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REAL-TIME FIRE DETECTION AND VIDEO ALERTING SYSTEM USING DEEP LEARNING

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Abstract - *Fire detection systems play a very important role in Industries, shops, malls etc. in detecting fire at the early stages and help in saving lives and property. Commercial fire detecting systems usually have an alarm signaling with a buzzer, which has been found inadequate. To overcome these deficiencies, we aim to design a fire detection system. In the proposed model we use YOLO v3 to detect the fire in images. Initially we will train the dataset and after the training, the trained model is used for further process. User has an option to upload the image and click submit, After this request hitting on the backend endpoint, identification of features will be done and soon the output will be shown indicating that the image has fire or not. Also if fire is detected, an alert message and the location will also be sent to the given email address.*

Key Words: Fire Detection, Deep Learning, Artificial Intelligence.

1. INTRODUCTION

Fire occurrence can cause several threats to life. Risk management in fire protection can involve a set of measure and among that fire detection alarm is considered as the early detection of fire. Traditional fire detection is based on photometry, thermal or chemical detection can react within several minutes, but this requires a lot of fire to trigger the alarm and also traditional alarm does not provide any information about exactly where the fire is caused. The image-based fire monitoring system can detect if the image has fire or not. When a fire is detected based on the picture, it will send an email alert to the administrator. The process is done by YOLO. Unlike most of the previous detection algorithms which apply a model to an image at multiple locations and high scoring regions are considered as detection, YOLO uses a completely different approach. It applies a single neural network to the entire image, which divides the image into multiple regions and predictions are done using bounding boxes and probabilities based on each region. Since YOLO uses a single network for evaluation of the entire image, this makes it faster than most of the other algorithms like R-CNN and Fast R-CNN.

2. EXISTING SYSTEM

Currently used fire detections systems are mostly based on one or a combination of the following technologies:

- Conventional CCTV systems, require continuous monitoring by people.
- Vision based sensors on RGB and YCbCr color-space approach.
- Flame Sensor
- Gas sensors or smoke detectors.

However, it is hard to apply these systems in large open areas for a variety of reasons such as high cost, energy usage by the sensors, and the necessary proximity of the sensor to the fire for accurate sensing resulting in physical.

3. PROPOSED SYSTEM

The proposed system works on an efficient AI based approach which uses YOLOv3. We have trained a full image classifier based on the positive and negative images. An image is called negative image if there is no fire patch in it and a positive image should contain at least one fire patch. Since we have a moderately small dataset, training a full image classifier from scratch may suffer from overfitting. One efficient way to train a YOLOv3 classifier on a small dataset is the fine-tuning technique, which can transfer the previously learned network parameters to the new model.

4. LITERATURE SURVEY

In paper [1], the risk management for forest fire has been aimed it includes many measures like preventing fire, preparedness for fire protection people. Optimization of geographic information such as creating thematic layers, development of digital terrain model, analysis of matrix substrate and soil type, all this recorded risk objects will help to respond in the event of forest fires.

In paper [2], Fire detection based on the color of the flame using RGB, HSV, YCVCR color model is discussed by Yen Feng, Luo Ningzhao, Wu Benxiang. Algorithms like YOLO, YOLOv2 are used to detect the location of multiple classes at one time. The captured images are detected for fire and smoke and with the score of fire and smoke the accuracy value is computed based on the value the fire situation is printed.

In paper [3], the authors have proposed a study on kitchen fire accidents, a real-sized kitchen platform was built to

study through the various fire accidents that can occur in a kitchen through the measure of temperature in the different positions and through the development law of oil pan fire, kitchen flue fire accident and the cabinet due to electrical faults.

In paper [4], the researchers have proposed different frameworks using different technologies to predict and detect the fire zone area. The fire detection algorithm is based on support vector machine where the input is given as video image from that the moving region is extracted and resampling for the same size has been done and then flame features like texture, color moment is extracted and data is normalized to get the eigen values and after that SVM recognition is done that produces the result.

