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TINY SUSPICIOUS OBJECT DETECTION IN SECURITY SURVEILLANCE

K. Thiruthanigesan[1*], R.D. Nawarathna[2] and R.G. Ragel[3]

[1]Postgraduate Institute of Science, University of Peradeniya, Peradeniya, Sri Lanka
[2]Department of Statistics and Computer Science, Faculty of Science, University of Peradeniya, Peradeniya, Sri Lanka
[3]Department of Computer Engineering, Faculty of Engineering, University of Peradeniya, Peradeniya, Sri Lanka

Computer vision-based security surveillance with automated CCTV cameras helps identify criminals and reduce the crime rate. It has been widely used in defence, transportation, and public places like airports, harbours, and bus terminals. The tiny object detection is essential for providing complete real-time surveillance in high-security zones. In real-time object detection, execution time is vital to provide adequate security. However, tiny object identification is often difficult because of a wide range of backgrounds, background congestion, and small objects with fewer pixels. This study proposes a method that aims to detect tiny suspicious objects for real-time security surveillance. The proposed method includes three main steps. In the first step, background modelling makes the system more efficient at detecting objects with the help of preprocessing techniques such as auto orient, static crop and auto-adjust contrast. In the second step, suspicious tiny objects images are annotated and labelled under 13 object classes, including a pocket-knife, lighter, metal nail and others collected from surveillance videos. In the last step, the developed dataset is trained with Tiny YOLOv4 and YOLOv4 models. The trained module with YOLOv4 took 4 h for training and 54 ms per image for detecting on a system with Tesla T4 GPU in the Google Colab environment and achieved a detection accuracy of 82.4%. Similarly, Tiny YOLOv4 algorithms took 1 h for training and 13 ms per image for detecting and achieved a detection accuracy of 74.6%. Thus, experimental results show that Tiny YOLOv4 performs faster than YOLOv4 while maintaining an accuracy of 74.6%, making it more suitable for real-time surveillance. Also, the lightweight architecture of Tiny YOLOv4 is more appropriate to install on embedded security surveillance devices. Our study explored the difficulties in real-time security surveillance of small suspicious objects. The proposed model will help detect small suspicious objects in public security surveillance.

Keywords: Computer vision, Deep Learning, Suspicious Tiny Object Detection