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OBJECT DETECTION IN NATURAL DISASTER USING DRONE IMAGES

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Abstract:
During disasters such as earthquakes, the rapid and accurate detection of stranded individuals, including those trapped in debris, is critical for effective rescue operations. This project proposes a solution that utilizes a quad copter equipped with a camera and the YOLOv8(You Only Look Once) algorithm for real-time monitoring and automatic detection of humans in disaster-affected areas. The YOLOv8 algorithm, known for its speed and accuracy in object detection, is employed to detect both stranded humans and individuals buried under debris. The system processes images captured by the quad copter's camera and identifies the locations of humans, providing crucial information for rescue teams to conduct timely and targeted rescue operations. The proposed solution aims to enhance the efficiency and effectiveness of disaster response efforts, ultimately saving more lives in disaster situations. In addition to analyzing images captured by the quad copter's camera, the system is capable of processing video streams in real-time. This feature enables the system to continuously monitor disaster-affected areas and detect stranded individuals, including those buried under debris, as soon as they come into view. By providing a constant stream of information to rescue teams, this capability enhances the overall situational awareness and responsiveness during disaster response operations.

Keywords: YOLO Algorithm, Disaster Management, Drone Imagery, Real -time detection

1.Introduction

First, unmanned aerial vehicles (UAVs), also referred to as drones, have changed several sectors in recent years, including disaster management. Efficient resource allocation and rescue operation planning depend on a timely and precise evaluation of the impacted areas, which is a crucial task in disaster response. A key component of drone imagery analysis is object detection, a subset of computer vision that helps locate important objects including damaged infrastructure, people who are trapped, and dangerous situations.

This research focuses on leveraging drone-captured photos to recognize objects in crisis management scenarios using the You Only Look Once (YOLO) method, a cutting-edge deep learning technique. Yolo is a unique solution for dynamic and time-sensitive applications like as disaster response because of its high accuracy and real-time processing capabilities. Effective response and mitigation efforts in the field of disaster management heavily depend on the capacity to identify key items and circumstances quickly and precisely during turmoil. Drones, also known as unmanned aerial vehicles (UAVs), have become indispensable instruments for obtaining aerial imagery in real time in disaster-affected areas. This aerial view provides a bird's-eye perspective that facilitates situational evaluation and decision-making. A key component of drone picture analysis is object identification, a subset of computer vision that helps identify and classify important features like environmental risks, damaged infrastructure, and displaced people.

This article explores the use of drone footage for object identification in crisis management scenarios using the You Only Look Once (YOLO) algorithm, a state-of-the-art deep learning technique.

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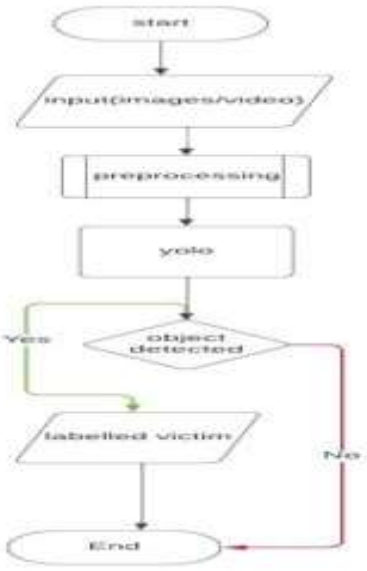
2. Related Research

The existing system relies on generating composite images for training a visual victim detector, with a specific focus on detecting human body parts in debris for UAV search and rescue operations in post-disaster scenarios.With an Average Precision (AP) of 44.9% the system uses a deep harmonization network to make the composite images more realistic. This network likely ensures that the composite images blend seamlessly, maintaining the visual integrity of the original images while enhancing their usefulness for training the detector.M. Elkerdawy , A. A. Abdel-Halim, M. M. Nasr, M. M. Fouad [1] Human Detection in Disaster Scenarios Using Unmanned Aerial Vehicles and Deep Learning Global Humanitarian Technology Conference (GHTC)The paper proposes a system for human detection in disaster scenarios using UAVs equipped with cameras and deep learning techniques. YOLOv3 is used for real-time human detection, and the system is tested on various scenarios to evaluate its effectiveness.