In paper [5], the authors Divya Pritam and Jaya H Dewan have discussed about the fire detection system with LUV color space. The input is given in the form of video and frame is extracted from that. The extracted frame color is detected using LUV color space and hybrid Wavelet. The result of flame color and edge detection are combined and to this, the segmentation technique is applied which detects the fire.

In paper [6], the authors Sergio Saponara, Abdussalam Elhanashi and Alessio Gagliardi has discussed about real-time video fire/smoke detection based on CNN in anti-fire surveillance systems. Here the principle of YOLO and YOLOv2 is used. YOLO is the deep learning version model for object detection and the drawbacks in YOLO is overcome by YOLOv2. The target is to develop smart IoT devices for fire/smoke detection in indoor and outdoor environments. The R-CNN and fast R-CNN object detectors were compared with our proposed method and it is found YOLOv2 is faster than both.

In paper [7], the authors Hanh Dang-Ngoc and Hiru Nguyen-Trung has discussed about the Aerial Forest Fire Surveillance. The aerial video-based forest fire detection framework uses both chromatic and motion feature of forest fire. The optical flow algorithm is used examine the motion characteristics. The fire area is segmented into segmentation mask and foreground mask. Smoke region is segmented by analyzing color characteristics. MCC and F1-score are some standard metrics for detection evaluation. This framework proves its robustness with high accuracy rate of detection and low false alarm rate in practical application.

In paper [8], the authors Xiangsha Yang, Linbio Tang, Hongshuo Wang, Xinxin He discussed about the fire detection method based on UAV (Unmaned arial vehicle) platform. The UAV forest fire monitoring system can be classified into subsystems' airborne system ensures the normal operation and the ground system responsible to process the images and control system controls the state of flight. Here the optical and infrared data is used for fire discrimination. And also, the frame difference model is used for smoke detection. This method is very effective when the drone is hovering.

In paper [9], the authors Divya TL, Vijayalakshmi MN, Anupama Kumar S proposed the fire detection using spatial and video data. These are categorized as Forest fire detection based on meteorological parameters, Satellite and Wireless sensor Network images, and finally using video analytics. The captured video in the real time is given as input and for the detection fire frame conversion RGB to grayscale is done. With the help of varying centroid value movement of blob in the fire video is traced.

In paper [10], the authors Arnoda L.Latifah, Ayu Shabrina, Intan N.Wahyuni and Rifki Sadikin has discussed about evaluation of random forest model for forest fire prediction based on climatology over Borneo. The study uses anthropogenic and geographical feature data with random forest algorithm. Ripley's K function and RF were applied to analyze the driver's spatial distribution and risk patterns of fire. The RF classifier is used to develop model applied to the test site for classification of burned area. Here the testing phase uses data for two years. Forest fire data is obtained from Global Fire Emission database. Several climate factors have used that are in correlation with weather condition. Random forest algorithm is used for classification and regression. It uses decision trees for selection process. The n tree bootstrap samples are drawn from the original data. The new data is predicted by predicting the aggregations of n-trees.

5. METHODOLOGY

The user has the option to upload the image, the image files supported are jpeg, jpg and png. Once the images files are successfully uploaded, this image is processed into the trained model. The trained model is the model that has been trained with the dataset collected. This is also called preprocessing. We are using YOLO algorithm for real time prediction. YOLO algorithm is an algorithm based on regression, instead of selecting the interesting part of an Image, it predicts classes and bounding boxes for the whole image in one run of the Algorithm.

