

Air Pollution Monitoring And Disease Prediction by Image Processing, Machine Learning And IOT

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Abstract— Air pollution has developed a chief dispute in the present generation; the cause is industrial emissions and growing urbanization along with traffic congestions and heating/cooling of houses and buildings. Intensive care of urbanite air superiority is thus mandatory by municipalities and by the civilian humanity. Present observing methods depend on gas and deplete recognition method that has been established for observing deplete fumes consuming distant ultraviolet i.e., infrared camera which is expensive. In this project, we inspect the consumption of digital cameras to identify the extent of atmospheric pollution existing in the air. Digital cameras are low in cost and are being consumed in limitless regions, several of which are outsiders and very public. For example, we see digital cameras situated at road connections, town and national parks, and reformation regions. The principle accessible in this project may perhaps support organizations to observe air quality at any of these locations. Our principle is established on by what means assured molecules and elements that are existing in fresh air engross, luminesce, divert, replicate, or disseminate the red, green, and blue (RGB) perceptible light spectrum in a computable method. The lengthier wavelength constituents (red side) of perceptible light through the air are dispersed fewer than the diminutive wavelength constituents (blue side). The blue constituent is dispersed further than the extra color constituents. The lengthier wavelength constituents of visible light are also diverted fewer than the diminutive wavelength constituents. The existence of certain impurities and adjourned elements in air will affect diverse stages of captivation, re-emission, deflection, or smattering in the RGB scale than that for fresh air.

Index terms— Air quality index, Image Processing, Machine Learning, Internet of things.

1. INTRODUCTION

The solitary motive World can endure life expectancy is for the reason of its ambience, which retains air willingly accessible for biochemical responses. An amount of diverse airs, comprising oxygen, make up the Earth's ambience in a combination that preserves flora, fauna and humans alive. Furthermore to satisfying life, airplays a major part in numerous additional significant purposes that are finest implemented when air quality is great. Air is essential to humanity and so is its worth. Air impurities can source a variation of well being difficulties- comprising inhalation difficulties, asthma, concentrated lung utility and lung destruction. Air pollution is able to annoy our eyes, nose and throat, and diminish conflict to coldness and further sicknesses. Air pollution can be particularly injurious to the very young, the very old, and those with assured previous therapeutic disorders. Air pollution sources diminish in discernibility, recompenses to constructions and former landmarks, destructions of plants, water bodies and wildlife. In several realms, pollution is the leading dispute. There are countless investigates completed in conservational scrutiny

and how pollutants distress the ambience all over the place. Nonetheless, very rare provide an easy, simple and reasonable manner by which individual can scrutinize the quality of the air we inhale and exhale. In this section we will concisely gaze into the elementary perceptions utilize to verify the concept which is greatly established on digital picture and environmental knowledge.

Digital Picture: A picture is a massive binary dimensional assortment of shade values of pixels, every single of which is coded on 3 bytes, demonstrating the three most important shades. This consents the picture to encompass an entire of $256 \times 256 \times 256 = 16.8$ million diverse shades. This method is also well-known as RGB encoding, and is precisely amended to human vision. With cameras or further evaluating gadgets we are proficient of watching thousands of further shades, in which circumstances the RGB encrypting is unsuitable. We can understand that shades as vectors in a three dimension space where every axis stands for one of the most important shades as displayed in figure 1. as shown below.

Wavelet Conversion: The wavelet conversion has appeared as a critical verge equipment, within the ground of indication and picture scrutiny.

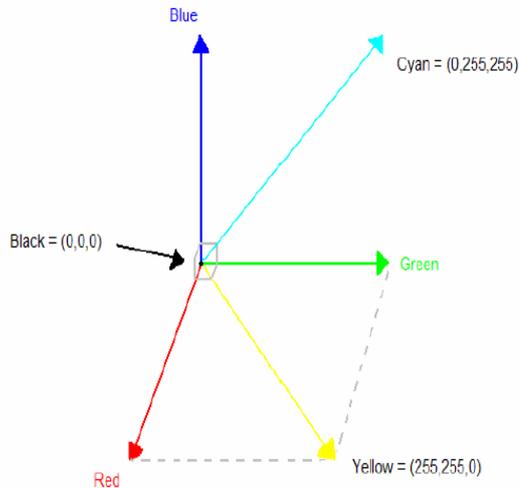


Figure 1: Vector representation of colours

Wavelets are a mathematical implement for hierarchically disintegrating utilities.. The occurrence SPECTRUM of a picture is essentially the rate of recurrence apparatuses of that picture. The occurrence spectrum of a picture displays what regularities are present in a picture. Instinctively,. If something varies quickly, we approximate that it is of high rate of recurrence, where as if this mutable does not change quickly, i.e., It changes effortlessly, we say that it is of low rate of recurrence. If this mutable does not change at all, then we say it has zero rate of recurrence, or no occurrence. One such methods is Haar wavelet transform.

