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Detection of Fire with Image Processing

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Abstract: *In image classification and other computer vision problems, convolutional neural networks (CNNs) have achieved state-of-the-art results. Their use in fire detection systems will significantly enhance detection accuracy, resulting in fewer fire disasters and less ecological and social consequences. However, because of the large memory and processing requirements for inference, the application of CNN-based fire detection systems in real-world surveillance networks is a serious challenge. In this study, we offer an innovative, energy efficient, and computationally efficient CNN architecture for fire detection, localization, and semantic understanding of the fire scenario, based on the Squeeze Net architecture. It makes use of smaller convolutional kernels and avoids thick, fully connected layers, which reduces the computational load. Despite its modest processing requirements, the experimental results show that our suggested approach achieves accuracies comparable to those of other, more sophisticated models, owing to its greater depth.*

I. INTRODUCTION

A RANGE OF SENSORS has recently been introduced for a number of applications, including sending off a fire alarm [1], detecting vehicle obstacles, viewing the interior of the human body for diagnosis [2] - [4], animal and ship monitoring, and surveillance [5]. Surveillance is the application that has drawn the most attention from researchers due to the greater embedded processing capabilities of cameras. Various abnormal events, such as traffic accidents, fires, medical emergencies, and so on, can be identified early using smart surveillance systems, and the proper authorities can be notified autonomously [6], [7]. A fire is an unusual occurrence that can do major harm to people and property in a short period of time [8]. Human error or a system breakdown are the most common causes of such disasters, which result in significant loss of human life and other harm [9]. Each year, fire disasters harm 10,000 km2 of vegetation zones in Europe; in the United States, fire disasters affect 100,000 km2 of vegetation zones each year.

II. LITERATURE SURVEY

Ke Chen, Yanying Cheng, Hui Bai, Chunjie Mou, Yuchun Zhang, “Research on Image Fire Detection Based on Support Vector Machines.” [1] Traditional temperature and smoke fire detectors are subject to environmental conditions such as the height of the monitoring space, air velocity, and dust in order to identify and alert early fire quickly and effectively. By researching the properties of fire in digital images, an image fire detection technique based on a support vector machine is developed. To begin, the inter-frame difference approach is used to extract the motion region, which is then referred to as the Suspected fire area. The uniform size is then sampled one more time. Finally, the flame colour moment feature and texture feature are extracted and used to classify and recognise objects using a support vector machine. Data sets were created by combining Internet resources and self-shot films, and the trained support vector machine was put to the test. The results of the tests revealed that the algorithm is more accurate in detecting early fire.

Shixiao wu, Libing Zhang, “Secure and Efficient Data Deduplication in JointCloud Storage.” [2] We focus on three issues surrounding forest fire detection in this paper: real-time, early fire detection, and erroneous detection. We apply traditional objective detection approaches to detect forest fire for the first time, including Faster R-CNN, YOLO (tiny-yolo-voc, tiny-yolo-voc1, yolo-voc.2.0, and yolov 3), and SSD. SSD has improved real-time properties, greater detection accuracy, and the potential to detect fires earlier. To reduce the number of false alarms, we create a fire and smoke benchmark and use the newly introduced smoke class and fire area adjustments. Meanwhile, we tweak the tiny-yolo-voc structure of YOLO and suggest a new one. The experiments show that tiny-yolo-voc1 improves the fire detection accuracy rate. This paper is extremely useful for forest safety and monitoring in real time.

Huang Hongyu, Kuang Ping, Li Fan, Shi Huaxin "An Improved Multi-Scale Fire Detection Method Based on Convolutional Neural Network" [3] Fire is a serious tragedy all over the world, and the fire detection system must accurately identify the fire in the shortest amount of time to minimize economic loss and environmental harm.

Traditional sensors are still widely employed in a variety of applications, but they do not function well in remote high-dome situations or in the early stages of low-flame fires, hence image and video-based fire prediction is gaining popularity. Based on Convolutional Neural Networks, this research developed an improved YOLOv4 fire detection algorithm (CNN). We use a self-built high-quality fire dataset to improve model accuracy, a changed loss function to improve small-scale flame detection, and a combination of Soft-NMS post-processing and DIoUNMS post-processing to improve the suppression effect of the redundant Bounding box and reduce low recall rate. The model's experimental findings on our dataset demonstrate

Oxsy Giandi, Surabaya, Indonesia oxsy. "Prototype of Fire Symptom Detection System "[4] One of the most important services of cloud computing is cloud storage, which allows cloud users to outsource their data to the cloud for storage and sharing with authorized users. Secure deduplication has been actively researched in cloud storage because it may minimize redundancy over encrypted data, reducing storage space and communication overhead. Many existing secure deduplication systems aim to achieve the following features in terms of security and privacy: data secrecy, tag consistency, access control, and resistance to brute-force attacks. However, none of them, as far as we know, can meet all four requirements at the same time. To address this limitation, we present an efficient safe deduplication approach with user-defined access control in this paper. Specifically, by permitting only the cloud service provider to authorize data access on behalf of data owners, our system may reduce duplicates to the greatest extent possible without jeopardizing cloud users' security and privacy.