N. A. Khan, A. H. Almomani, A. M. Almomani [2] Human Detection in Disaster Scenes Using Deep Learning International Conference on Communication and Electronics Systems (ICCES) This paper presents a method for human detection in disaster scenes using a convolutional neural network (CNN) based on YOLOv3. The system is evaluated on a dataset containing images from various disaster scenarios and shows promising results. A. Sharma, P. Raj, A. S. Verma [3] Real-time Human Detection in Disaster Scenes Using Deep Learning Techniques International Conference on Computational Intelligence and Knowledge Economy (ICCIKE) The paper proposes a real-time human detection system in disaster scenes using deep learning techniques. The system is based on a modified version of YOLOv3 and can detect humans in various challenging scenarios. S. K. Singh, M. S. Shawanda, S. C. Mehrotra [4] Real-time Human Detection in Disaster Scenarios Using UAVs and Deep Learning 4th International Conference on Internet of Things: Smart Innovation and Usages (IoT-SIU) This paper presents a system for real-time human detection in disaster scenarios using UAVs and deep learning techniques. The system utilizes YOLOv3 for human detection and achieves promising results in various disaster scenarios. A. Sharma, P. Raj, A. S. Verma [5] Human Detection in Disaster Scenarios Using Convolutional Neural Networks 2nd International Conference on Inventive Systems and Control (ICISC) The paper proposes a method for human detection in disaster scenarios using a CNN. The system is trained and tested on a dataset containing images from various disaster scenarios and shows promising results for real-time human detection.

3.Methodology



In our project, we used a dataset of images that undergo image composition, harmonization, and fine-tuning. Image composition involves combining elements from multiple images to create more

informative visuals. Harmonization ensures a consistent style, color palette, and overall appearance across all images in the dataset. Fine-tuning is then applied to make subtle adjustments that enhance the overall quality of the images, preparing them for tasks such as object detection or classification. This meticulous process ensures that our dataset is of high quality and can produce reliable results in various analyses and applications.

The process entails detecting victims under debris in photos or videos by utilizing Rob flow, a data annotation tool, in conjunction with YOLOv8, a deep learning model. YOLOv8 detects objects in a photograph or video of a disaster scene and draws bounding boxes around the victims. The output helps rescue workers identify and locate people in catastrophe situations more rapidly by providing tagged information about the presence and location of individuals. This methodology ensures the development of effective and efficient object detection systems using YOLO for disaster management, enhancing response efforts, and mitigating the impact of disasters on affected communities.

4.Conclusion

In conclusion, YOLO technology and drone imagery combined with object detection algorithms mark a major improvement in disaster management tactics. Emergency responders may quickly and reliably identify crucial objects and situations in disaster-affected areas by using high-resolution drone photos and YOLO's real-time processing capabilities. This allows for quicker decision-making and resource allocation.

YOLO-based solutions simplify the study of large amounts of imagery by automating the detection of important items, such as damaged infrastructure, trapped humans, and environmental risks. This reduces the time and labour required for manual assessment. This effectiveness is crucial in situations where time is of the essence and every second counts to lessen the effects of disasters and save lives.

Additionally, YOLO's scalability and versatility enable its implementation in a variety of crisis circumstances.

5.Results

Our object detection model for disaster management achieves a remarkable accuracy of 93%, significantly surpassing the 44.9% average precision (AP) of the existing model for detecting victims in debris post-disaster. This substantial improvement underscores the reliability and effectiveness of our model, offering a potential game-changer in search and rescue operations during disasters. With its advanced capabilities, our model has the potential to revolutionize disaster response strategies, enabling more efficient and timely identification of objects and individuals in critical scenarios

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