The Atmosphere: The atmosphere is the amalgamation of air molecules and additional resources surrounding the world. It is made up of the gases frequently nitrogen (78%), and oxygen (21%). The following utmost corporate possessions are argon gas and water. There are also slight quantities of further gases, along with numerous tiny solid constituent part, such as dust, soot and ashes, pollen, and salt from ocean. The configuration of the atmosphere fluctuates, liable on the position, weather conditions, and a lot of further things.

Light Waves: Light is a type of dynamism that releases, or explores, in waves. Light is a wave of pulsating electrically powered and captivating fields. It is one minor part of a bigger range of pulsating Electromagnetic fields. This range is called the electromagnetic spectrum. Electromagnetic waves transportable through space at 299,792

km/sec(186,282 miles/sec). This is called the promptness of light.

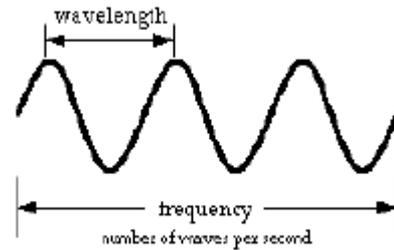


Figure 2: Light wave.

2. RELATED WORK

Kok-Wei Fong et al. [1] proposed the outcomes that vaporized and precipitation in the storm region and neighboring deserts are firmly connected to the extensive scale course and interweaved with the unpredictable rainstorm diabatic warming and dynamical procedures amid pre-storm and rainstorm periods. It Provides the substantial scale radiative driving and clean particles that are transported into storm districts. It also Increases environmental soundness and decreases convection potential.

Demin Wang et al.[4] introduced an evaluation of the fraction that intellectual inaccessible detecting capable mounting the implementation of agro-biological community demonstrating. It Increases the execution of agro-biological system demonstrating. S.N.Palve et al. [2] recognition of interior air contagion on drenched or saturated barrier employing tepid depiction preparing system were exhibited. To satisfy the picture preparing framework process, a blend strategies of shading thresholding and morphological task have been executed.

Amrita Nikhil et al. [7] the proposed another technique for air contamination information perception in light of picture handling. All through information preparing, they utilize facade prologue procedure to get uncontrollable thickness information as per the thickness of isolated information focuses. It Accomplishes the rendering in foundation pictures of various resolutions.

C. Zhu et al.[8] the proposed adjusted technique' demonstrates to decide the vaporized optical thickness for a specific zone of enthusiasm utilizing just the picture itself. The direct logarithmic plot between the airborne optical thicknesses vs. the deceivability information determines the airborne optical thickness for a specific zone of enthusiasm. Yaru li et al. [3] Transport-incited inter annual fluctuation of carbon monoxide (CO) is contemplated amid utilizing the

Goddard science and transport demonstrate (GCTM) driven by acclimatized information. Occasional changes in the latitudinal circulation of CO close to the surface and at 500hPa are caught by the model.

M. E. Keskin et al. [6] a short prologue to the fundamental information of scope idea is proposed.. Second, they contemplate vitality effective aspects; depict the capacity and network concerns from three perspectives: scope arrangement system, rest booking instrument and customizable scope span.

N. Khamisan et al. [5] A numerical improvement detailing (SAMDP) that coordinates sensor sending, movement booking, information and versatile sink steering choices. It reduces the vitality utilization which would in the end prompt longer system lifetimes.

Chuenmeeigan et al. [9] an identification of indoor air contamination on wet or sodden dividers utilizing warm picture preparing system is exhibited. To satisfy the picture preparing framework process, a blend strategies of shading thresholding and morphological task have been executed. It Improve the nature of indoor air to guarantee the building is all around ventilated and disposing of air poisons.