Jiang Feng, Yang Feng "Design and Experimental Research of Video Detection System for Ship Fire" [5] This paper uses the lightweight direct regression detection algorithm YOLO v3tiny to implement a small local video identification system for ship fire, based on the Raspberry Pi hardware conditions and the Keras deep learning framework, to make up for the shortcomings of traditional fire detectors and improve the reliability of fire alarm. The Rpi Fire system has achieved high accuracy and recall rate in video testing and fire simulation, and can match the needs of ship fire detection.

Sneha Wilson, Shyni P Varghese, Nikhil G A, Manolekshmi I, Raji P G, "A Comprehensive Study on Fire Detection" [6] Accidents caused by undiscovered fires have cost the globe a lot of money. The demand for effective fire detection systems is on the rise. Because of the system's inefficiency, existing fire and smoke detectors are failing. It is recommended that a vision-based system combined with a video surveillance fire detection system have a high detection rate and a low fault alert rate. Analyzing live camera data allows for real-time fire detection. The fire flame features are investigated, and the fire is recognised using edge detection and thresholding methods, resulting in the creation of a fire detection model. It detects hazardous fires based on the colour, velocity, shape, and texture of the fire. For more effective detection, colour models such as HSV and YCbCr are used in the system. It works well in both indoor and outdoor settings.

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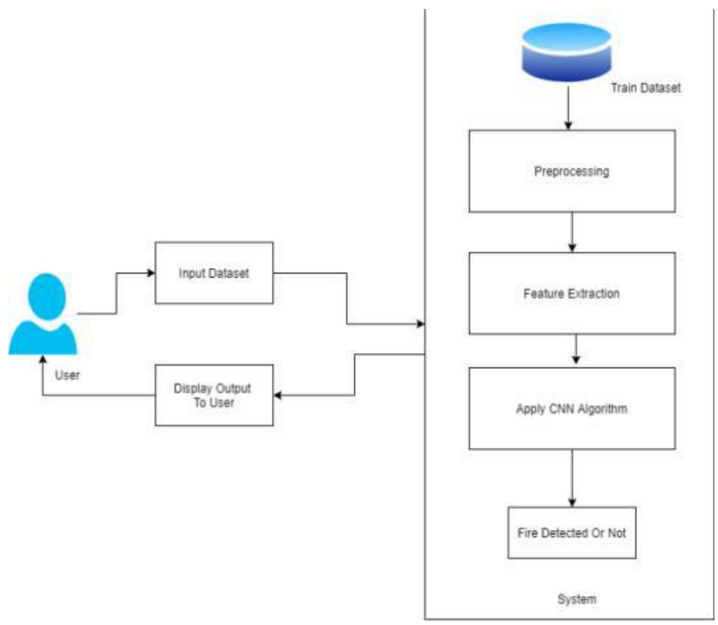
Xuan Zhao, Hang Ji, "Fire Smoke Detection Based on Contextual Object Detection" [8] Smoke detection using an autonomous visual system has been used to identify fires in open areas where regular smoke detectors are ineffective. Detecting the path of smoke, on the other hand, presented significant issues for both systems. We offer a new way to solve this problem that combines a context-aware framework with autonomous visual smoke detection. The strategy is tested on a dataset, and the findings show that the proposed method is effective.

Hanh Dang-Ng, Hieu Nguyen-Trung, "Aerial Forest Fire Surveillance – Evaluation of Forest Fire Detection Model using Aerial Videos" [9] Forest fire monitoring has lately been done with unmanned aerial vehicles (UAVs), which can provide an aerial picture for quick response in large-scale catastrophe zones. One broad model of forest fire identification using aerial films is examined in this research in order to demonstrate its robustness for use in airborne forest fire monitoring. The colour and motion characteristics of fire are used to extract fire pixels. The fire detection performance is assessed using a vast database of varied scene settings to demonstrate the efficacy as well as the shortcomings of our prior fire detection model. Our database contains 49 aerial films with a total of 16898 forest fire frames investigated. Our forest fire detection algorithm has a 93.97 percent accuracy rate, with a 7.08 percent false alarm rate and a 6.86 percent miss rate, respectively. The main cause is thick smoke that covers practically the entire fire.

