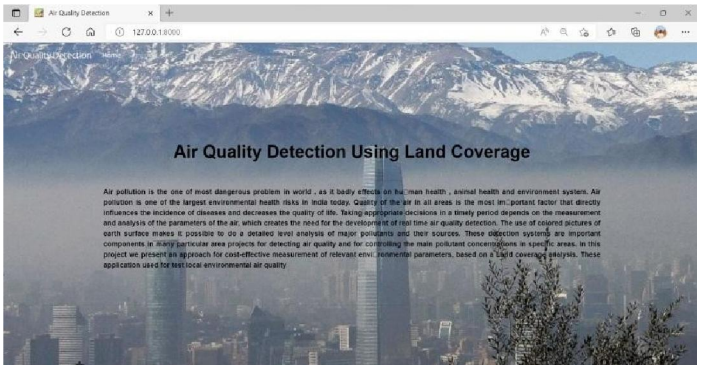

Figure 5.1: Home Page

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Step II: Signup page

Second step is registration page register username and password to become a part of our system.

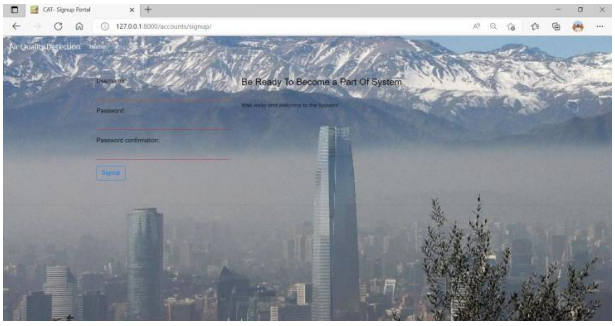

Figure 5.2: Signup Page

Step III: Login Page

Login page is the third step of our system login to the system

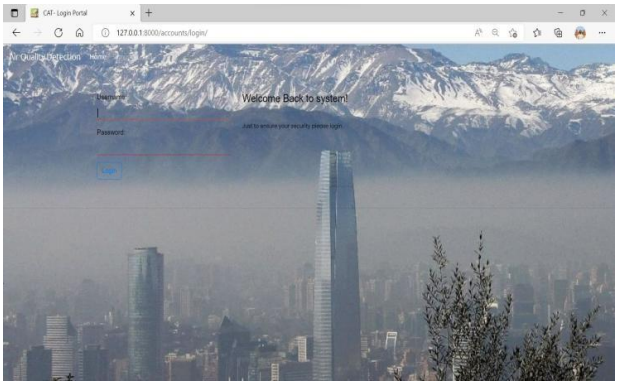

Figure 5.3: Login Page

Step IV: Browse Image

Upload image using choose file shown in the figure below and upload image to our system.

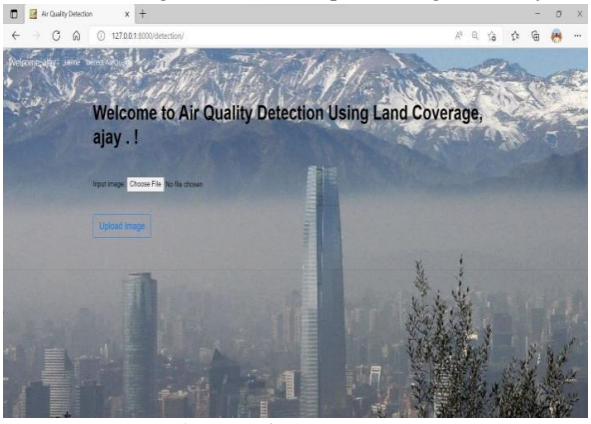

Figure 5.4: Browse Image

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Step V: Result 1

In figure below see the result of image that is air quality is best.