3. IMPLEMENTATION

Air pollution monitoring architecture consists of train and test parts. The data from the sensors and images acquired will be loaded to train the neural classifier, later the random image will be uploaded to test the accuracy of the classifier which gives the description of the pollution level and the diseased prediction by the classifier as shown in Fig 3.

1. PIN CONNECTION

The Arduino Uno is connected to MQ-9 sensor and a Buzzer to notify high pollution with Led lights . The threshold is set to 300 which classify it as Fresh Air or Polluted Air.

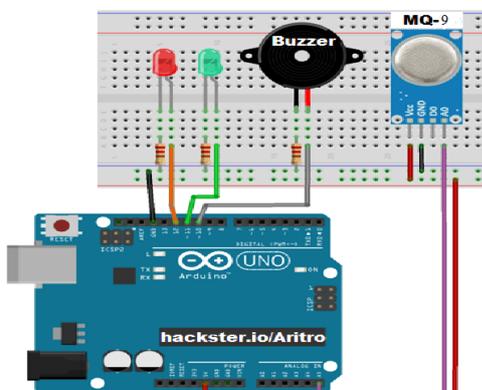


Figure 3: Connection between Arduino Uno and MQ-9 sensor

2. IMAGE ACQUISITION MODULE:

RGB Index Is Calculated

```
Img = imread('image name.extension');
imgR = Img(:,:,1);
imgG = Img(:,:,2);
imgB = Img(:,:,3);
```

3. FEATURE EXTRACTION MODULE:

//input: read an gray scale image

//output: features of the image such as Edge detection, Contrast and homogeneity, reflection.

//input the converted gray scale image and derive statistics

//store all the features of input fundus in a variable

4. MACHINE LEARNING MODULE:

A.Support Vector Machine

Input: k, m, q, c, γ , and termination criterion

Output: optimal value for SVM parameters and classification accuracy

Begin

Initialize k solutions

Call SVM algorithm to evaluate k solutions

T=sort(S_1, \dots, S_k)

