SPOTTER: Detection of Human Beings Under Collapsed Environment

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Abstract:- Collapse of man-made structures, such as buildings and bridges earth quakes and fire accident, occur with varying frequency across the world. In such a scenario, the survived human beings are likely to get trapped in the cavities created by collapsed building material. During post disaster rescue operations, search-and-rescue crews have a very limited or no knowledge of the presence, location, and number of the trapped victims. Deep learning is a fast-growing domain of machine learning, mainly for solving problems in computer vision. One of the implementation of deep learning is detection of objects including humans, based on video stream. Thus, the presence of a human buried under earthquake rubble or hidden behind barriers can be identified using deep learning. This is done with the help of USB camera which can be inserted into the rubble. Spotter also gives an audio message about the location of the human presence and gives the area where the human is likely to be present. Human detection is done with the help of Computer Vision using OpenCV.

Keywords:- USB, CV, rubble, OpenCV

I. INTRODUCTION

Among the large number of advancements done in the field of medicine, very few actually focus on helping the survived human beings who are often trapped in the cavities created by collapsed building material. Common cause of such collapses is overloaded due to faulty construction, faulty design, fire, gas explosions, terrorist's acts, but the most common and devastating cause of collapse of man-made structures is earthquake and landslides. Same is the case for landslides in flood areas. Thus, the case of trapped victims buried under rubble is a continuous threat that the mankind has to survive. During post disaster rescue operations, search-and-rescue crews have a very limited or

no knowledge of the presence, location, and number of the trapped victims. The main purpose of the project is to detect the presence of humans under collapsed environment using the concept of human detection using deep learning. Deep learning is a fast-growing domain of machine learning, mainly for solving problems in computer vision.

It is a class of machine learning algorithms that use a cascade of broader machine learning field of learning representations of data facilitating end-to-end optimization. Deep learning has ability to learn multiple levels of representations that correspond to hierarchies of concept abstraction. One of the implementation of deep learning is detection of objects including humans, based on video stream. Human detection is done with the help of Computer Vision using OpenCV.

II. DRAWBACKS OF EXISTING SYSTEM

- Rescuers have very limited knowledge of the location of trapped victims.
- Rescuers cannot see through tiny holes in the rubble.
- Searching may take more time.
- Victims have to suffer for longer time.
- Can rescue more number of people in relatively short time.

III. METHOD

To overcome all the above drawbacks and meet the requirements of the system, Spotter detects the presence of humans using the concept of deep learning. The working of detection occurs in the following manner.

The live video of the collapsed construction due to the occurrence of any disaster such as earthquake will be recorded by the USB camera which can be inserted into the

rubble. USB Cameras are the imaging cameras that use USB 2.0 or USB 3.0 technology, to transfer the image data. The purpose of designing USB Cameras is to easily interface with dedicated computer systems by using the same USB technology that is found on most of the computers. The transfer rate of USB 2.0 which is 480 Mb/s makes USB Cameras ideal for many imaging applications. A number of USB 3.0 Cameras are also available with data transfer rates of up to 5 Gb/s. USB Cameras are available both in Complementary Metal Oxide Semiconductor and Charge Coupled Device sensor types which makes them suitable across a larger range of applications. USB Cameras which uses low power USB ports like that of a laptop, may require a separate power supply for proper working. This video is captured and sliced into a number of frames with the help of YOLO algorithm and the resolution of each image is improved using CLAHE. Using different OpenCV programming functions, the video is sliced into different frames. Open CV is a programming functions' library that is mainly aiming at real-time computer vision. It supports the deep learning framework like TensorFlow, Torch/PyTorch and Caffe.

CLAHE is a variant form of adaptive histogram equalization where the contrast amplification is limited, thereby reducing the problem of noise amplification. In CLAHE, the slope of the transformation function gives the contrast amplification in the vicinity of a given pixel value. The histogram is clipped at a predefined value before computing the CDF which limits amplification. Thereby limiting the slope of the CDF and of the transformation function. And the input to the spotter is the high resolution image frames which are given for detection of the human presence.

The training is done using COCO dataset of trapped victims. YOLO is one of the most effective real-time object detection algorithms, which also encompasses many innovative ideas coming out of the computer vision research community. YOLO performs training on full images and directly optimizes the performance of detection. Since YOLO can be highly generalized, it is less likely to break down when applied to unexpected inputs or new domains. The Microsoft Common Objects in Context (MS COCO) dataset contains 91 common object categories with 82 of them having more than 5,000 labelled instances. In total the dataset has approximately 2,500,000 labelled instances in total 328,000 images. This can help to a large extent in learning detailed object models that are capable of precise 2D localization.

Fig 1:- Data Flow Diagram

Fig 1 shows the data flow diagram of the victim detection system.

Spotter can detect all the persons in the scenario, but once the victim is detected with the help of deep learning, the probability of person trapped under collapsed environment will be shown along with the red box specifying the location of the area where the remaining part of the victim is likely to be present. Spotter will also inform the user with the help of an audio message that will say that the person trapped under the collapsed environment is detected. In case if no human presence is detected it will continue to capture the video. The Fig 2 shows the architecture of the system spotter.

