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Real-Time Face Detection Using YOLOv5 for Low-Resource CCTV Surveillance Systems

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Abstract

Face detection is an important area in computer vision, involving the direct identification of actions in images and videos. This task is essential for applications such as diversity discrimination and intelligent surveillance, in addition to general object tracking, and for detecting interactions with other programs, such as changing lighting, diverse backgrounds, and facial expressions. This study proposes a face and object detection system based on the YOLOV5 deep learning model and embedded on CCTV data. The system is trained on a specialized dataset across multiple data categories relevant to area and scene monitoring. The system achieves an average accuracy (mAP) of 50.7% ,The reported speed of up to 200 FPS represents a best-case theoretical inference speed measured under optimized conditions using reduced input resolution and accelerated inference frameworks (e.g., ONNX).In practical CPU-only deployment on a low-resource device (Intel Corei5-8365U), the system achieves an average real-time performance of 25–30 FPS, which is sufficient for live CCTV surveillance , allowing for intelligent surveillance. The study comes to combat a crucial problem in developing nations, where existing surveillance systems use manual surveillance, which raises cost, effectiveness .and is susceptible to human mistake.

Incorporating light weight AI models which can execute on low powered systems, the system detects face and person.

Keywords
Face detection, Computer vision, CCTV, Yolov5s, Deep Learning