While classification accuracy \neq 100% or number of iteration \neq 10 do

for $i = 1$ to m do

select S according to its weight

sample selected S

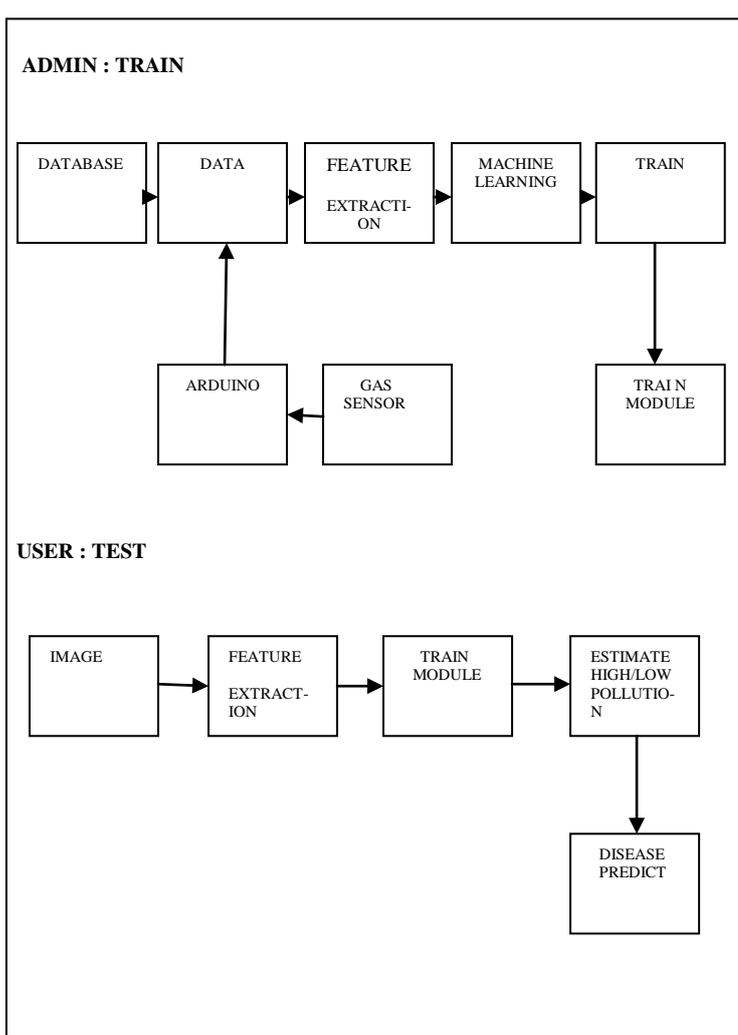


Figure 4 : Architecture diagram

```
[net,tr] = train(net,neural_feat,neur_label);
test y = net(test x);
testIndices = vec2ind(test y);
//compare the result and get the type of disease
if result_class==0
Not Polluted;
Else
Polluted;
```

B. Backpropagation

Input: Data set containing training examples and respective target outputs.

Output: Trained artificial neural network.

Initialize biases and weights to small random numbers

// Forwarding input vector:

For every neuron j in input layer,

$$O_j = I_j$$

for every neuron j in the hidden and output layer,

$$I_j = \sum_i W_{ij} O_i + \theta_j$$

$$O_j = \frac{1}{1 + e^{-I_j}}$$

//Propagating error backwards:

For every neuron j in output layer,

$$Error_j = (1 - O_j) (j - O_j)$$

For every neuron j in hidden layer,

$$Error_j = (1 - O_j) (\sum_k Error_k W_{jk})$$

For weight associated with every edge in the network,

$$\Delta W_{ij} = (1) Error_j O_i$$

$$W_{ij} = W_{ij} + \Delta W_{ij}$$

for every bias θ_j in network,

$$\Delta \theta_j = (1) or_j$$

$$\theta_j = \theta_j + \Delta \theta_j$$

```
store newly generated solutions
call SVM algorithm to evaluate newly generated solutions
end
T= Best (Sort S1, ... Sk + m), k)
end
End
```

A. Neural network

//input: input the test image and trained dataset features

//output: category of fundus input image

//input the test image and trained dataset features and store the result

4. RESULTS AND ANALYSIS

In this work, we assess the appearance of the anticipated system using the estimation metric ‘Accuracy’, and is defined well as the quantity of suitably categorized images alienated by the figure of all images.

Table 1: The performance of SVM and Neural Network

Technique	Classification precision (Accuracy)	Iterations	Complex Function	Efficiency
SVM classifier	79.11%	10 iterations	Linear, quadratic, polynomial	It is more efficient with less data
Neural network	63.41%	48 epoch iterations	Multilayer Perceptron, 100m hidden layers used	Less Efficient and slower

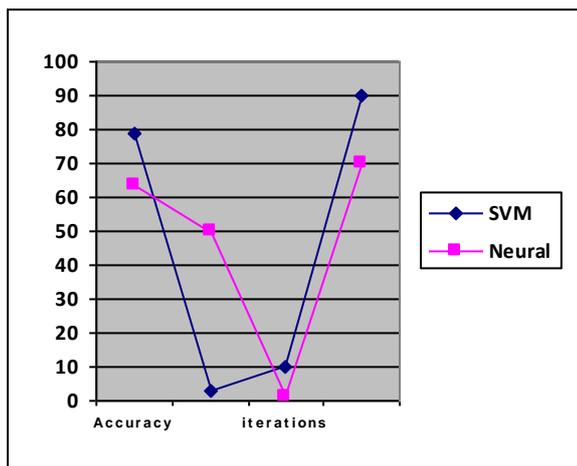


Figure 5: Comparison between SVM and Neural network

1. The figure below displays that the gas sensor will detect the pollutants, which will be processed by Arduino and hence controls the LED. If the pollution level crosses the threshold value 300 then there will be an alarm with the red light else it shows healthy.

