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Stick and Machete Detection in Crisis-Affected Areas using Yolov8

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ABSTRACT

Enhancing security measures in the crisis-affected regions of Cameroon, which have faced prolonged unrest over the years, is critically important. Detecting potentially threatening objects like sticks and machetes within dense crowds can significantly improve surveillance and safety amidst ongoing challenges. These regions require advanced security solutions to address persistent threats faced by the local population. This study develops a detection model based on the You Only Look Once (YOLOv8) architecture to accurately identify and segment sticks and machetes in these crisis-affected areas. By assembling a diverse dataset that captures various scenarios, orientations, and lighting conditions, the model learns to recognize the distinctive features of these objects. Data augmentation techniques further enhance the model's adaptability to new circumstances, ensuring reliable performance in real-world applications. Through rigorous training, the YOLOv8 model achieved a mean Average Precision (mAP) of 0.604 for stick detection and 0.618 for machete detection, marking a promising start for this type of detection. Fine-tuning the model on a region-specific dataset was pivotal for improving its accuracy and effectiveness in identifying these objects within crowds. This research highlights the potential impact of leveraging the YOLOv8 model for object detection in regions plagued by persistent crises. By enhancing security measures through advanced technology, this study aims to contribute to ongoing efforts to safeguard communities and restore stability in these troubled areas.

Keywords: Object Detection, YOLOv8, Crisis-Affected Regions, *Cameroon Security, Surveillance.*

INTRODUCTION

Cameroon is currently facing insecurity challenges, characterized by frequent attacks and protests involving weapons such as machetes and sticks. In major cities across the country, numerous surveillance cameras have been installed, with personnel constantly monitoring video feeds. However, the proposed model aims to automate this monitoring process by detecting these threatening objects in real-time. Detecting objects like sticks and machetes in crowded environments presents a unique challenge that demands a precise and efficient detection system. Object detection is one of the most sought-after skills today, as images can contain multiple classes of objects. Classifying an object addresses only part of the problem; the other part involves accurately localizing the object within the image. Object detection helps identify the class and location of an object using bounding boxes, which can be further processed for various sub-tasks.

There has been great advancement in the field of object detection lately. Of the numerous object detection approaches, we can break the journey into the pre-2012 era or pre AlexNet era and the post-2012 era. The pre-2012 era includes multiple object detection algorithms such as Histogram of Oriented Gradients (HOG), Haar cascades, some variations of Scale-Invariant Feature Transform (SIFT), Speeded-Up Robust Features (SURF), etc. The post-2012 era includes Regions with Convolutional Neural Networks (RCNN), Fast RCNN, Faster RCNN, YOLO, Single Shot Detector, etc. In recent years, significant advancements have been made in artificial intelligence technology, particularly in the field of machine vision. These breakthroughs have led to the development of various neural network models that provide high accuracy and rapid response times. This progress offers a new solution for object detection, significantly reducing the need for human and material resources while improving detection accuracy and efficiency. The You Only Look Once (YOLO) model series is a widely used target detection framework that has been extensively applied to detect defects, achieving commendable accuracy and detection results. Similarly, the Region-based Convolutional Neural Networks (Faster R-CNN) model is another popular target detection framework that uses candidate region extraction and classification regression networks to accurately locate and identify objects.

Additionally, several studies have combined deep learning models with image segmentation techniques to enable precise segmentation and detection. Notable examples include the use of models like U-Net and Mask R-CNN for localizing and segmenting defective regions [1].

Some regions in Cameroon have been plagued by a longstanding crisis, leading to increased violence and threats to human lives. In such volatile environments, the ability to detect and identify potential weapons, such as sticks and machetes, becomes crucial for ensuring the safety and security of individuals. Traditional methods of manual inspection and surveillance is time-consuming, resource-intensive, and often prone to errors. Therefore, there is a pressing need for an efficient and accurate computer vision model that can automatically detect these weapons in real-time. In this research

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