III. PROPOSED SYSTEM

We use the AES algorithm for encryption and decryption in the suggested system, as well as data security and secure access management. To avoid data duplication, the MD 5 algorithm should be used.

IV. SYSTEM ARCHITECTURE



V. ALGORITHM

We used the CNN Algorithm; CNN is a powerful image processing technique. These methods are currently the best we have for image processing that is automated. Many businesses utilize these algorithms to do tasks such as identifying the objects in a photograph.

Images contain data in the RGB colour space. Matplotlib may be used to load an image from a file into memory. The computer just sees a series of numbers rather than an image. Three-dimensional arrays are used to store colour images. The image's height and width are represented by the first two dimensions (the number of pixels). Each pixel's red, green, and blue hues are represented by the last dimension.

Three layers of CNN Convolutional Neural Networks, optimized for image and video recognition applications. Image recognition, object detection, and segmentation are among of the most common image analysis tasks that CNN is employed for.

Convolutional Neural Networks have three sorts of layers:

1. Convolutional Layer: Each input neuron in a conventional neural network is linked to the next hidden layer. Only a small portion of the input layer neurons connect to the hidden layer neurons in CNN.
2. Pooling Layer: The pooling layer is used to minimize the feature map's dimensionality. Inside the CNN's hidden layer, there will be several activation and pooling layers.
3. Fully Connected Layers: Fully Connected Layers are the network's final layers. The output from the final Pooling or Convolutional Layer, which is flattened and then fed into the fully connected layer, is the input to the fully connected layer.

VI. CONCLUSION

Intelligent surveillance systems have emerged as a result of smart cameras' embedded processing capabilities. These smart cameras can identify a variety of anomalous situations, including car accidents, medical emergencies, and fires. The most dangerous abnormal event is fire, because failure to control it at an early stage can result in massive disasters, resulting in human, ecological, and economic losses.

REFERENCE

[1] K. Chen, Y. Cheng, H. Bai, C. Mou and Y. Zhang, "Research on Image Fire Detection Based on Support Vector Machine," 2019 9th International Conference on Fire Science and Fire Protection Engineering (ICFSFPE), 2019, pp. 1-7

[2] S. Wu and L. Zhang, "Using Popular Object Detection Methods for Real Time Forest Fire Detection," 2018 11th International Symposium on Computational Intelligence and Design (ISCID), 2018, pp. 280-284

[3] HUANG HONGYU1, KUANG PING, LI FAN, SHI HUAXIN "AN IMPROVED MULTI-SCALE FIRE DETECTION METHOD BASED ON CONVOLUTIONAL NEURAL NETWORK "2020 17th International Computer Conference on Wavelet Active Media Technology and Information Processing (ICCWAMTIP) | 978-1-6654-0505-8/20/$31.00 ©2020 IEEE

[4] O. Giandi and R. Sarno, "Prototype of fire symptom detection system," 2018 International Conference on Information and Communications Technology (ICOIACT), 2018, pp. 489-494

[5] J. Feng, Y. Feng, L. Ningzhao and W. Benxiang, "Design and experimental research of video detection system for ship fire," 2019 2nd International Conference on Safety Produce Informatization (IICSPI), 2019, pp. 367-370

[6] S. Wilson, S. P. Varghese, G. A. Nikhil, I. Manolekshmi and P. G. Raji, "A Comprehensive Study on Fire Detection," 2018 Conference on Emerging Devices and Smart Systems (ICEDSS), 2018, pp. 242-246

[7] X. Zhaa, H. Ji, D. Zhang and H. Bao, "Fire Smoke Detection Based on Contextual Object Detection," 2018 IEEE 3rd International Conference on Image, Vision and Computing (ICIVC), 2018, pp. 473-47

[8] H. Dang-Ngoc and H. Nguyen-Trung, "Aerial Forest Fire Surveillance - Evaluation of Forest Fire Detection Model using Aerial Videos," 2019 International Conference on Advanced Technologies for Communications (ATC), 2019, pp. 142-148

[9] Georgiev, Georgi & Hristov, G.V. & Захариев, Пламен & Kyuchukova, Diyana. (2020). Forest Monitoring System for Early Fire Detection Based on Convolutional Neural Network and UAV imagery. 57-60.