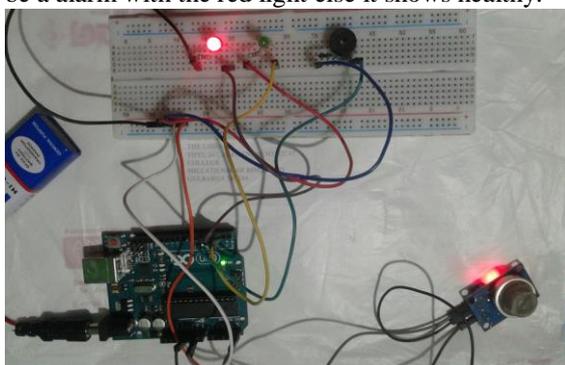


Figure 6: Air Pollution Monitoring by sensors

2. Training mode of SVM with the input image data from Feature extraction module

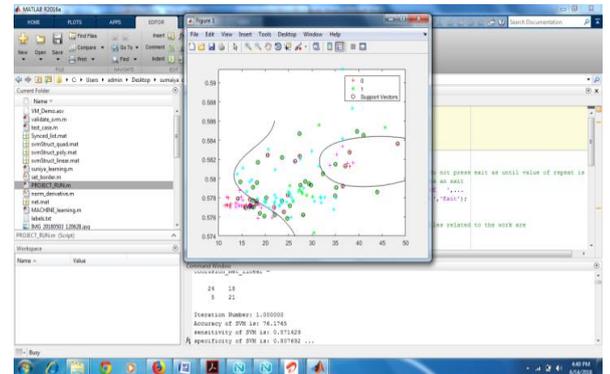


Figure 7: Training mode of SVM

3. Training mode of Neural Network with the input image data from Feature extraction module

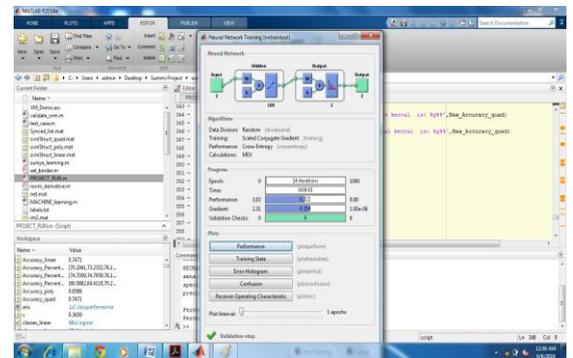


Fig 8: Training mode of Neural Networks

4. Testing of the Air pollution level of the random image

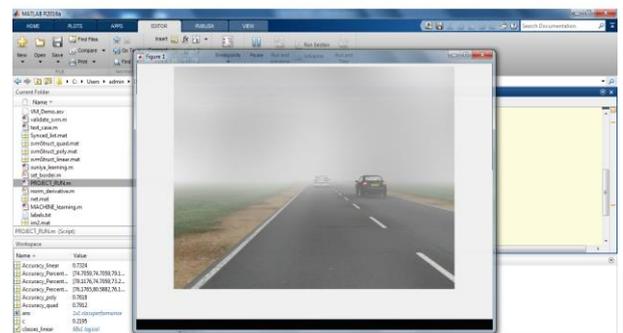


Fig 9: Testing mode of Machine Learning

5. Disease Prediction model based on the pollution level for the random image

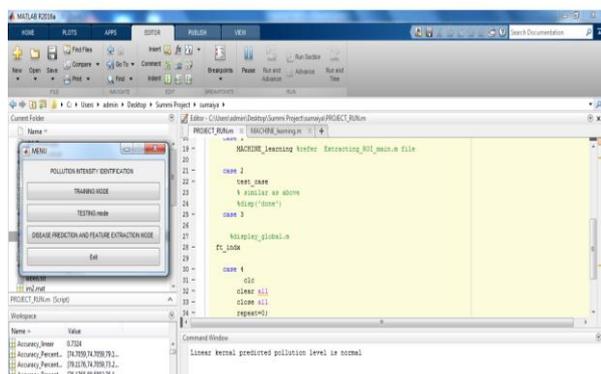


Fig 10: Disease Prediction

5. CONCLUSION

Pollution is one of the real issues which has adverse effects on the human well being. The goal of our task is to screen the pollution utilizing image processing technology. This goal is satisfied by getting the pollution record by hardware and Image processing acquires the images of dirtied and typical images which are looked at utilizing SVM and neural system. In this paper we brilliantly derived methods to perceive pollution in the environment, the current study conveys indication that ambient air effluence utilized adverse effects on well-being and augmented assured sorts of sickness outpatient visits. These results emphasize the significance of sickness anticipation and controls with assured types of sickness groups and sickness anticipation in fewer polluted areas. Furthermore, the study also delivers the beneficial indication for healthcare resource distribution in hospitals. Lastly, it is also significant to offer additional information to the public about the well-being possessions of air pollution.

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