Fig 2:- System architecture

The Fig 3 is the use case diagram which depicts the various design modules in the system including the rescuer and the victim side. The admin train the system using data set and YOLO detection algorithm is used to detect the human presence under collapsed environment. The rescuer captures the video using USB camera It then passes on this data to processes the data and displays the particular message on the screen as per input obtained i.e. if human is detected under collapsed environment the system gives an audio message as output then the system calculate the probability and area of human existence which will be displayed on personal computer at the same time.

Fig 3:- Use Case Diagram

In the system Spotter: Detection of Human Beings under Collapsed Environment, the location of the person lying under the collapsed environment is determined when their presence is identified. The percentage of success that the probability for the victim to be located correctly and efficiently is .91 approx. The efficiency of the system is more, as a result of using the USB camera which can be easily inserted into the tiny holes in the rubble and by enabling flash the video can be captured even in the dark regions under the rubble.

Some of the advantages of the system spotter are:

- No waste of time.
- Low cost and power consumption.
- Portable and can be placed anywhere.
- Easy for rescuer.

IV. EXPERIMENTAL RESULTS AND ANALYSIS

The system Spotter is fully automated, reliable, and convenient for everyone. The simulation of the system is done using the spyder software. Our project shows the successful transmission of mainly three different messages. One of the most effective function of the system is that the message can be heard through speakers when a person is detected under the collapsed environment.

In the system the real time video capturing can be done by inserting the USB camera into the small holes or rubbles. The Fig 5 shows a victim under collapsed building, where all people in the current scenario will be identified but the people who are detected under the collapsed environment will be shown in yellow boxes labelled as “person under collapsed environment” and it will give the audio message “person detected”. Also the red boxes show the area or the region where the remaining part of the victim’s body is likely to be present.

The Fig 6 shows an exceptional case while capturing the video in real time scenario i.e. if the camera captures the photo of the person, it will display only as a person not as a person under collapsed environment. And also it will not give the audio message and will not give the human area estimation.

Fig 4:- USB Camera Used For Detection

The USB camera used for detection is a 7 mm diameter water resistant camera with high resolution. This is shown in Fig 4.

Fig 5:- Victim Trapped Under Collapsed Building

Fig 6:- Photo of a Person

V. CONCLUSION

The present study concluded a CNN-based method for human detection using a video captured from a USB camera to identify the victims under a collapsed environment. Most of the issues which are present in early human detection approaches are significantly reduced in newer deep learning based approaches to a large extent. These fixes are introduced at the cost of more computations. However, the modern machine learning libraries, in the presence of GPU acceleration, are capable of delivering these improved results with comparable frame-rates. The system uses YOLO algorithm for detecting the presence of human under collapsed environment.

It is one of the most effective real time object detection algorithms that also encompasses many innovative ideas related to the computer vision applications. MS COCO contains considerably more object instances and precisely more human objects per image as compared to other datasets. The work will continue to conduct research on detection using low-resolution human images captured at much further distances than a normal surveillance environment.

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REFERENCES

- [1]. Zahid Ahmed ; R. Iniyavan ,Madhan mohan P,"Enhanced vulnerable pedestrian detection using deep learning" ,IEEE, 2019 International Conference on Communication and Signal Processing (ICCSP), 25 April 2019.
- [2]. Kun-Mu Chen ; Yong Huang ; Jianping Zhang ; A. Norman,"Microwave life-detection systems for searching human subjects under earthquake rubble or behind barrier", IEEE Transactions on Biomedical Engineering (Volume: 47 , Issue: 1 , Jan. 2000), Page(s): 105 – 114, Jan. 2000.
- [3]. Lan Shen ; Dae-Hyun Kim ; Jae-Hwan Lee ; Hyung-Myung Kim ; Pil-Jae Park ; Hyun Kyu Yu," Human detection based on the excess kurtosis in the non-stationary clutter environment using UWB impulse radar", IEEE,2011 3rd International Asia-Pacific conference on Synthetic Aperture Radar (APSAR), 28 November 2011.
- [4]. Widodo Budiharto ; Alexander A S Gunawan ; Jarot S. Suroso Andry Chowanda ; Aurello Patrik ; Gaudi Utama, "Fast object detection for quadcopter drone using deep learning",IEEE, 2018 3rd International Conference on Computer and Communication Systems (ICCCS), 13 September 2018.
- [5]. Lam H. Nguyen ; Trac D. Tran," RFI-radar signal separation via simultaneous low-rank and sparse recovery", 2016 IEEE Radar Conference (RadarConf), 09 June 2016.
- [6]. Jia Lu ; Wei Qi Yan ; Minh Nguyen," Human behaviour recognition using deep learning", 2018 15th IEEE International Conference on Advanced Video and Signal Based Surveillance (AVSS), 14 February 2019.
- [7]. Xinyu Wang ; Chunhua Shen ; Hanxi Li ; Shugong Xu, " Human detection aided by deeply learned semantic masks", IEEE Transactions on Circuits and Systems for Video Technology (Early Access), 26 June 2019.
- [8]. Ganlin Zhao ; Qilian Liang ; Tariq S. Durrani," UWB radar target detection based on hidden markov models", IEEE Access (Volume: 6), Page(s): 28702 – 28711, 22 May 2018.
- [9]. Amer Nezirovic ; Alexander G. Yarovoy ; Leo P. Lighthart," Signal processing for improved detection of trapped victims using uwb radar", IEEE Transactions on Geoscience and Remote Sensing (Volume: 48 , Issue: 4 , April 2010), 31 December 2009.