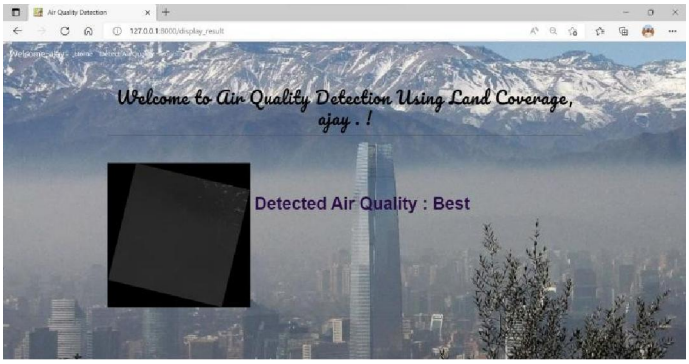

Figure 5.5: Result 1

Step VI: Result 2

In figure below see the result of image that is air quality is good.

Step VII: Result 3

In figure below see the result of image that is air quality is worse.

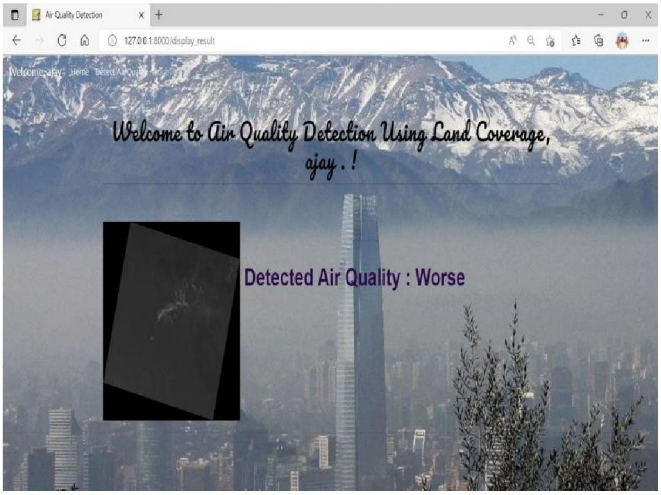

Figure 5.7: Result 3

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Step VIII: Performance Analysis

The confusion matrix Class 1, Class 2 training modules can be seen in the diagram above. In Class 1, the input photos are 50, and we achieved accuracy of 99.33 % and precision of 0.98 % while training the classifier as a train with the supplied input database. Because the 50 classifier failed to classify 1 photos as an output form of a class 1. In Class 2, the input photos are 51, and we achieved accuracy of 99.33 % and precision of 1.0% while training the classifier as a train with the supplied input database. Because the 50 classifier failed to classify 1 photos as an output form of a class 2.

In Class 3, the input photos are 50, and we achieved accuracy of 98.67 % and precision of 0.98% while training the classifier as a train with the supplied input database. Because the 50 classifier not failed to classify photos as an output form of a class 3. We can conclude that our system's performance is better with 99.33% after looking at the above performance parameters.

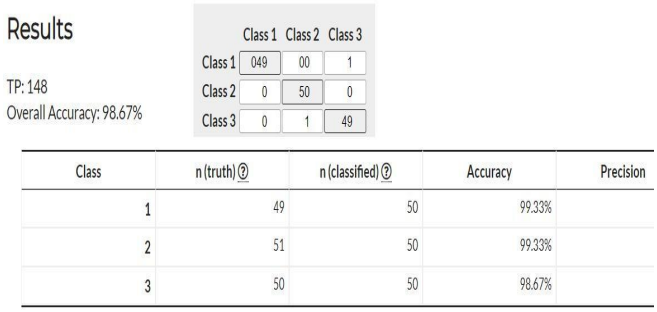

Figure 5.8: Performance Analysis

VI. CONCLUSION

Traditionally, air pollution levels have been recorded at fixed monitoring stations, which are mostly constructed by environmental or governmental agencies. The key benefits of these stations are the measurement availability for a wide range of contaminants, as well as the measurement dependability, which aids in long-term pollution assessment. However, air pollution monitoring with these permanent stations suffers from the data's low spatial resolution, which can result in incorrect assessments across the whole study region. These monitoring stations also require continual electricity and maintenance. This suggested system provides various image processing algorithms for detecting air quality. This project provides people with information that they may use to improve and evaluate themselves.

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