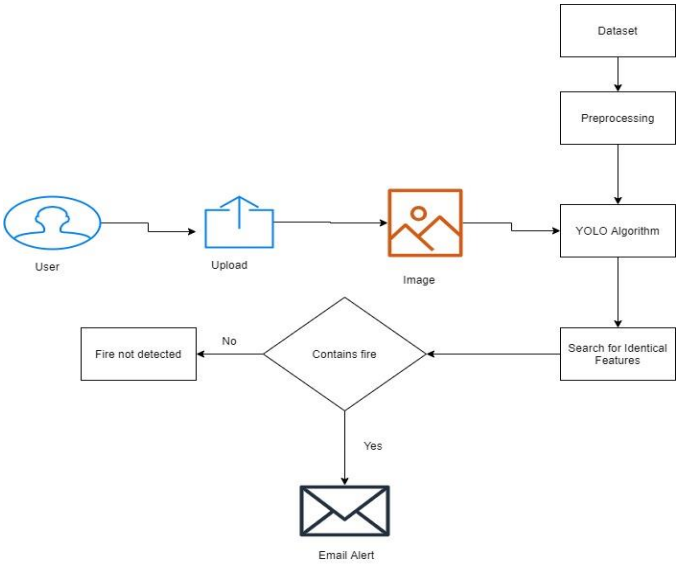

Fig -1: Working Module

If the image fig 1 which has been uploaded contains fire, fire detection message will be printed and immediately email alert has been sent to the given address or else if there is no fire in the image, fire not detected text will be displayed.

6. CONCLUSION

The currently used methodologies for fire detection in enclosed areas seem to be outdated technologies and there is a dire need to evolve new methods and systems to handle such emergencies. The proposed project is a step in this direction to seek and develop a new advanced technology that can fill this gap. With growing urbanization and improving life styles, many new enclosures like office building, mega hospitals, malls, auditoriums and the like see vast areas of building space to handle materials and are also frequented by vast many people. So, an accidental fire in such a scenario could be devastative. Advanced fire detection technologies could come in very handy to protect such infrastructure and people on real time basis.

REFERENCES

[1] PETKOVIC, M., GARVANOV, I., KNEZEVIC, D., & ALEKSIC, S. (2020). Optimization of Geographic Information Systems for Forest Fire Risk Assessment. 2020 21st International Symposium on Electrical Apparatus & Technologies (SIELA).

[2] Yen Feng, Luo Ningzhao, Wu Benxiang (2019) Design and Experimental research video detection system for ship fire, 2019 2nd International Conference on Safety Produce Infromation

[3] Xu, X., Wang, P., Yu, N., & Zhu, H. (2019). Experimental Study on Kitchen Fire Accidents in Different Scenarios *. 2019 9th International Conference on Fire Science and Fire Protection Engineering (ICFSFPE).

[4] Chen, K., Cheng, Y., Bai, H., Mou, C., & Zhang, Y. (2019). Research on Image Fire Detection Based on Support Vector Machine. 2019 9th International Conference on Fire Science and Fire Protection Engineering (ICFSFPE).

[5] Pritam, D., & Dewan, J. H. (2017). Detection of fire using image processing techniques with LUV color space. 2017 2nd International Conference for Convergence in Technology (I2CT).

[6] Feng, J., Feng, Y., Ningzhao, L., & Benxiang, W. (2019). Design and experimental research of video detection system for ship fire. 2019 2nd International Conference on Safety Produce Informatization (IICSPI).

[7] Dang-Ngoc, H., & Nguyen-Trung, H. (2019). Aerial Forest Fire Surveillance - Evaluation of Forest Fire Detection Model using Aerial Videos. 2019 International Conference on Advanced Technologies for Communications (ATC).

[8] Yang, X., Tang, L., Wang, H., & He, X. (2019). Early Detection of Forest Fire Based on Unmaned Aerial Vehicle Platform. 2019 IEEE International Conference on Signal, Information and Data Processing (ICSIDP).

[9] TL, D., MN, V., & S, A. K. (2019). Speculation of Forest Fire Using Spatial and Video Data. 2019 1st International Conference on Advanced Technologies in Intelligent Control, Environment, Computing & Communication Engineering (ICATIECE).

[10] Latifah A. L., Shabrina, A., Wahyuni, I. N., & Sadikin, R. (2019). Evaluation of Random Forest model for forest fire prediction based on climatology over Borneo. 2019 International Conference on Computer, Control, Informatics and Its Applications (IC3INA).