Chapter 3
Automatic Video Object Detection Using Particle Swarm Optimisation in Fog Computing

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ABSTRACT

In this chapter, the authors focus on optimising video surveillance by considering five factors while processing the surveillance. The five factors are bandwidth availability, connection availability, storage availability, CPU availability, and memory availability. Since the research work mainly focused on fog computing environment, two major factors are bandwidth and connection availability while sending a video content to the authorized person. The size of video content will be large and slow while transferring the data from one location to another location through wireless network. This problem will be optimized using particle swarm optimization algorithm (PSO). This proposed PSO algorithm will optimize the video content and make it effective and efficient to transfer from one location to another location, and then the object detection (OD) is conducted using suitable hardware arrangements involving a microcontroller unit and GSM communication module for altering the user with objects in forest area.

INTRODUCTION

Object detection and recognition have been actively researched in recent years as a result of their widespread application in a variety of fields, including manufacturing, security, surveillance, medicine, and robotic systems, all of which have shown promising results in terms of accuracy and efficiency (Tang & Chen, 2021). This is due to the fact that their widespread application has resulted in an increase in the number of research opportunities in these areas (Chakravarthi & Venkatesan, 2015). The human eye is incredibly precise, allowing us to conduct and process complex images while also analyzing them

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quickly (Chakravarthi & Venkatesan, 2016). On computers, it takes a lot of effort to recognize and identify an object in an image, and when we apply this to live video streaming in real-time, we will not be able to fulfil our goals, even with the most advanced approaches (Wu, et al., 2020; Vishwanathraddi & Chakravarthi, 2017).

It is challenging to put out forest fires in a short amount of time due to the rapid rate at which they spread once they have started (Chakravarthi & Venkatesan, 2018). Even though early detection of forest fires is essential, it appears that current detection methods need to be improved when it comes to detecting them in open forest settings (Jolly & Jindal, 2016). These improvements are required (Uday Kiran Ruttala & Balamurugan, 2015). Sensor-based detection systems (Cui, 2020) have good indoor performance, but because of their high cost of coverage (Wu, et al., 2021; Ahmed, et al., 2021), they are difficult to install outside (Fabela, et al., 2017).

It is impossible for firefighters to be of assistance because they are unable to provide vital visual information that could enable them to rapidly assess the situation at the fire scene (Lohith Ujjaniya, 2015). Large open spaces are not an ideal setting for infrared or ultraviolet detectors (Hu, et al., 2022; Ponn, et al., 2020) due to the fact that these detectors are susceptible to interference as a result of their limited detection range (Patil, et al., 2021). In spite of the fact that SAR (Chiang, et al., 2020) is effective at identifying large-scale forest fires, it is not effective at detecting localised fires that are just getting started (Xu, et al., 2020; Moura, et al., 2021).

Any solution that uses RGB images to recognise things can only do so successfully in bright light if the images themselves were captured using RGB (Bhandari, et al., 2021). In addition, there is a possibility that a surveillance application will need a greater quantity of light in order for RGB images or videos to function appropriately for the task of object detection (Zhang, et al., 2020). This possibility exists because there is a possibility that a surveillance application will need to detect objects (Chen, et al., 2021). This will add another layer of complexity to the situation. An infrared video surveillance system is used to capture images of potentially suspicious activity that occurs at night (Patil, et al., 2015). These images are then manually examined for indications of potentially questionable behaviour (Zan, et al., 2020). If the area to be monitored is too large, it will take a significant amount of time and effort to successfully complete this entire process. Automating the process of real-time object detection is essential to achieving success in overcoming the challenges outlined above (Zhang, et al., 2020).

Due to the large size of the video content's file, moving it from one location to another through a wireless network will be a time-consuming process that will take a long time (Jain, 2022abc). Within the context of this study, video surveillance is carried out by maximising the available bandwidth, connections, storage, processing power, and memory (Jain, et al., 2022). The assignment of hardware that can recognise items in an image by making use of a meta-heuristic optimisation in a video frame is a novel aspect of this body of work (Jain, et al., 2022).

The main contribution of the study involves the following:

- The authors focused on the cloud environment; two major factors are bandwidth and connection availability while sending video content to the authorized person.
- The study aims to optimize the size of video content using the Particle Swarm Optimization algorithm (PSO). PSO algorithm will be optimized video content and make it effective and efficient to transfer from one location to another location.